STAP International Journal of Accounting and Business Intelligence
https://www.ijabi.thestap.com/

Exploring the Influence of Supplier Management on Supply Chain Flexibility

Abdallah O. Mohmmad ALHusban[1], Ahmad Omar Hardan[2]

[1] *Faculty of Strategic Management and International Business, Universidad De Sevilla, Spain*
[2] *Department of Accounting, University Malaysia Terengganu, Malaysia.*

ARTICLE INFO

Article History

Received: 17-01-2024
Revised: 10-02-2024
Accepted: 11-02-2024
Published: 12-02-2024

Vol.2024, No.1

DOI:

***Corresponding author.**
Email:
abdalh@alum.us.es

Orcid:

ABSTRACT

The aim of this study was to investigate the influence of supplier management (supplier quality improvement, trust-based relationship with suppliers, supplier lead time reduction, supplier collaboration and supplier development) on supply chain flexibility (products various sizes, products various types, and rapid product improvement) at Jordanian industrial companies The study was conducted on 33 industrial companies listed on the Amman Stock Exchange. The analysis unit includes of managers working at the top and mid-level management of targeted companies. A questionnaire was developed to collect the data required for the study. A total of 165 questionnaires were distributed, whereas 155 were retrieved and deemed suitable for further analysis; the data collected was analyzed using various statistical techniques, such as descriptive statistics, construct reliability and validity, ensuring discriminant validity, as well as multiple and simple regressions through the SMART PLS. The study results show that there is a significant statistical influence of supplier management on supply chain flexibility at Jordanian industrial companies.

Based on the study findings, several key recommendations are offered to enhance the competitiveness of Jordanian industrial companies in the industrial sector. Most notably, it is essential to adopt innovative approaches that capitalize on advanced methodologies, including supplier management, and supply chain flexibility. By integrating these elements into their strategic planning, companies can better leverage their outputs to achieve and sustain a competitive advantage. Emphasizing these factors in future plans will not only optimize operational efficiency but also position the companies as leaders in a rapidly evolving market landscape especially benefiting from the era of artificial intelligence.

Keywords: Supplier management, supply chain flexibility, Jordanian industrial companies.

How to cite the article

1. Introduction

The current manufacturing landscape is extremely competitive and catering to clients who increasingly require for personalized products and short lead-times. Companies that depend on order-winning through low The current manufacturing landscape is extremely competitive and catering to clients who increasingly require for personalized products and short lead-times. Companies that depend on order-winning through low-cost, standardized production tend to be more flexible. The significance of flexibility in meeting customer expectations is widely recognized (Javaid, Haleem, Singh, & Suman, 2022) to the point where it is now regarded as a strategic capability (Arias-Pérez, Velez-Ocampo, & Cepeda-Cardona, 2021).

While valuable, this was restricted to studying the flexibility of manufacturing systems, cells and plants, i.e. intra-firm flexibility. Nowadays, manufacturing companies (often by choice) are becoming increasingly reliant on external sources of supply and are increasingly aware of the need to manage and integrate the whole value chain (Pananond, Gereffi, & Pedersen, 2020). Consequently, the need to study flexibility in a wider supply chain context, as well as at the firm level, is now being recognized (Schmenner and Tatikonda, 2015). Supply chain flexibility is highly relevant to practitioners, but empirical research in this area is limited and many authors have called for further research (Kumar et al., 2021). In response, this study presents results from an empirical study into supply chain flexibility across a network of 16 inter-related UK-based manufacturing companies. The findings from this exploratory study can be used as the basis for future in-depth work and to develop theory about flexibility in a supply chain context (Kumar et al., 2021).

Limited studies have been done on the influence of supplier management (supplier quality improvement, trust-based relationships with suppliers, supplier-lead time reduction, supplier collaboration, and supplier development) on supply chain flexibility (products in various sizes and types and rapid product improvement) related to industrial companies in Jordan. This study aims to examine this influence on industrial companies in Amman, Jordan. In addition providing them with what they need to know about this issue to obtain a higher competitive advantage against their competitors.

2 . Research Problem

In the face of competition in the global industrial sector environment, Jordanian industrial companies face an increasing need to adapt and respond quickly to changing market conditions and external customer requirements. A critical factor affecting their ability to deal with these challenges is the effectiveness of supplier management (SM) practices within their supply chains (Zighan, & Dwaikat, 2023). Also, the continuous change in customer needs and market needs requires companies to be distinct from other companies operating in the same sector to survive and achieve goals. However, there is a gap in understanding the specific influence of supplier management on achieving this flexibility for Jordanian industrial companies.

In addition, the increasing interconnectedness of local and regional markets and the increasing frequency of supply chain disruptions require a detailed understanding of the relationship between supplier management and supply chain flexibility (Katsaliaki, et al, 2021). For the Jordanian industrial sector, where the economic landscape is characterized by unique challenges and opportunities, exploring the precise influnce of supplier management on supply chain flexibility becomes imperative (Sandri, et al, 2020). The lack of tailored research addressing this specific relationship hinders the ability of Jordanian industrial companies to optimize their supply chains efficiently. Consequently, a detailed examination of how SRM strategies can be fine-tuned to enhance supply chain flexibility will not only contribute to academic knowledge but also provide actionable insights for practitioners seeking to fortify their supply chains against uncertainties and capitalize on emerging opportunities in the Jordanian industrial sector (Al Amosh, & Mansor, 2021).

However, as far as the researcher knows, these studies were not interested in simultaneously studying a conceptual model in all these dimensions. Thus, this study may have new theoretical and practical contributions to understanding the influence of supplier management as an overall approach to supply chain flexibility including its three dimensions at Jordanian Industrial Companies.

Therefore, this study seeks to address this gap by systematically investigating the influence of SM on the supply chain flexibility of Jordanian industrial companies, offering valuable insights that can inform strategic decision-making and improve the overall competitiveness of these organizations within the global marketplace.

3. Research Questions

Building on the background of the study and the identified problem statement, the research endeavors to address the following main question

What is the influence of dimensions of supplier management with its dimensions on a significant relationship with supply chain flexibility with its dimensions at Jordanian Industrial Companies?

The main question is divided into the following sub-questions:

1.1 What is the influence of supplier quality improvement, on supply chain flexibility in Jordanian Industrial Companies?
1.2 What is the influence of trust-based relationship with suppliers, on supply chain flexibility in Jordanian Industrial Companies?
1.3 What is the influence of supplier lead- time reduction, on supply chain flexibility in Jordanian Industrial Companies?
1.4 What is the influence of supplier collaboration, on supply chain flexibility in Jordanian Industrial Companies?
1.5 What is the influence of supplier development, on supply chain flexibility in Jordanian Industrial Companies?

4. Research Objectives

This study attempts to investigate the exploring of the influence of supplier management on supply chain flexibility in Jordanian industrial companies that will be achieved through the following research objectives:

1. To examine the influence of the dimensions of supplier management on supply chain flexibility in Jordanian Industrial Companies.

2. To examine the influence of the supplier quality improvement, on supply chain flexibility in Jordanian Industrial Companies.

3. To examine the influence of the trust-based relationship with suppliers, on supply chain flexibility in Jordanian Industrial Companies.

4. To examine the influence of the supplier lead time reduction, on supply chain flexibility in Jordanian Industrial Companies.

5. To examine the influence of the supplier collaboration, on supply chain flexibility in Jordanian Industrial Companies.

6. To examine the influence of the supplier development, on supply chain flexibility in Jordanian Industrial Companies.

5. Literature Review

5.1 Supplier Management:

Supplier Management (SM) is a management approach that focuses on organizing all interactions between a company and its suppliers. In this regard, suppliers are any entity that provides products or services to a company that adopts SRM. The primary goal of supplier management is to enhance the efficiency and effectiveness of interorganizational processes, while ensuring that they deliver value to customers (Adesanya, Yang, Bin Iqdara, & Yang, 2020). In the past, the customer was the focus of organizations, but the importance of suppliers has increased with the reliance on global sourcing for non-core operations. Relations with suppliers used to be adversarial, with traditional dealing techniques prevailing. With the advancement of information communication systems, total quality management, and industrial restructuring, buyer behavior is shifting from contractual strategies to more collaborative strategies (Wright, 2020).

Close collaboration with suppliers leads to benefits that exceed unilateral gains. Diplomatic suppliers in the 21st century increasingly rely on their resource base and technology. High-end companies rely on critical suppliers to achieve cost reductions and increase quality, as well as to develop innovative products and processes quickly and outpace competitors (Webb, 2021). These suppliers also contribute to adding intrinsic value to the company by providing access to unique technologies, markets, and information (Cheng, 2020). These factors have compelled companies to adopt effective strategies in their supplier collaboration relationship. Based on this explanation, the researcher reviews how the term has been defined, conceptualized, and measured in previous research, and defines supplier management accordingly.

Mäntylä (2021) suggests that supplier management represents a sophisticated approach to communicating with suppliers. According to supply chain experts, supplier management is a comprehensive design that aims to identify a company's needs from suppliers and manage communication between the two parties to achieve the necessary requirements (Matunga et al., 2021). Supplier management seeks to bridge the gap between the organization and the end user. However, many companies face challenges within their supply chains, which can result in lost value and business. Different studies indicate the important of supplier management in promoting the efficiency of supply chain. According to a study conducted by Matunga and colleagues in 2021, enforcement SRM practices had a major role in improving the performance of the supply chain. Hughes and colleagues (2018) emphasize that weak supply chain performance negatively affects the achievement of desired goals, emphasizing the importance of integration and collaboration between different parties in the chain.
Poku (2022) agrees with this view, clarifying that supplier management goes beyond traditional supplier management. it includes building strong and beneficial relationships for each party, frequently developing them, and effectively monitoring them. Gomez-Trujillo and colleagues (2020) emphasize the collaborative nature of supplier relationships, where both parties seek to maintain a long-term relationship that maximizes mutual benefit.

Giannakis et al, (2019) suggest that commitment to long-term relationships is a hallmark of successful supplier relationships. This commitment drives companies and suppliers to collaborate on product development and process improvement, which results in significant cost savings. (Kang, Lee, Hwang, Wei, & Huo, 2021) highlights the importance of building sturdy and permanent relationships with suppliers, noticing that these relationships help to improve the quality of products and services.

Collaboration with supplier play a crucial role in achieving these goals. By establishing strategic alliances with carefully selected suppliers, companies can achieve a wide range of mutual benefits, including lower overall costs, increased customer satisfaction, improved flexibility in the face of market changes, and increased productivity, thus achieving a sustainable competitive advantage in the market (Kumar, et al., 2021, Wisner & Tan, 2000). Research confirms that supply chain management represents a comprehensive approach to developing and maintaining supplier (Lii and Kuo, 2016). By working together, companies and suppliers can leverage their combined strengths, build new capabilities, and enhance their ability to compete in global markets (Cahyono et al., 2023).

Supplier management is an important area in business and many researchers are interested in identifying its components and influencing factors. Mwangi (2017) points out several factors that play role in creating a strong supplier- buyer relationships, such as communication, flexibility, employee involvement in purchasing processes, and continuity. On the other hand, Prajogo and colleagues (2019) showed the importance of supply chain, customer management, and relationships that have a positive impact on supplier management, and thus on overall business performance.
By looking at these different factors, the researcher says that supplier management is a relational relationship that is developed and maintained through close collaboration for the common goods. Supplier management focuses on how to create and maintain a long-term relationship with suppliers.

5.1.1. Supplier Quality Improvement:

Supplier quality improvement (SQI) is a critical factor in improving procurement. It includes a set of management practices that aim to improve a company's efficiency through supplier and buyer collaboration and information exchange (Chakravarty, 2018).

Research has identified three key aspects of supplier quality improvement: supplier selection, supplier development, and supplier integration. Although there has been a significant focus on supplier selection (Cole and Aitken, 2019; Quigley et al., 2018), the importance of supplier integration is becoming increasingly apparent (Mandal and Jha, 2018). This is return to the direct impact of early integration of suppliers into the development and production stages on a company's internal quality performance (De Giovanni and Cariola 2021).

Research shows the importance of supplier integration in a variety of context, from customer sourcing to collaboration between suppliers themselves. As management and network- based supply chain change, improving supplier quality is a key factor in achieving differentiation (Stevens and Johnson 2016).

Manufacturers face significant challenges in ensuring the quality of their products, especially with external dependencies. As supply chains become more complex and production increase, it becomes more difficult to control the quality of incoming materials. Several cases, such as the Mattel leak and the Boeing 787 parts quality issues, demonstrate the importance of good product management (Sanders, 2019). To reduce quality risks in their final products, companies rely on quality control of incoming materials from suppliers. This inspection provides several benefits, including control over the quality of output: inspection helps discover blemish in products when they arrive, it's allowed to take an action to correct product before the product reach customers. This reduces the costs of recalling products or compensating consumers (Hall, 2021). It also helps determine responsibility, as inspection allows identifying the supplier responsible for any defects in the products, making it easier to claim compensation. If defects are discovered long after the shipment is received, it can be difficult to determine the source of the problem, especially if the supplier is located in another country (Babich & Berg, 2021). In short, incoming product inspection is an essential step in supplier quality management. It helps companies ensure the quality of their final products, protect their business reputation, and reduce costs associated with quality issues.

5.1.2. Supplier lead time reduction:

In order to stand out in the competitive market, companies need to operate at low cost. For this purpose, improving transportation service systems is essential and has led to improvements such as cost reduction, shorter delivery times, and improved customer satisfaction. Based on advance planning, deep communication between the purchasing department and suppliers becomes important for a company that seeks to expand and control suppliers. It is essential for the company and its suppliers to meet the demand and needs of customers on time. Therefore, companies need to strengthen the relationship with their suppliers in order to maintain loyalty between the two parties. For this purpose, suppliers must be classified to determine their importance. They are classified by 1) identifying the products and; 2) identifying the suppliers who work hard. After identifying the core product, the suppliers who provide these products must be identified and ranked as "ineffective suppliers". These are the suppliers that need to be developed and their performance should be taken care of (Krajewski et al., 2016).

There are two methods to look at such a relationship, either from an economic or behavioral perspective. This will lead to a sub-optimization. Therefore, these two types are important to complement each other in a single loop. Modern trends such as rapid and sustainable decision making are enhancing lead time management and supply chain efficiency (Kamble et al., 2020). Understanding and effectively managing supplier delivery times remains vital for companies to optimize inventory and production and thus improve supplier reputation and customer satisfaction.

5.1.3. Supplier collaboration:

According to Iqbal and Suzianti (2021), understanding supplier knowledge is one of the most important factors in new product development. Marzi and Dabic (2020) suggested that suppliers should be involved in new product development and testing when there are advanced technologies, and the company does not have much experience. Also, involving

suppliers in new product development and arranging technical meetings with them is valuable when implemented (Morgan et al., 2023). From another perspective of the same researcher, Marzi and Dabic (2020) found that companies that collaborated with suppliers in developing their products achieved significant improvements and additional profits compared to those that did not collaborate with suppliers. They also concluded that understanding suppliers' knowledge in ideas, capabilities, and opinions would facilitate their integration into new product development.

These results were taken to a sample of 134 companies worldwide and 17 case studies of industrial companies. De Toni and Nascimbene (2001) concluded a few advantages of supplier collaboration in the new product development process such as decreasing development costs, knowing the suppliers' capabilities and qualifications in implementation, and providing feedback that suppliers derive from the current market reality. Echtelt et al. (2008) stated that supplier involvement in new product development efforts allows for the creation of learning experiences and matching capabilities for both parties and better understanding of market fluctuations.

Morgan et al. (2023) examined several studies in several developed and developing countries and found that only reliable and thoroughly selected suppliers should be involved in new product development projects. They also recommended that involving suppliers in product development is important and worth exploring, especially when the technology is advanced or when the company lacks knowledge, experience, and qualified personnel, which is consistent with the previous findings of Smith and Reinertsen.

5.1.4 Trust-based relationship with suppliers:

According to studies, trusting in suppliers as buyer is a successful indication that the quality of the business relationship mirrors the level of customer satisfaction, the absence of unethical practices, and spent effort (Yang et al., 2020). The concept of "trust" includes a variety of dimensions of the relationship among the seller and the buyer, such as mutual trust cooperation between the two parties, continuity, in addition to the absence of opportunistic behavior (Liu et al., 2020). Earlier studies declared that building stronger trust among the two parties requires adopting cooperative, open discussions, rational behaviors, and commitment between the supplier and the company relationship to long term (Liu et al., 2020; Patruocco et al., 2020).

Past studies have mentioned that the relationship between system adoption and specific relational constructs, such as socialization mechanisms (Sweet, & Valenzuela, 2023), cooperation, opportunism, and collaboration (Agarwal & Narayana, 2020). Still, no one explicitly refers to the effect of relationship trust. According to the discussion so far, a buyer-supplier trust should be an important deterrent for opportunistic behaviors, keeping tight attention on the relationship goals and increasing the relational trust; thus, positively influencing relational trust. Building on these arguments, we expect buyer-supplier trust should positively affect trust and ultimately drive better supplier performance (Brinkhoff et al., 2015).

5.1.5. Supplier development:

In their comprehensive study, Coşkun et al. (2022) provide a detailed look at supplier development methods in practice, based on a large-scale industry survey. They provide a detailed model of the supplier development process, which has proven to be relevant to many contemporary companies. In this process, efficient products and suppliers are identified, performance areas that need improvement are identified, a specialized team is formed, and appropriate activities are selected, implemented, and their results evaluated in order to improve performance. An interesting aspect of this study is the emphasis on the importance of identifying "opportunities and improvements" during the supplier development process. However, despite the importance of these findings, the study does not delve into how to identify and evaluate these improvements more precisely. While the study points out the importance of criteria such as the potential to impact the production and development process, and available resources, it does not provide a clear framework for identifying and classifying these results.

Supply chain managers highlight performance metrics; Kamble and Gunasekaran (2020) study four levels: quality, delivery, flexibility, and cost. Kamble and Gunasekaran (2020) point out that quality has been regarded as critical in manufacturing since the 1980s and that quality processes have been of interest since the beginning of scientific studies and remain a major concern because customer behavior toward the quality of the final product varies by market. They discovered that performance results, as well as delivery and flexibility, are affected by the direct involvement of suppliers in their development. Thus, determining how much to invest in supplier development and performance improvement remains a significant challenge for all companies.

5.2 Supply Chain Flexibility:

Supply Chain Flexibility (SCF) has evolved through the challenges faced by industrial companies (Delic, & Eyers, 2020), and the idea of resilience within companies has expanded to include entire supply chains to remain viable and competitive. Recent studies have proposed several definitions of supply chain flexibility (Martínez and Pérez, 2005), and all of these studies agree that supply chain resilience represents a type of behavior that adapts to fluctuations within markets, without further losses in performance and quality (Delic, & Eyers, 2020). Therefore, flexibility depends on many surrounding factors (Stockmann, & Winkler, 2022), and therefore it is very difficult to measure supply chain flexibility using a single measure and define it from a specific perspective. Many different views on supply chain flexibility have been proposed in old and recent studies (Rojo et al., 2018). The results of useful studies are provided by Namoun, & Alshanqiti, (2020). It showed that supply chain flexibility was primarily viewed in terms of products of different sizes for example, flexibility provided by firms and products of different types or options for example, the ability to be flexible in the supply chain by selecting and deselecting suppliers, and rapid improvement of the effective product.

The results of previous studies on the subject of supply chain flexibility have shown that flexibility is usefully defined from the internal and external aspects of industrial companies (Delic, & Eyers, 2020), where internal flexibility is related to what the production system can do, and external aspects are related to what the customer perceives of the system's ability to efficiently perform this aspect.

Florescu, & Barabas, (2020) define flexibility competencies (internal capabilities of the manufacturing system) and flexibility capabilities (types of flexibility that give a high-performance result). It is useful to apply this logic to supply chain flexibility, where definitions such as seller or company flexibility relate effectively to the seller or company's response to internal or external market requirements and to regional and surrounding factors in the country.

Thus, supply flexibility is the ease with which the supply chain can be reconstituted to exploit the seller's capabilities and evaluate the seller's performance (Huo et al., 2021), and therefore it gives highly significant results on the evaluation of the seller or company. Supply chain flexibility allows new and existing products to be quickly placed on the market in the required quantities and quality, and flexibility in the delivery process. Delic and Eyers (2020) showed that supply chain resilience has significantly contributed to the competitiveness of supply chains among large industrial firms.

However, the findings related to supply chain flexibility cannot be limited to the performance of a particular firm but should also include other members of the supply chain such as suppliers. Namoun and Alshanqiti (2020) concluded that the elements and factors of supply chain flexibility have different impacts on financial and non-financial performance, such as customer satisfaction.

5.2.1. Products in various size:

Supply chain flexibility, the ability to adapt to market changes, becomes more important when managing products of different sizes. Research by Jum'a and Bushnaq (2024) show how companies achieve change through different dimensions. For example, flexible sourcing allows companies to switch between larger or smaller suppliers based on changing needs. Similarly, a study by Javaid et al. (2022) highlights the importance of flexibility. This helps companies adjust production

lines for products according to requirements. Additionally, Al-Zoubi and Yanamandra (2020) emphasizes the role of information systems in managing product size. Statistical information and real-time customer needs enable accurate decisions to be made regarding production and service plans of all products. Overall, supply chain flexibility is important for manufacturing companies of all sizes.

In general, a multi-dimensional approach is required to achieve supply chain flexibility for products of different sizes. Correct views of the supply chain, production processes that adapt to market supply and demand, and the information age are crucial factors now. In addition, the production of flexible products can enhance the company's ability to exploit available market opportunities' and compete with other companies.

5.2.2 Products in various type:

All recent studies their interesting topic is studying the different types of flexibility in supply chain. To deal with the changing market conditions such as supply and demand within markets and customers, many supply chain experts integrate different types of flexibility into their supply chains depending on the changing needs and requirements of customers. Zhejun Gong (2018) found that the higher the level of product diversity, the higher the level of both supply flexibility and demand flexibility; however, the diversity capability of products enhances the flexibility of markets and changes in products and product lines. The economic evaluation model of supply chain flexibility was studied by (Yang et al, 2019). They concluded that improving the most important flexibility factors of product type (such as labor flexibility, production line flexibility, and leadership flexibility) provided less contributions to production flexibility. Manu and Serguei (2019) showed that a flexible and agile supply chain is a way to deal with high levels of product diversity. Wallace et al. (2015) did very good research to study the effect of variability on the optimal position of operational flexibility in a multi-product, multi-level supply chain. The sources of volume flexibility and their impact on supply chain performance have been studied in depth by Eric et al. (2012) who identified four main parts of flexibility such as flexibility of product delivery system, production line system, development of all products, and receiving and delivery system.

Finally, research on supply chain flexibility emphasizes its importance in dealing with changing market factors. Studies by Zhejun Gong (2018) highlight the role of strong supplier relationships in enhancing resilience, while Yang et al. (2019) focus on identifying the most influential areas for improving resilience within a supply chain system. Furthermore, Wallace et al. (2015) analyzes the optimal location of resilience within a supply chain, and Eric et al. (2012) categorize different sources of resilience across product development, sourcing, and delivery. These previous studies highlight the wide diversity of supply chain flexibility and its critical importance in ensuring a firm's competitiveness.

5.2.3. Rapid product improvement:

One of the factors influencing supply chain flexibility is raising companies' net profits; it can also lead to better products for customers (Jum'a, and Bushnaq 2024). When suppliers are able to achieve cost reduction through flexibility, it can increase the market value of the company, this can lead to lower product prices for customers, which increase competitiveness compared to other companies and drives small companies out of the local market. Furthermore, building collaborative environment for marketing products it's happen when building strong relationships between companies in the supply chain (Psarommatis et al., 2022). For example, early supplier involvement can lead to products that are easier to manufacture, have fewer defects, and are developed faster (Belhadi et al., 2022). Also, by taking advantage of current market research and knowledge of consumer demands. This allows customers to customize products or choose features that best suit their needs. In summary, information exchange between companies in the supply chain enables customers to make appropriate decisions about delivery times and product options (Nguyen et al., 2024). Overall, a resilient supply chain promotes collaboration, innovation, and responsiveness to customer needs, ultimately leading to a better product experience.

5.3 The relationship between Supplier Management and Supply Chain Flexibility:

The relationship between supplier management and supply chain flexibility in Jordanian industrial companies is an important research area that has a significant implication for competition (Al-Shboul, 2023). A good supply chain management system is essential to improve cooperation with suppliers and helps companies to respond quickly to changes in supply and demand in local and global markets and unexpected events. Jordanian industrial firms face many problems such as instability (Al-Shboul, 2023). By developing strong relationships with suppliers, companies can benefit from collaboration in creating value, thus improving their ability to meet customer needs (Mahmood, Rehman, & Rehman, 2020). However, although supplier management is known to be important, there is still a lack of research that specifically examines its impact on supply chain flexibility in Jordanian industrial companies. Therefore, this study aims to fill the gap in exploring the relationship between supplier management and market flexibility.

However, research also indicates some challenges, such as limited resources and export laws, that hinder the optimal implementation of supplier management in Jordan. Further research could explore the specific types of supplier relationship management implementation that have the most influence on supply chain flexibility in different Jordanian industries.

In the Jordanian industrial sector, studies provide a promising idea of how strong supplier management can enhance supply chain flexibility in the industrial sector. By enhancing trust and aligning supplier capabilities with the company's needs through practices such as information sharing and keeping up with technological developments, companies gain the ability to survive and compete in the local, regional and international markets.

6. Methodology

6.1. Study Design and Sample of Study

The study used quantitative methods and descriptive analytical methodology to investigate the influence of supplier management as an independent variable on supply chain flexibility as a dependent variable. It examined five specific dimensions of SM: supplier quality improvement, trust-based relationship with suppliers, supplier lead time reduction, supplier collaboration, and supplier development. The study assessed their influence on three aspects of supply chain flexibility: offering products in various sizes and types and achieving rapid product improvement. Finally, the goal was to generate valuable and timely insights for academics and decision makers working in this field in Jordanian Industrial Companies.

The study focused on Jordanian industrial companies listed in Amman. Data were collected using a reliable and valid questionnaire distributed to participants holding four different managerial level in industrial companies in Amman, head of department or supervisor, department manager, deputy general manager, and general manager. Finally, paving the way for accurate recommendations. The approach was followed taking into account the objectives and purpose of the study. Descriptive and naturalistic analysis, validity and reliability, and impact testing were conducted through multiple regression analysis.

This study sheds light on Jordanian industrial companies listed at Amman Stock Exchange, Jordan. The study utilized a convenience sample. The analysis unit includes of individuals taking four different managerial level in Jordanian industrial companies in Amman, Jordan including head of department or supervisor, department manager, deputy general manager, and general manager those who were present at the distribution and willing to participate. (33) Companies listed on the Amman Stock Exchange were covered within the framework of the study population, and an equally stratified sample technique was used. Each company received (5) questionnaires so (165) questionnaires, of which (155) questionnaires were retrieved, and this number is considered appropriate for the purposes of the study based on (Thompson, 2012), which explained that the size of the sample drawn from within a statistical population range in number of observations between (30) - less than (500). It is considered it is acceptable for many human and social studies and research.

6.2.Data Analysis And Results

The Partial Least Squares (PLS) The famous statistical program was used in the current study to describe all variables (The Partial Least Squares (PLS). Also, the demographic file of the respondents aims to show the frequencies and percentages of the demographic characteristics of the respondents, and this is related to the first part of the questionnaire, such as gender, age, qualifications, experience and job.

As mentioned in Table 1, 40% are females, representing 62 participants, while 60% of the respondents are males, representing 93 participants. This shows that majority in the sample examined in this study are men's because most of the workers in the industrial sector are men.

Table 1: frequencies and percentages of respondents based on gender.

Gender	Frequencies	Percent
Male	93	60%
Female	62	40%
Total	155	100%

The finding of table 2 indicates that the most of the respondents are between 30 and 40 years old with a 36% of respondents representing 56 participants. A 27% is within the ages between 40 to 50 years old representing 42 participants. The 18% is between 18 to 30 years old, while 19% is over 50 years old, representing 28 and 29 participants, respectively.

Table 2: Frequencies and Percentages of respondents based on age.

Age	Frequencies	Percent
From 18 to less than 30 years	28	18 %
From 30 to less than 40	56	36 %
From 40 to less than 50 years	42	27 %
50 Years or above years	29	19 %
Total	155	100 %

The findings of table 3 show that the most of the respondents hold Bachelor's degrees with a percentage of 67% representing 104 participants. Although 21% of the participants hold Master's degree 32 individuals who are well educated and interested in getting a academic certifications. Noticeably, there are only 12 participants hold a less than Bachelor constituting a 8% of the sample and lastly 5% is Ph.D only 7 participants.

Table 3: Frequencies and percentages of respondents based on qualification.

Qualification	Frequencies	Percent
Less than Bachelor	12	8%
Bachelor	104	67%
Master	32	21%
Ph.D	7	5%
Total	155	100%

The findings of table 4 indicate that the percentage of the participants hold different Job position including head of department or supervisor, department manager, deputy general manager, and general manager were 42%, 22%, 20%, and 16% respectively. Of a sample of 155 participants, 66, 33, 31, 25, also respectively.

Table 4: Frequencies and percentages of respondents based on job position.

Job Position	Frequencies	Percent
Head of Department or Supervisor	66	42%
Department Manager	33	22%
Deputy General Manager	31	20%
General Manager	25	16%
Total	155	100%

The results of the table 5 show that the respondents experiences that are less than 5 years 2% and range from 5 to 10 years peaked at the top with the same percentage 45% representing of total 69 participants, the next is 28% of respondents whose experience range between 10 to 15 years representing 43 participants. In addition, the rest 25% of respondents who's representing 40 participants their experiences above 15 years.

Table 5: Frequencies and percentages of respondents based on experience.

Experience	Frequencies	Percent
Less than 5 years	3	2%
From 5 to less 10 years	69	45%
From 10 to less 15 years	43	28%
15 or above years	40	25%
Total	155	100%

6.3. Cronbach' Alpha value for each domain

The researcher used the Cronbach's alpha test to measure the stability of the respondents' answers to all the scale questions, as obtaining an alpha ≥ 60.0 is considered acceptable in the applied aspect of administrative and human sciences in general (Sekaran and Boujgie, 2010). Table 6 shows the stability values of the main study variables, which range between (0.779 - 0.933), indicating the acceptable Cronbach's alpha value for each field. The Cronbach's alpha indicators indicate that the study tool in general has a high stability coefficient and its ability to achieve the study objectives according to (Sekaran and Bougie, 2010).

Table 6: Cronbach' Alpha value for each domain

Variable Type	Variable	Cronbach Alpha Values
Independent (Supplier Management)	Supplier Quality Improvement	0.857
	Trust-Based Relationship with Suppliers	0.771
	Supplier Lead Time Reduction	0.871
	Supplier Collaboration	0.836

	Supplier Development	0.835
Dependent (Supply Chain Flexibility)	Products in Various Sizes	0.935
	Products in Various Types	
	Achieving Rapid Product Improvement	

6.4 Statistical Descriptive Analysis

As shown in Table 7, present a detailed statistical analysis of the various aspects related to supplier management and supply chain flexibility in Jordanian industrial companies. The main measures evaluated include the mean, median, standard deviation, over-kurtosis and skewness for each of the items to be measured. From the data shown in the table below, we find that the average scores for the items range from 1.799 (TRS3) (depended variable) to 4.214 (SD2) (independed variable), indicating variation and variance in satisfaction levels across different aspects of supplier management and supply chain flexibility. In more detail, it is clear that the items related to reducing supplier delivery lead time and improving supplier quality have obtained higher average scores, indicating better performance in these areas. On the other hand, the items related to trust-based relationships with suppliers (TRS) have obtained lower average scores, indicating potential but not certain areas for improvement in building trust with suppliers.

In the same context of statistical description, the standard deviation values show us the degree of variation in responses, where higher values indicate a variation in perceptions among respondents. Items such as SC3 and SC4 have relatively high standard deviations, indicating a different set of views on supplier cooperation. Furthermore, the excess deviation values give us insights into the shape of the distribution for each item. As shown in the statistical description table, SD2 had a high negative deviation, indicating that a large percentage of respondents rated it highly.

Table 7. Statistical Descriptive analysis

Items	Key	Mean	Standard deviation	Excess kurtosis	Ranking	Implementation
Our relationships with suppliers are characterized by open collaboration and transparency in all transactions	**SC1**	2.648	1.133	-0.130	2.34-3.66	medium
Suppliers work closely with us to ensure that our requirements and needs are met efficiently.	**SC2**	2.390	1.298	-0.494	2.34-3.66	medium
Our suppliers are able to adapt to changes in order volume.	**SC3**	2.535	1.268	-0.478	2.34-3.66	medium
Our supply chain can efficiently handle large and small orders with no impact on service quality	**SC4**	2.358	0.892	-0.648	2.34-3.66	medium
Our supply chain is flexible enough to adapt to seasonal orders	**SCF1**	2.849	0.810	-1.195	2.34-3.66	medium
We can modify purchasing and storage	**SCF2**	2.881	0.730	0.067	2.34-3.66	medium

procedures to suit the diversity of products.						
Our suppliers are flexible in adapting to changes in product specifications demand.	**SCF3**	2.956	1.241	-1.156	1-2.33	low
We can meet the changing market needs by offering diverse types of products effectively.	**SCF4**	2.937	1.196	-1.115	2.34-3.66	medium
We have the ability to handle any new requirements to optimize products without affecting the flow of the supply chain	**SCF5**	2.836	0.977	-1.030	2.34-3.66	medium
We have the ability to respond quickly to feedback from various parties on how to improve our products quickly.	**SCF6**	2.931	1.332	-1.271	2.34-3.66	medium
Suppliers are committed to optimizing their internal processes to reduce the lead time required to process and deliver orders.	**SLR1**	3.887	1.058	-1.134	3.67-5	high
The company is working on building strategic partnerships with our major suppliers to reduce the lead time for speedy product delivery.	**SLR2**	3.377	1.026	-1.236	2.34-3.66	medium
Speed and efficiency are the continuity criteria in dealing with suppliers.	**SLR3**	3.421	1.018	-1.003	2.34-3.66	medium
Suppliers show a willingness to provide innovative solutions to problems.	**SLR4**	3.038	1.253	-0.862	2.34-3.66	medium
Suppliers are obliged to deliver products or services on time according to the agreed contracts.	**SQI1**	3.516	1.364	-1.238	2.34-3.66	medium
Suppliers provide the necessary support and training to improve the quality of products or services.	**SQI2**	3.604	1.046	-0.971	2.34-3.66	medium

Suppliers are interested in enhancing the quality of the products or services.	**SQI3**	4.057	1.029	-0.761	3.67-5	high
The quality of supplier's products is continuously improved through periodic evaluations.	**SQI4**	3.358	0.763	-0.225	2.34-3.66	medium
We have long-term partnership and collaboration programs with suppliers to foster their development and performance	**SD1**	4.088	1.024	-0.800	3.67-5	high
The organization continuously provides suggestions to suppliers to improve their performance.	**SD2**	4.214	1.036	0.577	3.67-5	high
We encourage suppliers to invest in technology and innovation to develop better products and services.	**SD3**	3.465	0.937	-0.512	2.34-3.66	medium
Suppliers are constantly improving their capabilities and skills to meet our growing requirements.	**SD4**	3.824	1.179	-0.643	3.67-5	high
Our suppliers deal with us with integrity.	**TRS1**	2.170	0.848	-0.047	1-2.33	low
Our suppliers respect the confidentiality of the information they receive from our company.	**TRS2**	2.233	0.795	-1.081	1-2.33	low
Our suppliers deal with us with trust and without supervision.	**TRS3**	1.799	0.558	0.944	1-2.33	low
Our organization continues to make efforts to strengthen its relations with suppliers.	**TRS4**	2.031	0.686	1.485	1-2.33	low

6.5. Assessment of the Measurement Model

PLS-SEM was used to evaluate the measurement model (outer loadings). The outer model involves measuring components because it determines how well the items theoretically load and relate to the corresponding constructs. Thus, based on the outer model analysis, the survey actually measures the constructs they were created to measure. Simply, the items are reliable and valid.

Reliability and validity are the two primary criteria applied in PLS-SEM analysis and the evaluation of the outer model (Hair et al., 2019). Measurement reliability and validity determined the deduction derived about the relationship between

constructs (inner model). Individual items reliabilities, measurement convergent validity, and discriminant validity were examined to determine the suitability of the outer model. The reliabilities of individual items consist of indicator reliability and internal consistency reliability with the use of composite reliability (CR), meanwhile measurement convergent validity is linked with individual constructs with the use of average variance extracted (AVE). Discriminant validity uses the Fornell-Larcker and Heterotrait-Monotrait ratio (HTMT) criteria.

Focusing on analyzing the reliability of internal consistency, item loadings, besides convergent and discriminant validity. The results, as shown in Table 8 and Figure 1, proved that all item loadings exceeded 0.70, therefore confirming the measuring items strength. Cronbach's alpha and composite reliability values for internal consistency and reliability were both equal to or above the suggested limit of 0.70. According to the above, the items reliably measure their respective constructs, thus there is a high degree of confidence in the stability and reliability of the data collected.

Convergent validity is assessed to ensure that the measures of theoretically related constructs are actually related. One of the basic indicators of convergent validity is the average variance extracted (AVE). According to Benitez et al. (2020), an AVE value greater than 0.50 indicates that the construct is able to explain 50% of the variance of its indicators. As can be seen in Table 8, all AVE values in our study scored above 50%, demonstrating strong convergent validity. This indicates that the items used in the study to measure each construct are closely related to each other, thus achieving the validity of the measurement model. Discriminant validity is also assessed to ensure that the constructs measure different concepts. This is assessed using two tests, the Fornell-Larcker criterion and cross-loadings. The Fornell-Larcker criterion requires that the square root of the AVE for each construct be higher than the correlation with any other construct. Our analysis confirmed this.

Table 8. Construct Reliability and Validity

Construct	Code	Loadings	VIF	Cronbach's alpha	Composite reliability	Average variance extracted
Supplier Quality Improvement	SQI.1	0.833	1.912	0.857	0.876	0.699
	SQI.2	0.841	2.127			
	SQI.3	0.877	2.175			
	SQI.4	0.790	1.802			
Trust-Based Relationship with Suppliers	TRS.1	0.740	1.473	0.771	0.777	0.591
	TRS.2	0.782	1.497			
	TRS.3	0.759	1.518			
	TRS.4	0.794	1.489			
Supplier Lead Time Reduction	SLR.1	0.811	1.903	0.871	0.876	0.723
	SLR.2	0.911	3.127			
	SLR.3	0.836	2.012			
	SLR.4	0.839	2.171			
Supplier Collaboration	SC.1	0.852	2.420	0.836	0.846	0.669
	SC.2	0.833	1.964			
	SC.3	0.820	2.250			
	SC.4	0.765	1.528			
Supplier Development	SD.1	0.866	2.213	0.835	0.846	0.669
	SD.2	0.803	1.932			
	SD.3	0.836	1.825			
	SD.4	0.765	1.563			

Supply Chain Flexibility	SCF.1	0.918	3.239	0.935	0.939	0.757
	SCF.2	0.749	1.880			
	SCF.3	0.896	3.173			
	SCF.4	0.888	3.283			
	SCF.5	0.880	3.066			
	SCF.6	0.880	3.301			

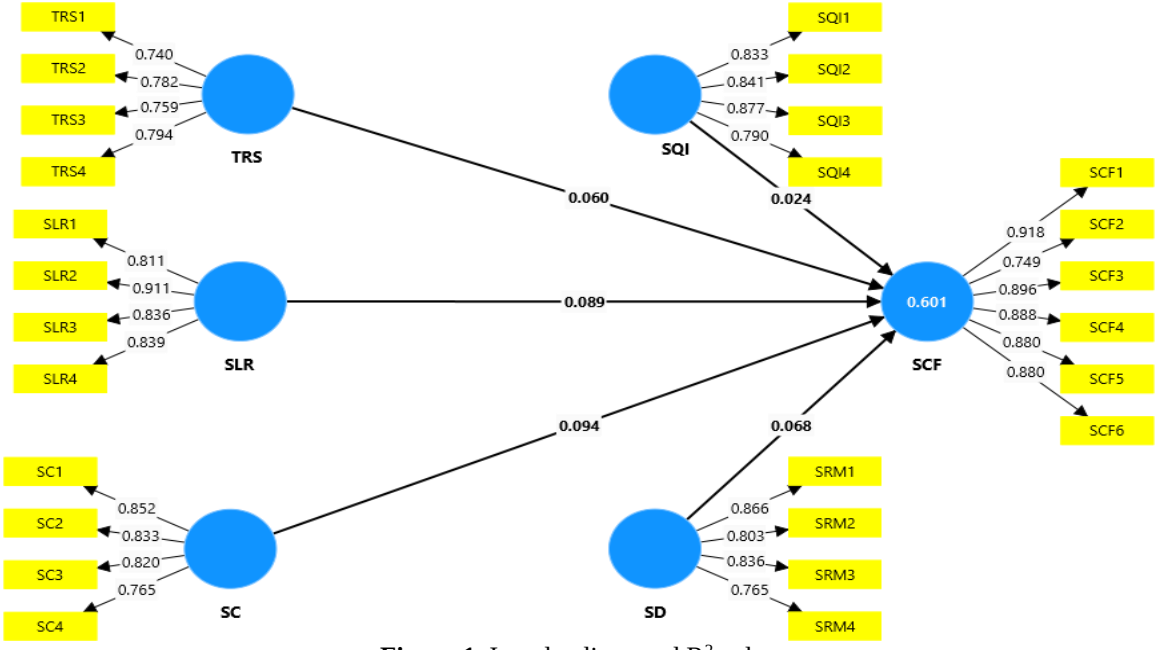

Figure 1. Item loadings and R^2 value

6.6. Ensuring Discriminant Validity

A comprehensive assessment of discriminant validity using three robust methods: the heterogeneous trait-to-monometric (HTMT) ratio, the Fornell-Larcker criterion, and cross-loadings testing, as recommended by Hensler et al. (2015). First, the heterogeneous-to-homogeneous trait ratio test was performed. This method assesses the association between constructs by comparing the ratio of HTMT to monometric traits. A heterogeneous-to-homogeneous trait ratio value of less than 0.90 is generally considered an indicator of good discriminant validity.

In our analysis, all values of the HTMT ratio fell below this threshold, confirming that the constructs are sufficiently different from each other. Second, we applied the Fornell-Larcker criterion, which requires that the square root of the average variance extracted (AVE) for each construct be greater than the correlations with any other construct. Finally, we tested cross-loadings, where the load of an indicator on its assigned construct should be higher than on any other construct. The results, as shown in Table 9, show that each item has a stronger association with its assigned construct than with any other construct, supporting discriminant validity.

Table 9. Discriminant validity based on the cross-loadings criterion

Items	**SC**	**SCF**	**SD**	**SLR**	**SQI**	**TRS**
SC1	**0.852**	0.246	0.212	0.192	0.197	0.002

SC2	**0.833**	0.320	0.229	0.212	0.271	0.021
SC3	**0.820**	0.298	0.252	0.207	0.283	0.116
SC4	**0.765**	0.356	0.278	0.273	0.269	0.170
SCF1	0.383	**0.918**	0.604	0.631	0.526	0.499
SCF2	0.150	**0.749**	0.499	0.499	0.345	0.511
SCF3	0.337	**0.896**	0.657	0.685	0.615	0.447
SCF4	0.356	**0.888**	0.634	0.641	0.594	0.464
SCF5	0.349	**0.880**	0.660	0.656	0.580	0.500
SCF6	0.391	**0.880**	0.604	0.568	0.511	0.426
SLR1	0.158	0.548	0.691	**0.811**	0.656	0.393
SLR2	0.265	0.634	0.775	**0.911**	0.808	0.535
SLR3	0.370	0.639	0.740	**0.836**	0.784	0.455
SLR4	0.125	0.579	0.683	**0.839**	0.647	0.543
SQI1	0.247	0.518	0.745	0.709	**0.833**	0.390
SQI2	0.261	0.463	0.688	0.691	**0.841**	0.353
SQI3	0.257	0.616	0.776	0.815	**0.877**	0.501
SQI4	0.314	0.417	0.611	0.618	**0.790**	0.421
SD 1	0.224	0.630	**0.866**	0.768	0.770	0.394
SD 2	0.119	0.485	**0.803**	0.637	0.640	0.436
SD 3	0.298	0.633	**0.836**	0.726	0.743	0.567
SD 4	0.333	0.532	**0.765**	0.639	0.611	0.419
TRS1	-0.011	0.367	0.457	0.444	0.449	**0.740**
TRS2	0.026	0.437	0.511	0.536	0.485	**0.782**
TRS3	0.170	0.380	0.343	0.376	0.333	**0.759**
TRS4	0.124	0.473	0.401	0.391	0.293	**0.794**

The Fornell-Larcker criterion involves examining the cross-loading between each indicator and a latent variable. The cross-loading data were generated using PLS SEM software. When the square root of the AVE for each construct was higher than the highest correlation of the construct with any other latent construct, there was discriminant validity. Therefore, the discriminant validity in this study was assessed by comparing the square root of the AVE for all constructs with the correlations shown in the correlation matrix. The results of the assessment of the Fornell-Larcker criterion with the square root of the constructs can be seen in Table 10. It can also be noted that the square root of the AVE in bold is higher than the highest correlation of the construct with any other construct. Hence, we conclude that the construct has discriminant validity (Henseler et al., 2015).

Table 10. Discriminant validity assessment using the Fornell-Larcker criterion

Construct	**SC**	**SCF**	**SD**	**SLR**	**SQI**	**TRS**
SC	**0.818**					
SCF	0.381	**0.870**				
SD	0.302	0.703	**0.858**			
SLR	0.276	0.708	0.851	**0.859**		
SQI	0.318	0.613	0.850	0.846	**0.836**	
TRS	0.102	0.543	0.557	0.568	0.503	**0.769**

There is a new approach to the evaluation of construct discriminant validity it's called Heterotrait-Monotrait ratio (HTMT). During this phase, the HTMT method was used as a more stringent compared to the conventional approach. The use of PLS-SEM software, the HTMT correlation criterion for this study was computed. HTMT values smaller than 1 show that the true correlation between the two constructs should differ, but if HTMT is higher than this threshold, there is a lack of discriminant validity (Henseler et al., 2015).

Some authors suggest that the HTMT criterion be smaller than 0.85 for each latent variable, and others propose that HTMT values to be normed between 0 and 1 in PLS-SEM as no issues result from negative correlations (Henseler et al., 2015). In this study, all HTMT values were less than 0.85 for each latent variable. Based on the HTMT values in this study, there is discriminant validity as defined by Henseler et al. (2015). Table 11 show the results of HTMT criterion for each variable.

Table 11. Discriminant validity assessment using the HTMT criterion

Construct	SC	SCF	SD	SLR	SQI	TRS
SC	-					
SCF	0.417	-				
SD	0.350	0.787	-			
SLR	0.310	0.780	0.991	-		
SQI	0.374	0.667	0.989	0.975	-	
TRS	0.166	0.637	0.691	0.691	0.617	-

6.7. Model Fit Assessment

In PLS-SEM, aside from reliability, the validity of the measurement model is an important pre-condition of model assessment. Scholars have employed the standardized root mean square residual (SRMR) criterion as another structural model assessment condition. SRMR functions as an indicator that demonstrates estimated model fit. The SRMR is the square root of the sum of the squared differences between the model-implied and the empirical correlation matrix, or the Euclidean distance between the two matrices. SRMR was proposed by Henseler et al. (2014) as a goodness of fit measure for PLS-SEM. SRMR can be employed to prevent model misspecification.The SRMR value for the reduced model generated by PLS-SEM was 0.073 (see Table 12). In this study, the value linked with composite model SRMR was acquired from PLS-SEM. The obtained value was smaller than 0.08, which is a tolerable cut-off threshold for PLS-path model fit (Henseler et al., 2016). This means that no considerable difference exists between the theoretical model and the empirical correlation matrix. Worded differently, the value of 0.073 denotes an adequate fit between the established data and the theoretical model (Henseler et al., 2016).

Furthermore, the Normed Fit Index (NFI) values computed for both models. The NFI is a measure of the relative fit of the model compared to a null model, with values closer to 1 indicating better fit. Despite yielding an NFI value of 0.779, this value still suggests a good fit based on criteria of Schuberth et al. (2023), see table 12.

Table 12. Model fit evaluation

Test	Saturated model	Estimated model
SRMR	**0.073**	**0.073**
d_ULS	**1.896**	**1.896**
d_G	**0.835**	**0.835**

NFI	**0.779**	**0.779**

Evaluation of the Structural Model

In this study, we used the basic measures to measure the structural model including each of the following tests: coefficient of determination (R^2), effect size (f^2), and predictive significance (Q^2) to assess the explanatory power of the model, the strength of the relationships, and potential multicollinearity.

As shown in Table 13, the model shows significant variance in the relationship between supplier management and supply chain flexibility within Jordanian industrial companies. The adjusted R and R^2 values reveal that the model can account for 60.1% and 58.8% of the variance in this relationship, respectively. It can also be concluded that the study model has sufficient adequacy to explain the relationships to be studied.

The model also showed significant explanatory power, as the adjusted R2 and R-squared values exceeded 51%. According to Hair et al. (2019), these values indicate a good fit for the model, indicating its ability to explain the variance in the dependent variable. In addition to R^2, the effect size (f^2) analysis revealed moderate contributions from most of the variables, further confirming the importance of the relationships within the model. The predictive relevance (Q^2) analysis confirmed the strength of the model in predicting the dependent variable, with Q^2 values reaching 0.564, confirming the model's prediction accuracy and reliability. Finally, the examination of the variance inflation factor (VIF) values showed scores less than 3.3, ensuring the absence of multicollinearity among the predictive variables, thus enhancing the credibility of our study results.

Table 13. Structural model evaluation

Construct	R^2	Adj. R^2	f^2	Q^2
Supplier Quality Improvement	-	-	0.024	-
Trust-Based Relationship with Suppliers	-	-	0.060	-
Supplier Lead Time Reduction	-	-	0.089	-
Supplier Collaboration	-	-	0.094	-
Supplier Development	-	-	0.068	-
Supply Chain Flexibility	0.601	0.588	-	0.564

We observed through the results of the study a significant positive influence of supplier management on supply chain resilience in Jordanian industrial companies, with a high path coefficient (β = 0.762, T = 17.898) and a p-value of 0.000, which supports the hypothesis. We conclude from the result that effective supplier management is important to enhance the adaptive and responsive capacity of the supply chain.

When we divided supplier management into its components, the data showed varying degrees of influence on supply chain resilience. First: Improving supplier quality has a negative coefficient (β = -0.212, T = 1.998) with a p-value of 0.046, indicating an inverse relationship. Second: Trust-based relationship with suppliers (TRS) shows a positive and significant influence (β = 0.191, T = 3.041) with a p-value of 0.002. Supplier lead time reduction (SLR) has a high positive effect (β = 0.419, T = 4.299) with a p-value of 0.000, which indicates the importance of reducing delivery lead time. Finally, supplier

collaboration (SC) and supplier development (SD) also contribute positively to SCF with coefficients of 0.205 (T = 3.541) and 0.358 (T = 3.246), respectively, both with p-values of 0.000 and 0.001.

7. Conclusion, And Recommendations

The purpose of the present study is to investigate the exploring the influence of supplier management on supply chain flexibility in Jordanian industrial companies. The study from the different details that supported this study can conclude the necessary of supplier management on supply chain flexibility in Jordanian industrial companies and obtain the benefit in making high quality, valuable and timely decisions in the time of technology and huge flow of data daily.
This study result shows that the main study question, "What is the influence of elements of supplier management (supplier quality improvement, trust-based relationship with suppliers, supplier lead time reduction, supplier collaboration and supplier development) have a significant relationship with supply chain flexibility (products in various sizes, products in various types, and rapid product improvement) at Jordanian Industrial Companies?" is answered in addition to the sub-questions.

This study follows a quantitative descriptive design. The data was collected from 155 employees in four different job positions in Jordanian industrial companies in Amman, Jordan including head of department or supervisor, department manager, deputy general manager, and general manager who were present in the time of distribution and were ready and willing to participate. (33) Companies listed on the Amman Stock Exchange were covered within the framework of the study population. The findings shows that there is an agreement among the supplier management and supply chain flexibility in Jordanian industrial companies.

In conclusion, the study highlights the significant yet varied influence of Supplier Management (SM) on supply chain flexibility within Jordanian industrial companies. Key elements of supplier management—such as improving supplier quality, trust-based relationships, reducing lead times, collaboration, and supplier development—show varying levels of effectiveness, influenced by factors such as a company's competitive environment. High-impact practices reflect companies that prioritize long-term partnerships with suppliers, use forecasting, and invest in technology and training, which enhance flexibility and survivability within supply chains.

Conversely, the less influential elements highlight the challenges faced by companies, including constraints such as state regulations, short-term contracts, and road infrastructure limitations. Tailored solutions to these issues, such as establishing long-term contracts, public-private sector collaboration, enhancing supplier collaboration, and implementing supplier development programs at multiple levels, are critical to bridging supply gaps. By adopting these factors, Jordanian manufacturing companies can improve the coherence of their supply chain flexibility practices, leading to a more adaptable, and resilient, and competitive supply chain in a competitive business environment.
Based on the study results as well as the study conclusions, the Jordanian industrial companies are advised for the following recommendations:

1. The researcher advice to clear and consistent quality standards for suppliers, conduct regular audits, and provide ongoing training. Encouraging suppliers to obtain third-party certifications will help maintain quality standards across the supply chain, especially for collaborative suppliers.
2. Move from short-term contracts to longer-term agreements with key suppliers to foster stability and mutual commitment. Regular communication, transparent information exchange, and supplier involvement in decision-making processes will help build strong, trusting relationships.
3. Invest in local supplier warehouses to reduce transit times. Implement market-based demand forecasting tools, such as predictive analytics, to enable suppliers to manage inventory in real time and adapt to demand.
4. Use secure servers to share data to facilitate transparent communication and protect sensitive information. Collaborate with suppliers on joint planning, performance reviews, and goal setting to ensure compliance.

5. Develop a multi-level supplier development system, provide basic training for all suppliers and focus intensive resources on actual partners. Collaborate with public or international organizations to access funding and support for supplier training.
6. Collaborate with government agencies and industry associations to create partnerships that support supply chain development. These collaborations can provide financial assistance, transportation infrastructure improvements, and all of this can enhance supplier management practices.

After implementing the previously mentioned recommendations, Jordanian industrial companies can address current challenges in supplier management practices, create stronger relationships with suppliers, and achieve a high level of supply chain flexibility. Through these improvements, companies will maintain their competitiveness and respond flexibly to market demands. To close the gaps and improve results to make it easier to understand supplier management and how it affects supply chain flexibility this study offers a series of recommendations for future research. These recommendations as follow:

1. The researcher advice to study the influence of supplier management on supply chain resilience across a variety of sectors, such as service, healthcare, or technology. When results are compared across sectors, insights may expand, and industry-specific supplier management practices and challenges may be easier to understand.
2. Studies can analyze how changes such as new management styles or surrounding regional changes may occur affect the relationship between supplier management practices and supply chain flexibility.
3. The comparative studies across different countries or nations can highlight how the differences economics influence the practices and the outcomes of supplier management
4. Researcher can study how supplier management practices contribute to supply chain flexibility when crises occur, such as economic recessions and epidemics by examining these research trends, researchers can build on the existing knowledge base, address emerging challenges, and provide actionable findings for companies seeking to improve supplier management practices in an increasingly evolving global marketplace.

Corresponding author

Dr. Abdallah O. Mohmmad ALHusban
abdalh@alum.us.es

Acknowledgements

NA.

Funding

NA.

Contributions
A.M.A; A.O.H; Conceptualization, A.M.A; A.O.H; Investigation A.M.A; A.O.H; Writing (Original Draft), A.M.A; A.O.H; Writing (Review and Editing) Supervision, A.M.A; A.O.H; Project Administration.

Ethics declarations
This article does not contain any studies with human participants or animals performed by any of the authors.

Consent for publication
Not applicable.

Competing interests
All authors declare no competing interests.

References

Agarwal, U. A., & Narayana, S. A. (2020). Impact of relational communication on buyer–supplier relationship satisfaction: role of trust and commitment. Benchmarking: An International Journal, 27(8), 2459-2496.
Al Amosh, H., & Mansor, N. (2021). Disclosure of integrated reporting elements by industrial companies: evidence from Jordan. Journal of Management and Governance, 25, 121-145.
Al-Shboul, M. D. A. (2023). Investigating the quality of the relationship, supply risk mitigation on medium and large-sized manufacturing firms' supply chain performance in the developing countries: the moderating effect of supplier involvement. The TQM Journal, 36(4), 1162-1192.
Alshourah,S (2022).Role of strategic orientation dimensions of green supply chain management practices in Jordanian manufacturing companies. Zarqa Journal For Research and Studies in Humanities,22(2),380-390https://doi.org/10.12816/0061213.
Al-Tarawneh. R. & Al-Shourah, A. A. (2018). The Impact of Supply Chain Management and Manufacturing Flow Management Practices on Competitive Advantage of Jordanian Industry. European Journal of Scientific Research,148(3), 394-407.
Alzoubi, H., & Yanamandra, R. (2020). Investigating the mediating role of information sharing strategy on agile supply chain. Uncertain Supply Chain Management, 8(2), 273-284.
Arias-Pérez, J., Velez-Ocampo, J., & Cepeda-Cardona, J. (2021). Strategic orientation toward digitalization to improve innovation capability: why knowledge acquisition and exploitation through external embeddedness matter. Journal of Knowledge Management, 25(5), 1319-1335.
Babich, V., & Birge, J. R. (2021). The interface of finance, operations, and risk management. Foundations and Trends® in Technology, Information and Operations Management, 15(1–2), 1-203.
Belhadi, A., Kamble, S. S., Venkatesh, M., Jabbour, C. J. C., & Benkhati, I. (2022). Building supply chain resilience and efficiency through additive manufacturing: An ambidextrous perspective on the dynamic capability view. International Journal of Production Economics, 249, pp.108-516.
Benah, S., & Li, Y. (2020). Examining the relationship between lean supplier relationship management (LSRM) and Firm Performance: A study on manufacturing companies in Ghana. Open Journal of Business and Management, 8(06), pp. 24-35.
Brinkhoff, A., Özer, Ö., Sargut, G. (2015), "All You Need Is Trust? An Examination of Inter-organizational Supply Chain Projects", Production and operations management, Vol. 24 No. 2, pp. 181-200.
Cahyono, Y., Purwoko, D., Koho, I., Setiani, A., Supendi, S., Setyoko, P., ... & Wijoyo, H. (2023). The role of supply chain management practices on competitive advantage and performance of halal agroindustry SMEs. Uncertain Supply Chain Management, 11(1), 153-160.
Chakravarty, A.K. (2018). Supply Chain Transformation: Evolving with Emerging Business Paradigms. Berlin: Springer.
Cole, R., & Aitken, J. (2019). Selecting suppliers for socially sustainable supply chain management: post-exchange supplier development activities as pre-selection requirements. Production Planning & Control, 30(14), 1184-1202.
Coşkun, S. S., Kumru, M., & Kan, N. M. (2022). An integrated framework for sustainable supplier development through supplier evaluation based on sustainability indicators. Journal of Cleaner Production, 335, pp. 259-287.
De Giovanni, P., & Cariola, A. (2021). Process innovation through industry 4.0 technologies, lean practices and green supply chains. Research in Transportation Economics, 90, pp. 839-869.
De Toni, A. D. & Nassimbeni, G., (2001). A method for the evaluation of suppliers' co-design effort. International Journal of Production Economics, Volume 72, pp.169-180.
Delic, M., & Eyers, D. R. (2020). The effect of additive manufacturing adoption on supply chain flexibility and performance: An empirical analysis from the automotive industry. International Journal of Production Economics, 228, 107689.
Echtelt, F. E., Wynstra, F., Van Weele, A. J., & Duysters, G. (2008). Managing supplier involvement in new product development: a multiple-case study. Journal of Product Innovation Management, 25(2), 180-201.
Eric P. Jack, Amitabh Raturi. (2012) 'Sources of volume flexibility and their impact on performance', Journal of Operations Management, Vol.20, pp.519-548.
Florescu, A., & Barabas, S. A. (2020). Modeling and simulation of a flexible manufacturing system—A basic component of industry 4.0. Applied sciences, 10(22), 83.
Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. In: Sage Publications Sage CA: Los Angeles, CA 8(11), 27.
Giannakis, M., Spanaki, K., & Dubey, R. (2019). A cloud-based supply chain management system: effects on supply chain responsiveness. Journal of Enterprise Information Management, 32(4), 585-607.

Gomez-Trujillo, A. M., Velez-Ocampo, J., & Gonzalez-Perez, M. A. (2020). A literature review on the causality between sustainability and corporate reputation: What goes first?. Management of Environmental Quality: An International Journal, 31(2), 406-430.
Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, *31*(1), 2-24.
Hall, D. C., & Johnson-Hall, T. D. (2021). The value of downstream traceability in food safety management systems: an empirical examination of product recalls. Operations Management Research, 14, 61-77.
Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, *43*, 115-135.
Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In *New challenges to international marketing* (Vol. 20, pp. 277-319). Emerald Group Publishing Limited.
Huo, B., Haq, M. Z. U., & Gu, M. (2021). The impact of information sharing on supply chain learning and flexibility performance. International Journal of Production Research, 59(5), 1411-1434.
Iqbal, M., & Suzianti, A. (2021). New product development process design for small and medium enterprises: A systematic literature review from the perspective of open innovation. Journal of Open Innovation: Technology, Market, and Complexity, 7(2), 153.
Javaid, M., Haleem, A., Singh, R. P., & Suman, R. (2022). Enabling flexible manufacturing system (FMS) through the applications of industry 4.0 technologies. Internet of Things and Cyber-Physical Systems, 2, 49-62.
Jum'a, L., & Bushnaq, M. (2024). Investigating the role of flexibility as a moderator between supply chain integration and firm performance: the case of manufacturing sector. Journal of Advances in Management Research, 21(2), 203-227.
Kamble, S. S., & Gunasekaran, A. (2020). Big data-driven supply chain performance measurement system: a review and framework for implementation. International journal of production research, 58(1), 65-86.
Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2020). Achieving sustainable performance in a data-driven agriculture supply chain: A review for research and applications. International Journal of Production Economics, 219, 179-194.
Kang, M., Lee, G., Hwang, D. W., Wei, J., & Huo, B. (2021). Effects of cross-functional integration on NPD success: mediating roles of customer and supplier involvement. Total Quality Management & Business Excellence, 32(13-14), 1515-1531.
Katsaliaki, K., Galetsi, P., & Kumar, S. (2021). Supply chain disruptions and resilience: A major review and future research agenda. Annals of Operations Research, 1-38.
Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (ijec)*, *11*(4), 1-10.
Kopyto, M., Lechler, S., von der Gracht, H. A., & Hartmann, E. (2020). Potentials of blockchain technology in supply chain management: Long-term judgments of an international expert panel. Technological Forecasting and Social Change, 161, 120330.
Krajewski, W., Aumatell, J., Subiela, J. D., Nowak, Ł., Tukiendorf, A., Moschini, M., ... & Urothelial carcinoma working group. (2022, November). Accuracy of the CUETO, EORTC 2016 and EAU 2021 scoring models and risk stratification tables to predict outcomes in high–grade non-muscle-invasive urothelial bladder cancer. In Urologic Oncology: Seminars and Original Investigations (Vol. 40, No. 11, pp. 491-e11). Elsevier.
Kumar, P., Singh, R. K., & Kumar, V. (2021). Managing supply chains for sustainable operations in the era of industry 4.0 and circular economy: Analysis of barriers. Resources, Conservation and Recycling, 164, 105215.
Li, Suhong, Bhanu Ragu-Nathan, T. S. Ragu-Nathan, and S. Subba Rao. "The impact of supply chain management practices on competitive advantage and organizational performance." Omega 34, no. 2 (2006): 107-124.
Lii, P., & Kuo, F. I. (2016). Innovation-oriented supply chain integration for combined competitiveness and firm performance. International Journal of Production Economics, 174, 142-155.
Liu, J., Yi, Y., & Wang, X. (2020). Exploring factors influencing construction waste reduction: A structural equation modeling approach. Journal of Cleaner Production, 276, 123185.
Mahmood, K., Rehman, M., & Rehman, C. (2020). Improving Supply Chain Performance through Supplier Relationship Management: A Moderating Model of Knowledge Management Practices in Automobile Sector of Pakistan, 10(3), 659-686.
Mandal, S., & Jha, R. R. (2018). Exploring the importance of collaborative assets to hospital-supplier integration in healthcare supply chains. International Journal of Production Research, 56(7), 2666-2683.
Mäntylä, J. (2021). Best practices of supplier relationship management in value creation. Master's Thesis, Lappeenranta-Lahti University Of Technology Lut.
Manu Goyal, Serguei Netessine. (2019) 'Volume flexibility, product flexibility or both: The role of demand correlation and product substitution' .Modern Applied Science, Vol. 4, No.7, pp.110-123.

Martínez Sánchez, A., & Pérez Pérez, M. (2005). Supply chain flexibility and firm performance: a conceptual model and empirical study in the automotive industry. International Journal of Operations & Production Management, 25(7), 681-700.
Marzi, G., Ciampi, F., Dalli, D., & Dabic, M. (2020). New product development during the last ten years: The ongoing debate and future avenues. IEEE Transactions on Engineering Management, 68(1), 330-344.
Matunga, H., Steyl, S., Borell, P., Dionisio, R., & Hāpuku, A. (2021). Mana whenua engagement in Crown and Local Authority-initiated environmental planning processes: A critique based on the perspectives of Ngāi Tahu environmental kaitiaki. New Zealand Geographer, 77(2), 63-75.
Morgan, T., Friske, W., Kohtamäki, M., & Mills, P. (2023). Customer participation in manufacturing firms' new service development: the moderating role of CRM technology. Journal of Business & Industrial Marketing.
Mwangi, M. (2017). Supplier relationship management and operational performance of sugar firms in Kenya (Doctoral dissertation, University of Nairobi).
Namoun, A., & Alshanqiti, A. (2020). Predicting student performance using data mining and learning analytics techniques: A systematic literature review. Applied Sciences, 11(1), 237.
Nguyen, T., Akbari, M., & Nguyen, K. (2024). Unlocking the Potential of Vietnamese Supply Chain with Digitalization: A Bibliometric Analysis and Systematic Literature Review. Operations and Supply Chain Management: An International Journal, 17(1), 123-141.
Olivia Adu Poku, (2022). Supplier relationship management and firm performance: the role of operational capabilities (Doctoral dissertation, Doctoral dissertation, Kwame Nkrumah University of Science and Technology, Kumasi).
Pananond, P., Gereffi, G., & Pedersen, T. (2020). An integrative typology of global strategy and global value chains: the management and organization of cross-border activities. Global Strategy Journal, 10(3), 421-443.
Patrucco, A. S., Moretto, A., Luzzini, D., & Glas, A. H. (2020). Obtaining supplier commitment: antecedents and performance outcomes. International Journal of Production Economics, 220, 107449.
Poku, O. A. (2022). Supplier Relationship Management And Firm Performance: The Role Of Operational Capabilities (Doctoral Dissertation, Kwame Nkrumah University Of Science And Technology, Kumasi).
Prajogo, W. (2019). The relationship among emotional exhaustion, job satisfaction, performance, and intention to leave. Advances in Management and Applied Economics, 9(1), 21-29.
Psarommatis, F., Sousa, J., Mendonça, J. P., & Kiritsis, D. (2022). Zero-defect manufacturing the approach for higher manufacturing sustainability in the era of industry 4.0: a position paper. International Journal of Production Research, 60(1), 73-91.
Putra, A., Tarigan, Z. J. H., & Siagian, H. (2020). Influence of information quality on retailer satisfaction through supply chain flexibility and supplier relationship management in the retail industry. Jurnal Teknik Industri, 22(2), 93-102.
Quigley, J. Wall, L., Demirel, G., MacCarthy, B. L., Parsa, M. 2018. "Supplier quality improvement: The value of information under uncertainty". European Journal of Operational Research 264(3): 932-947.
Rajab, F., Ngugi, P., & Kiarie, D. (2021). Influence of supplier relationship management on performance of manufacturing firms in Kenya. International Journal of Supply Chain and Logistics, 5(1), 31-45.
Rojo, Araceli, et al. "Supply chain flexibility in dynamic environments: The enabling role of operational absorptive capacity and organisational learning." International Journal of Operations & Production Management 38.3 (2018): 636-666.
Rostamkhani, R., Gavareshki, M. H. K., Abbasi, M., & Karbasian, M. Operational Research Application to Minimize the Uncertainty of Time And Cost in the Main Domains of Industrial Engineering By Using Quality Engineering Techniques.
Sadalia, N. (2020). The Effect of Supply Chain Management on Competitive Advantage and Operation Organization Performance at PT PLN (Persero). International Journal of Research and Review, 7(4),80-87.
Salimian, H., Rashidirad, M., & Soltani, E. (2021). Supplier quality management and performance: the effect of supply chain oriented culture. Production Planning & Control, 32(11), 942-958.
Sanders, N. R. (2019). Operations management: an integrated approach. John Wiley & Sons.
Sandri, S., Hussein, H., & Alshyab, N. (2020). Sustainability of the energy sector in Jordan: Challenges and opportunities. Sustainability, 12(24), 10465.
Sarstedt, M., Hair Jr, J. F., Nitzl, C., Ringle, C. M., & Howard, M. C. (2020). Beyond a tandem analysis of SEM and PROCESS: Use of PLS-SEM for mediation analyses!. International Journal of Market Research, 62(3), 288-299.
Schmenner, R. W., & Tatikonda, M. V. (2015). Manufacturing process flexibility revisited. International Journal of Operations & Production Management, 25(12), 1183-1189.
Schuberth, F., Rademaker, M. E., & Henseler, J. (2023). Assessing the overall fit of composite models estimated by partial least squares path modeling. *European Journal of Marketing*, *57*(6), 1678-1702.
Sekaran, U & Bougie, R. (2010). Research Methods for Business: A skill building Approach. 5th ed., John Wiley & Sons.
Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach*. john wiley & sons.
Stevens, G. C., & Johnson, M. (2016). Integrating the supply chain… 25 years on. International Journal of Physical Distribution & Logistics Management, 46(1), 19-42.

Stockmann, C., & Winkler, H. (2022). Robustness of production systems: Evidence from the German manufacturing industry. Journal of Engineering and Technology Management, 63, 101672.
Stolk, B. (2021). Supplier relationship management as a tool for strategic purchasing development, a sleep brand case study. Master's Programme in Business Administration, Master's thesis. Lappeenranta–Lahti University of Technology LUT.
Sweet, K. M., Sturm, R. E., Zare, M., & Valenzuela, M. A. (2023). Control-Trust Dynamics during Socialization: Lessons from Workgroup Hazing. Journal of Management Studies, 60(8), 1962-1985.
Thongrawd, C., Ramanust, S., Narakorn, P., & Seesupan, T. (2020). Exploring the mediating role of supply chain flexibility and supply chain agility between supplier partnership, customer relationship management and competitive advantage. International Journal of Supply Chain Management, 9(2), 435-443.
Wallace J. Hopp, Seyed M.R. Iravani, Wendy Lu Xu. (2015) 'Vertical flexibility in supply chain', Management Science, Vol.56 No.3, pp.495-502.
Webb, T., Beldona, S., Schwartz, Z., & Bianco, S. (2021). Growing the pie: an examination of coopetition benefits in the US lodging industry. International Journal of Contemporary Hospitality Management, 33(12), 4355-4372.
Wisner, J. D., & Tan, K. C. (2000). Supply chain m anagement and its impact on purchasing. Journal of Supply Chain Management, 36(3), 33-42.
Wright, A. (2020). How technology and a changing consumer behaviour instigated change in the Deutsche Post DHL Group: An analysis on organizational change. Bachelor of Commerce Best Business Research Papers, 1-116.
Xie, L., Guan, X., Cheng, Q., & Huan, T. C. T. (2020). Using customer knowledge for service innovation in travel agency industry. Journal of Hospitality and Tourism Management, 45, 113-123.
Yang Huaizhen, Li Lei, Li Linghua. (2019) 'Exploring for VMI strategy impact on supply chain flexibility', International Conference on Information Management, Innovation Managem-ent and Industrial
Yang, B., Bin Iqdara, F. W., & Yang, Y. (2020). Improving sustainability performance through supplier relationship management in the tobacco industry. Supply Chain Management: An International Journal, 25(4), 413-426.
Zhejun Gong. (2018) 'An economic evaluation model of supply chain flexibility', European Journal of Operations Research, Vol.184, pp.745-758.
Zighan, S. M., & Dwaikat, N. Y. (2023). Exploring organisational agility in SMEs. International Journal of Entrepreneurship and Small Business, 49(4), 561-576.
Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2013). *Business research methods*: Cengage Learning.
Zulkarnain, Maulana, and Ubud Salim. "Effect analysis of supply chain management on competitive advantage and company performance (study at New Djombang sugar factory)." *South East Asia Journal of Contemporary Business, Economics and Law* 15, no. 5 (2018): 63-69.

Biographies