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An agility and performance assessment framework for supply chains using confirmatory factor analysis and structural equation modelling

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ABSTRACT

This study examines the impact of agile practices on supply chain performance measurements in manufacturing firms. Following COVID-19, there have been operational and logistics disruptions in manufacturing firms and supply chains worldwide. We study the link between supply chain performance and agile manufacturing practices by designing experimental research and collecting data from 340 responses from manufacturing firms. The experimental design proposed in this study uses a confirmatory factor and reliability analysis and smart-partial least square structural equation modeling. This research demonstrates the positive effect of agile supply chain strategies on manufacturing companies' performance. The values obtained from the experiment support the dependability and effectiveness of the study. The research is supported by factors like customer involvement, facility management, supply chain responsiveness, strategic management, and supplier relationships but is undermined by technology utilization and supply chain contracts. The study will aid companies in combining agile with more conventional approaches to better adapt to market volatility and fierce global competition. Developing core competencies and acquiring a competitive advantage contribute to sustained advantage in the manufacturing industry. This study further outlines the need to understand how supply chains perform when agile practices are adopted.

1. Introduction

Markets have been increasingly volatile in recent years because of rising international competition and shifting consumer preferences. Businesses have had to deal with several supply chain problems that include fluctuating demand, improved on-time deliveries and services, and decreased lead times. In such scenarios, it would be good if organizations adapt swiftly to market volatility to thrive in the marketplace [8].

Supply chain management is highly esteemed by academic managers and scholars since it is crucial to meeting customer demands and establishing a market edge [15,61]. It has been said that "agility has emerged as the prevailing competitive vehicle for organizations functioning in uncertain and continuously changing business settings," and that "agility has been lauded as the business paradigm of the twenty-first century" [76]. While several definitions share commonalities, there is no agreed-upon one for agility [46,6]. Agility, as defined by [16], is the ability of an organization to respond rapidly and effectively to changes in demand volume and variety.

Agility entails leveraging market information and a virtual firm to

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capitalize on economic possibilities in a dynamic economy [79]. One of the most pressing issues in strategic management (SM) today is how to deal with the unknown [128]. As a result of the shock waves caused by COVID-19, several industrial supply networks lost control of their fluctuating production [10,2,68]. Agility in supply chains is crucial for firms because it allows them to explore and capitalize on possibilities in rapidly changing markets. Factors like political unpredictability, global rivalry, and the complex nature of the modern business environment made organizations adapt quickly and in unanticipated ways [86,89]. However, in today's dynamic economic world, the method by which firms may attain agility in their supply chain is an essential problem. As a result, supply chain managers must apply various technologies and techniques in their supply chain to gain substantial agility.

Supply chain agility is the strategic capability that enables firms to rapidly detect and respond to internal and external uncertainty by integrating supply chain linkages effectively [28,89]. Hence, agility is seen as holistic rather than procedural, and as having strategic rather than tactical importance. This concept has been extended beyond its original scope, including the firm's supply chain operations as well.

Ultimately, the effectiveness with which a company adapts to volatile market conditions will depend on the capabilities of its trading partners. High levels of customer service would be difficult to maintain even under steady conditions for a company whose primary suppliers have a history of subpar quality and late deliveries. When faced with rapid change, this company will be compelled to give up the game altogether. In such a setting, the reliability of supplies becomes a critical issue, and one possibl2023e solution is to improve communication with suppliers.

The manufacturer's ability to perform at the end of the supply chain will be hindered if the distribution channels are unable to respond due to physical or information flow issues. From this perspective, it is essential for supply chain management to establish strategies for competing based on agility [73]. Agile supply chain management (ASCM) is a set of practices that may help businesses effectively manage fluctuating demand [31]. There is an extent of literature available on agility in various fields wherever it is found to be applicable enough, but the current study outlines the need to understand how supply chains work and perform when agile practices are adopted that contribute most to the organization's success.

As supply chain management (SCM) is considered a strategic mechanism to boost a firm's competitive advantage, adopting agile supply chain management (ASCM) is becoming more important for organizations to survive [125]. Yet, in an agile supply chain, it may be especially challenging for firms to anticipate opportunities that develop because of changes in the market [109,127].

ASCM may take corrective measures for the company under certain conditions. Nevertheless, in highly fluid sectors like fashion, traditional supply chains based on organizational structure and demand estimates often fall short of customer expectations. Businesses require adaptability if they are to meet the ever-changing demands of their clients [17]. Previous research has focused mostly on answering the question, "How can we evaluate the agility of a company systematically?" by exploring various methods of doing so, validating the assessment findings, and comparing various evaluation methods of agility [89].

The current literature [22,24,37] emphasizes the importance of information technology as an enabler in agile manufacturing. Agile manufacturing, according to recent research [96,24], is intimately linked to information-sharing technologies that help businesses boost their responsiveness and the accuracy of their sensors [26]. Jamil et al., [50] integrates theoretical frameworks from the manufacturing and supply chains, and created a theoretical model highlighting the factors that influence Industry 5.0, Sustainable Supply Chain Practices. Comparable studies use multicriteria decision making to explicate the contextual links of circular SCM indicators by the application of Interpretative Structural Modeling (ISM), which is specifically designed for SMEs [97]. Özaşkın and Görener, [85] performed interviews in person with 11 decision-makers in manufacturing firm who know about green supply chain activities to prioritize impediments and solution recommendations connected to green supply chain practices. Nonetheless, there is a clear knowledge void about the relationship between agility practices and SCP. This study aims to fill this gap by methodically compiling and classifying all important parameters related to ASCM and SCP. Thus, the success of agile manufacturing relies heavily on technological advancements and the free flow of data.

We propose a model that includes seven well-established independent variables, and then analyze their combined effect on the supply chain performance of manufacturing sector. The strategic imperatives of customer-centricity, efficiency, effectiveness, integration and coordination of business processes with supply chain partners, responsiveness, and environmental sustainability are all reflected in the aforementioned improvement variables developed by supply chain management [51]. In order to achieve better supply chain performance that can create a beneficial firm strategy and give a competitive edge in the manufacturing sector.

Based on the above discussion, the following research questions have been described:

RQ1: How do these independent variables of ASCM impact supply chain performance?

RQ2: How do these variables elucidate manufacturing pathways to better supply chain performance contributing to the theory on the ASCM?

Thus, the following research objectives are to answer the above RQs: (i) to establish a connection between the factors considered and ASCM in manufacturing-related businesses. (ii) By offering a deeper comprehension of the joint significance of variables in SCP and how they should be incorporated to achieve better performance, this research adds to the body of knowledge on ASCM. The authors of this study postulate that there is a connection between supply chain performance and variables such as the use of technology, quality of supplier relationships (SR), the speed with which orders can be filled, facility management (FM), supply chain contracts (SCC), strategic management, and customer participation as shown in Appendix A. A research model and hypotheses are then proposed after a short introduction to the context of the study is provided. Empirical findings and conclusions are presented after some statistical and methodological suggestions are made in the next section of the study. Lastly, the study's limitations and future research objectives are reviewed, as well as the study's results and implications.

2. Literature review

Agility in the supply chain has been a key factor in achieving competitive goals by researchers like [136]. Similarly, [16] looked at ASCM and explored ASCM in a high-volatility market. The following sub-sections discussed about agile practices indicators for supply chain, theoretical framework and hypothesis development, and research gaps.

2.1. Supply chain performance measurements in manufacturing firms

The creation and use of measurements for the thorough assessment of the individual and group performances of each supply chain members is known as supply chain performance measurement. It is imperative that all parties involved in the supply chain use a thorough and fair approach to identify and assess the variables that are critical to the chain as a whole [20]. In manufacturing companies, performance evaluation is a crucial managerial task that is closely linked to other tasks including organizing, motivating, managing, and planning [40]. To create a performance measurement system that connects strategy, execution, and value generation, supply chain processes can be grouped into bands [133]. Performance evaluation contributes in strategy formulation and clarity, management information providing, communication between the vertical and horizontal axes, decision making and integration, motivation, and learning [1]. The process of choosing which supply chain performance measurement techniques to use is crucial [100,88].

A variety of measurement tools, including BSC models (Balanced Scorecard), ASLOG (French Association for Logistics), EVALOG (Evaluation of Logistics), and SCOR (Supply Chain Operations Reference), have been developed to assess SC performance. Prior research has demonstrated a noteworthy advancement in the creation of SC performance metrics: Beamon [12] identified four categories of SC practices: flexibility, customer happiness, efficiency, and financial success. The cost, profitability, efficiency, productivity, and inventory program are the most obvious measures for an agile approach. It is claimed that organizations implementing lean strategies should prioritize financial and efficiency metrics over the others by comparing them to the metrics [12, 130,3] suggested, which include financial performance, efficiency, customer satisfaction, and flexibility.

2.2. Agile Practices indicators for supply chain

Manufacturing firms employed techniques like lean management and just-in-time inventory (JIT) to adapt to unpredictable shifts in the market [72]. However, agile manufacturing practices was shown to be the most productive [96,28]. According to study by Piardi et al. [93], agile manufacturing practices develop as a solution in competitive environments, especially where there are varied consumer expectations. Leitão et al. [63] have underlined the necessity for a smart, autonomous, and intelligent system in order to address the problem of changing client needs while retaining cost-effectiveness. In the manufacturing context, it is critical to have a high degree of automation, digitalization, and strong connection [96]. According to Lu et al. [69], computerized automation and cutting-edge technical tools like sensors and actuators are important in today's environment for improving and streamlining supply chain performance.

To improve the performance of the supply chain, an agile supply chain strategy has been implemented. Supply chain management is one of the methods used to put this strategy into practise in businesses. In other words, the goal of implementing these practices is to take a more agile approach to the supply chain in order to improve its performance ([68]; Liu et al., 2024). Many studies have proposed the implementation methodologies for the agile approach to be used in the supply chain, in addition to emphasizing the importance and need of doing so.

In the paper, Hofman and Cecere, [48] argued that organizations should consider uncertainty and complexity because of their potential to impair business operations. That's why, in agile supply chain systems, adaptability in supplier relationships and interaction both in terms of providing services or goods and in responding to customer needs is crucial.

In our study, we have considered certain agile practices to determine the overall supply chain performance. These practices are taken from the extant literature available which is mentioned in Table 1. The following are the variables considered for the study:

a. **Technology utilisation (TU):**

The rise of technology across all industries has had a significant impact on the success of agile supply chain management (ASCM), with a beneficial effect on performance ([92]; Liu et al., 2024) and efficiency. Therefore, businesses need to embrace new technology to deal with challenges like intense rivalry in today's and tomorrow's marketplaces [105,78,95].

Access to pertinent data defined by extensive communication, information exchange, and extensive use of information systems and technology is required for an agile supply chain [113,124,28,76]. Companies operating in electronic marketplaces need to put their attention on developing efficient strategies and building strong partnerships based on the supply chain [73,84]. Information systems and information technologies, according to [114,89], are crucial to achieving industrial agility.

In addition to providing us with the necessary materials for the investigation, the company should have the right kinds of technology to be more successful in the marketplace. Manufacturing technology at its core (regardless of age or specifics) serves the purpose and helps us compete effectively.

b. **Supplier Relationship:**

Businesses' interactions with suppliers affect their capacity to deploy agile SCM. Supply chain management depends on careful

Table 1
Agile supply chain practices.

SN	Practice	Resource
1	Coordination and integration of the product's design, manufacturing, and development using information technology (Technology Utilisation).	[73,65,134,89,96,112, 5]
2	Use of IT for supply-chain integration and cooperation (Technology Utilisation)	[73,65,134,89,96,112, 104]
3	Coordination and integration of purchasing processes via the use of information technology.	[73,65,134,96,112, 108]
4	When information and communication technologies are used together to streamline service provision.	[73,65,134,89];, 2012; [96,112,108,103]
5	Forming reliable partnerships with vendors and clients.	[65,96,66]
6	Product personalization.	[73,134,112]
7	Maintenance and expansion of connections with buyers.	[65,96,112]
8	The prompt collection of demand data.	[108,78]
9	The quality of service has increased.	[65,134,68]
10	Streamline and enhance existing procedures.	[65,96,66,112]
11	Planning in tandem with our vendors and communicating as a team.	[112,108]
12	Supplier flexibility in changing order quantities.	[134,108]
13	The flexibility of the supplier to shift the order date.	[134,108]
14	Capabilities and processor providers in terms of technology.	[108,68,112]
15	Trusted, ongoing collaboration with our supply chain partners.	[108,78]
16	Helps boost productivity via the use of technology.	[108,78]
17	Accelerate the pace of product deliveries and shorten turnaround times.	[108,68,112]
18	Educating and enabling workers.	[108,96,106]
19	Multi-skill human resources	[108,78,82]
20	Human resources balance	[108,68,112]
21	Team building and leadership in the workplace.	[108]
22	Shorten the time it takes to create a new product.	[134,108]
23	Haste in shortening both lead and cycle times.	[134,65,68]
24	Rapidity in strengthening the dependability of shipping.	[65,134,108]
25	Capability to adjust output levels quickly.	[134,68,112,108]
26	Potential to create spare capacity (buffer).	[134,68,112,108]
27	Flexibility in terms of shipping times.	[134,78]
28	Ease of assembly of products	[73,108]
29	Accuracy of data	[65,108]
30	In order to foster innovation, it is necessary to put in place the appropriate framework.	[108,78]
31	Increase the frequency of introduction of new products	[134,78]
32	Participate in supplier activities to supply customer specification	[65,89]
33	Maintain surplus inventory to meet demand quickly	[68]
34	Outsourcing	[89,108]
35	Engaging suppliers in product development	[89,108]
36	The interdepartmental transferability of staff.	[89,108]
37	Flat and flexible organizational structure	[89,108]
38	Ability to change in production combination	[134,112,78]
39	The capacity to speed up production and cut down on downtime.	[134,108,68]
40	Speed in meeting customer needs	[134,68,112,108]
41	The capacity to produce in both great and small quantities.	[108,66]
42	Become a learning organization	[108,134]
43	Developing honest connections with clients.	[68]
44	Get rid of bottlenecks and silos in the system.	[112,108]
45	Management of manufacturing processes and material requirements planning.	[89,66]

supplier selection [118]. Identifying the best suppliers early in the design process minimizes costs, improves quality, and speeds up time to market [71]. As suggested by [77], fewer steps like identifying needs, analyzing viable suppliers, bidding, negotiating, choosing, obtaining buy approval, releasing and receiving requirements, and evaluating supplier performance are important (Liu et al., 2024). The goal is to ensure that all operations function efficiently and that all items, services, and information are easily accessible.

Purchasing begins with identifying a need where raw materials, subassemblies, shipping, and maintenance may be needed. This is typically followed by the procurement department where the buyer must explain how the unique product or service fits the business's current offerings and whether demand can be met. Market research or current vendors might help identify prospective suppliers where existing suppliers list down the possible (Request for Information) RFIs along with the (Request for Proposal) RFPs. A method is a full approach to identifying suppliers; however, it's not used in every company or purchasing situation [98].

Choosing a Supplier is crucial to minimizing business risk [131, 134]. A purchase order is further made by the procurement team which might comprise one item or many reorders. Long-lead orders need follow-up via phone or email at frequent intervals throughout delivery to ensure the provider can deliver as promised and the goods are received and examined. These purchases are then managed by gathering and filing papers and keeping or deleting files. McQuarrie [74].

c. **Supply Chain Responsiveness (SCR):**

The responsiveness of a company may be improved by implementing supply chain practices that support and implement the supply chain strategy of that business [111,4]. Flexibility, learning orientation, visibility, rapidity, and responsiveness in the supply chain all contribute to agility in the service industry [108,11]. We analyze the significance of adaptability in the industrial sector in light of these observed trends.

Adaptability is defined as the capacity to detect, react to, and recover from change quickly [10,113,124,137,28,54]. The ability to quickly recognize changes, opportunities, and hazards is the definition of alertness [64], a term that is sometimes used synonymously with responsiveness. speed, which may be seen as the ability to quickly put one's decisions into action [137,72]. These characteristics of an adaptive supply chain are what allow for its reconfigurability in terms of scope, time, and cost [28] or, from a more distant vantage point, its ability to identify fundamental changes in the supply chain and market environment [25].

d. **Facility management:**

The facility's layout and location are both part of the facility management. The facility's layout is dynamic and asks for responding quickly to shifts in demand. Planning for each period's layout is developed by comparing the associated expenses with material handling, which might include adjustments to the layout from period to period [56].

Due to the growth of the internet, multimedia, and computer-aided design and manufacturing (CAD/CAM), non-value-adding tasks in the production process have been rendered obsolete [68]. In agile settings, this also aids in reducing the likelihood of human error during data replacement, process monitoring, and product development [99,37].

e. **Supply Chain Contracts:**

A supply chain relies heavily on facilities, inventory, transportation, sourcing, pricing, and information [101]. Previous studies [13,53] have established supply chain contracts as a core pillar of SCM.

A company's manufacturers are the end clients in this situation, and supply chain contracts regulate the interaction between suppliers and their customers. This means that a supply chain contract will address issues like minimum order quantities, quality standards, and lead times. Requirements are a standard part of every supply chain contract. Sellers' and buyers' operations, strategies, and performance are all significantly impacted by these demands (Liu et al., 2024; [73]). Therefore, supply chain choices must take contracts throughout the supply chain into account.

Various supply chain contract methodologies have been examined before and methods like buy-back and return policies, as well as incentive schemes [62], fall within this category [27]. Many of these methods focus on the coordination of complex supply networks [35].

f. **Strategic Management:**

Strategic management is the process by which a company ensures its competitiveness by integrating its ability to compete in all its operations. This is where the strategic character of an entrepreneurial mindset comes into play [65]. For this reason, there has been a surge in research into the confluence of supply chain management and entrepreneurship. First proposed by Miller, [75] and refined by Covin and Slevin [18], the Entrepreneurial Orientation (EO) concept characterizes an organization's strategic health along with characteristics like proactivity, creativity, and willingness to take risks [134].

To better manage time, money, and quality, businesses must use strategic management practices, which investigate a wide range of process variables (items) that contribute to the formulation of management's overall strategic orientation. Certain aspects of nature, inventory, time, and design management are examined. To guarantee the dedication of upper management and regular management-employee meetings, nature management investigates the participatory management style. Using streamlined procedures, Inventory Management implements a pull production system [68]. Time management is the practice of organizing one's time and resources efficiently. Utilizing a modular product design approach allows for an optimal SCM paradigm in product development and service delivery.

g. **Customer Involvement (CI):**

Businesses use customer participation to tap into consumers' knowledge, insight, and feedback throughout crucial phases of product creation, such as the design, development, and customization phases, and to get a deeper understanding of what those customers need from the company. Following previous works [29,67,81]. As per [34] including consumers in the standardization of processes improved customer service, while including customers in product design improved product performance overall ([126]; Liu et al., 2024).

Additionally, an organization's capacity to distinguish its goods is influenced by its customer interactions [102,122], which in turn increases customer satisfaction [19]. Therefore, businesses need to learn who, how much, and why to involve from their client base [91]; [67]). Aligning the aforementioned factors with the experiences, understanding, and expertise of the customers is crucial to achieving agility, which is directly correlated with service quality, customer sensitivity, customer satisfaction, or the extent to which customer-related objectives have been met and could be achieved [7].

There is a recommended set of actions that may be taken to realize the benefits of an agile supply chain. The following table displays the findings from a previous study on the implementation of agile supply chain techniques. Research is primarily interested in answering the question, "What role does an agile supply chain play in the manufacturing industry?" because of the importance and need for agility in this sector. To develop this framework, we looked at the mechanics of an agile methodology, what kinds of practices it involves, and the connections between them. Seven independent factors are significant in explaining the relationship between agility, supply chain management methods, and desired organizational performance results. Recent literature and the findings of current research where these constructs were evaluated and verified informed the choice of these variables. This data was then sorted into independent and dependent variables as shown in

Appendix A.

2.3. Theoretical framework and Hypothesis development

The hypothesis of this study rests on the concept of an SC strategy that evolves in line with the business plan of the focal company [52], giving precedence to a selected group of performance indicators. The seven elements of supply chain performance—supplier relationship, customer participation, strategic management, supply chain contracts, technology use, supply chain responsiveness, and facility management—are originally proposed as the basis for such interactions.

This study employs a unified theoretical strategy to explore the RBV hypothesis. Important theoretical frameworks in the manufacturing and processing sector nowadays include the resource-based approach as well as transaction cost economics [45].

These ideas are grounded in a wealth of research and literature pertaining to globalization. RBV theory illustrates how businesses are becoming more reliant on information technology in order to improve supply chain operations [135,78]. ISCA, which stands for IT-enabled integrated SCA, can assist a company in making the most of its IT resources [115,65]. Because manufacturers and suppliers have fewer opportunities to take advantage of one another, transaction costs are reduced when the supply chain is nimble. Based on RBV theory, this study adopts a unified theoretical strategy to develop a conceptual model of SCA, intending to identify its most crucial components [87].

According to RBV, in order for companies to sustain a competitive advantage over the long term, they need to consistently adapt to changing conditions and rebuild their capabilities [94]. SCA has been shown to improve the adaptability of a company to new operating methods, which is an important competitive advantage [87].

According to [23], SC agility is defined as the capacity of an SC (within the focal organization and its component members) to align the system and related operations efficiently and quickly to the ever-changing needs of the customer [59,89]. In other words, agility is characterized by a degree of flexibility and responsiveness, and it involves a broad variety of elements, including organizational structures, processes, and management attitudes [9].

The major instruments for effectively predicting and reacting to shifts in the market are the system for exchanging information and integrated processes [38,57]. The utilization of buffer stocks and other methods to deal with demand fluctuations are hallmarks of agile supply chain management [60].

Since they often deal with novel items, there is a sense of urgency in launching ahead of the competition, keeping lead times short, and maintaining flexibility in production and logistics in accordance with changing marketing plans. This is why most production systems are designed to accommodate the pull-demand approach by providing appropriate reaction capabilities [68].

Based on what has been said so far, it seems clear that manufacturers benefit most from an agile supply chain. This reflects features like increased innovation, product variety, risk, flexibility, and delivery performance, but at the expense of lower costs, more accuracies, greater efficiencies, and greater uniformity.

2.3.1. Technology Utilisation

Researchers have paid a great deal of attention, as of late, to the question of what function information technology plays in supply chains. The information system has evolved into a potent instrument that businesses can utilize to obtain a competitive advantage [78]. As a result of this, the vast majority of businesses are putting money into relevant software in order to implement information systems because the return on investment has been so successful. If businesses have the intention of cultivating and improving their communication as well as their relationships with their partners, they need to make use of technical tools or software that will help them to do so [110].

H1. : There is a positive relationship between technology Utilisation and Agile supply chain performance.

2.3.2. Supplier Relationship

To have an agile supply chain, there is also a lot of evidence that close relationships with suppliers are important. Christopher [16] says that a key part of agility is groups of partners who work together through networks and firms that use best practices in supply chain management and value cooperation highly. They even claim that this sometimes necessitates collaborating with rivals on non-strategic matters [89].

H2. : There is a positive relationship between the Supplier relationship and Agile supply chain performance.

2.3.3. Supply Chain Responsiveness

When a firm has a flexible supply chain, it is better able to deal with competitive scenarios and unforeseen events like natural catastrophes, sudden changes in demand, rapidly developing technology and the need for cooperative vendors. IT solutions may strengthen a company's foundation by providing access to relevant data in real-time.

A company's competitive edge is bolstered when supply chain partners, Technology, and inter-organizational divisions are all integrated [78]. The business has had to increase its speed of reaction to change and responsiveness to customers as a result of the unpredictable and constantly shifting external environment. A quick response time is essential in today's global economy.

H3. : There is a significant effect of responsiveness on Agile Supply chain performance.

2.3.4. Facility management

Facility managers can select designs that do not significantly deteriorate with production changes if they take into account potential future adjustments during the design phase [68]. In light of this unpredictability, the organization's facility management system needs to be as robust and as flexible as possible in order to ensure that everything runs smoothly.

H4. : There is a significant effect of facility management on Agile Supply chain performance.

2.3.5. Supply chain contracts

Supply chain contracts help manage the interaction between various suppliers and the businesses they supply. So, a supply chain contract will deal with matters like price policies, allocation guidelines, minimum order quantities, quality, and delivery times. There are requirements included in every supply chain contract. Customers' and vendors' productivity and the methods they use in their businesses are profoundly affected by these regulations [121]. That's why it's so important to include supply chain contracts in all supply chain choices.

H5. : There is a significant effect of supply chain contracts on Agile Supply chain performance.

2.3.6. Strategic management

According to [119], companies with high innovations will advance and develop more rapidly than those with low Entrepreneurial Orientation. As an interesting side note, [32] argued that EO would lead to methods that encourage novelty, creativity, and invention, as well as display greater levels of imitation and risk-taking in their choices.

Improving innovation performance and maintaining stable links in the supply chain by bolstering relational and institutional understandings of relational governance and dynamic capabilities [14]. The existence or lack of entrepreneurship is closely tied to the level of innovation in each industry. Behaviors that are considered innovative result from a propensity to try something new, to be open to and even encourage the development of unique ideas that may lead to novel services, goods, or technical processes, and to break with conventional

norms [36,70]).

In addition, salespeople's willingness to take the lead in testing out novel approaches to marketing and customer service is a hallmark of EO [120].

H6. : There is a significant effect of strategic management programs on Agile Supply chain performance.

2.3.7. Customer involvement

Integrating consumers into manufacturing processes is essential for realizing the full potential of agile methods [96,38], and doing so is also linked to a significant improvement in the handling of demand unpredictability. Therefore, only customers who are actively involved and who possess valuable knowledge should be invited to join agile manufacturing.

H7. : There is a positive relationship between customer involvement on Agile Supply chain performance.

The suggested research framework used in this study is depicted in Fig. 1.

2.4. Research gaps

Several studies have been conducted on the topic of agility in supply chain management, as discussed in the previous section. Even if the final product to work at its best, the strategic, tactical, and operational layers of supply chain must be all in sync. Hence, it's important to think about things that matter for our study, which is centered on manufacturing companies. In this respect, several supply chain activities are to be integrated, which is why we have considered the whole supply chain to determine the performance further. From the point of considering the suppliers and their relationship with the business, contracts employed with them, facility management as the whole scope of the facility comes into one image, entrepreneurial orientation, which falls under the strategy level and is evaluated when deciding whether to lean in that specific way or not [123,80]. Accordingly, business choices at the level of strategy, including those concerning the nature, time, inventory, and design of an enterprise, are integrated with an entrepreneurial mindset [49]. By looking at these elements, we would get insights into the interplay between the supply chain's strategic, operational, and business-level roles as they are crucial to attaining agility in post COVID era where agile has been one of the prominent methods to manage dynamic market demands and uncertainties.

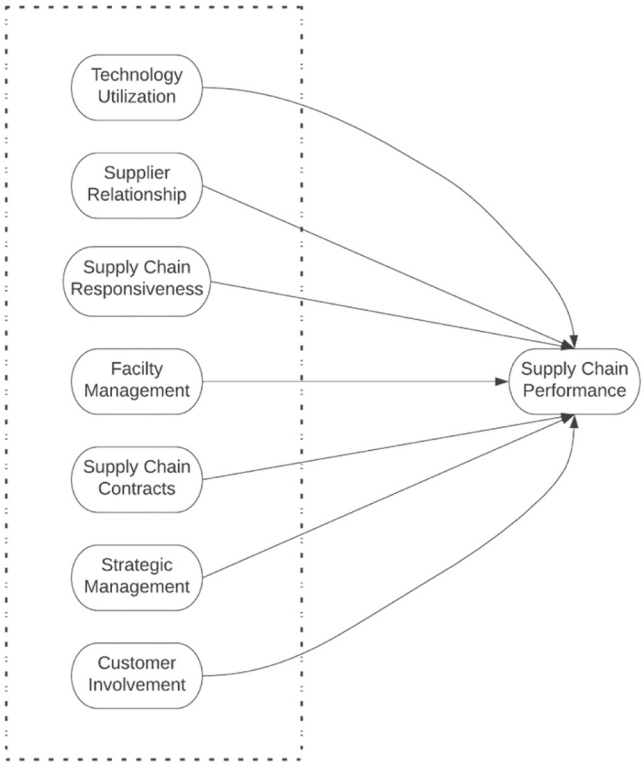


Fig. 1. Theoretical framework of SCP.

As a result of this study, we now know what to look for when assessing a manufacturer's agility [99]. By focusing on manufacturing businesses, this study seeks to fill a knowledge vacuum by investigating the correlation between supply chain performance (SCP) according to COVID-19 and Agile manufacturing techniques [55]. Findings from the research will help businesses utilize Agile with more traditional methods in order to effectively respond to shifting market conditions and intense global competition [116,39]. Companies in manufacturing sector provide the data needed for the research.

3. Methodology

3.1. Study design

The goal of this study was to determine how agility in firms influences supply chain performance. The study can be utilized to determine how these companies' cutting-edge agile techniques or tactics were used post-COVID-19. The structure of methodology for the study is depicted in Fig. 2.

3.2. Pilot study

We carried out the project's pilot test. The idea was examined and improved before the questionnaire was made available to the intended audience. To validate its content, the questionnaire has undergone two rounds of pre-testing. The questionnaire was initially distributed to six distributors and a supervisor from the firm's supply chain distribution network to fine-tune the survey instrument and ensure high content validity. Pre-testing this questionnaire during the second round involves 40 employees who agreed to take part. To confirm the validity and accuracy of the measurements, a preliminary test of reliability was performed using SPSS. The modified questionnaire was then sent to the businesses that had been sampled and shown in Appendix B.

3.3. Sample and data collection

Employees in manufacturing between the ages of 20 and 60 make up the bulk of the study's population. This research was broken down into two categories: agile supply chain techniques and supply chain efficiency. Data was obtained both physically and digitally from these respondents. In all, 625 questionnaires were sent out, with 352 usable replies returned to the authors. A response rate of 54 % and a sample size of 340 valid replies were sufficient to test the hypotheses provided in the study [41]. The sample is collected through a survey sent to people working in core manufacturing companies. The targeted companies were from around India where manufacturing plants and special economic zones are established. The cities from where we got the most responses were Chennai, Jamshedpur, Visakhapatnam, Gurugram, Manesar, Bengaluru, Hyderabad, and Ahmedabad.

The summary of the demographic details of respondents is given below in Table 2.

4. Data analysis and results

4.1. Data analysis

The study's research methods section opened with a description of demography and a measurement scale before moving on to data analysis and conclusions that assessed how well the stated independent and

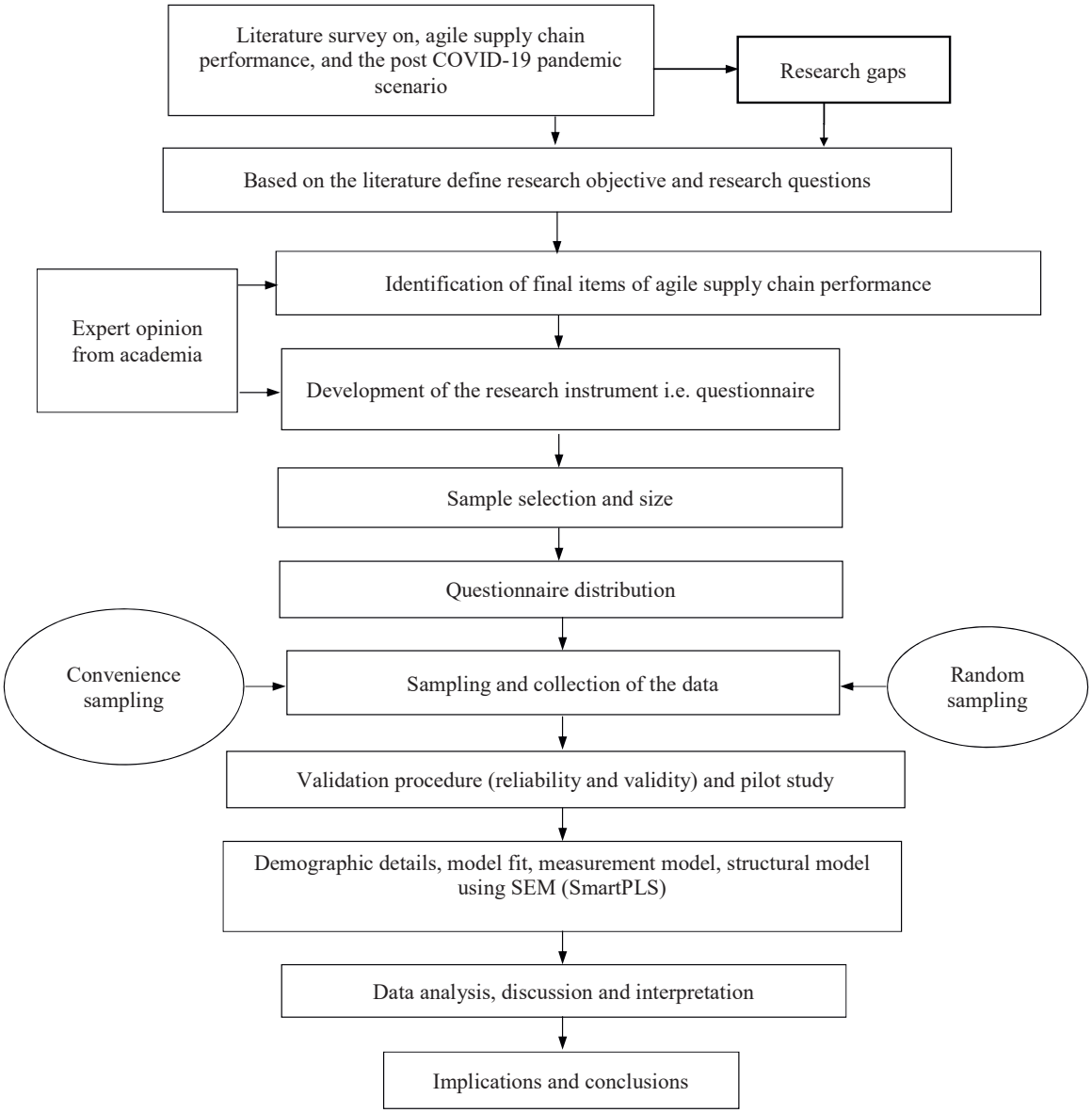


Fig. 2. The structure of methodology for this study.

dependent variables were assessed. This study aims to evaluate the impact of several independent variables on agile supply chain performance concerning seven parameters to test seven hypotheses. The partial least squares structural equation modeling (PLS-SEM) version 4 was used to assess the outcomes. The PLS-SEM technique, which has the obvious advantages of simplicity and adaptability, was employed in the investigations by [43] and [58].

4.2. *Measurement model assessment: confirmatory factor analysis (CFA)*

Table 3 summary provides descriptive statistics for the mean and standard deviation for

important metrics, including technology utilization (TU), supplier relationship (SR), supply chain responsiveness (SCR), facility management (FM), supply chain contracts (SCC), strategic management (SM), customer involvement (CI) and agile supply chain performance (ASCP).

The SPSS program was used to conduct a confirmatory factor analysis. Before conducting the final analysis, the model fit must be verified. A perfect model fit is indicated by the Chi-square value of 1629.531 and the SRMR value of 0.044 (<0.08). ([58,47]). For each construction (factor), the reliability (α) test—one of the key measures of the scale's dependability—was computed to evaluate internal consistency. Internal consistency suggests that it is preferable to have a "higher" figure of (>0.6) [52] and 0.7 is sufficient to satisfy the reliability (α) value for all variables ([83,41]). Every construct had average variance extracted (AVE) values greater than 0.5, as shown in Table 2 [107].

All the AVE values, according to the study's analysis, lie between 0.648 and 0.806. Thus, it demonstrates that convergence is true. According to [42], VIF stats are first evaluated to see if collinearity problems might skew the results of the structural model. All VIF values were less than 3.5, as shown in Table 3, indicating that collinearity was not a concern to the structural model results [21]. All constructions' composite reliability levels exceeded the 0.7 cutoffs [43]. Fig. 3 displays the statistics for the measurement model.

The measuring model has therefore supported eight latent components from the proposed research model (TU, SR, SCR, FM, SCC, SM, CI, and ASCP). Path coefficient values and outer loadings are also taken into consideration, and the corresponding ASCP R-Squared values are 0.828 (as mentioned in Fig. 3). Construct validity, according to [44], analyzes how correctly a measure captures the target variable. The credibility of

Table 2
Summary of demographic details.

Profile	Classification	Count
Gender	Male	265
	Female	75
	Total	340
Age	21–30	252
	31–40	54
	41–50	17
	51–60	17
	61 and above	0
	Total	340
Designation	Supervisor	206
	Manager	65
	Senior Manager	27
	Executive	42
	Total	340
Highest level of Education	Diploma	23
	Bachelor's	264
	Master's	52
	Doctoral	1
	Total	340
Current job type	Technical stream	246
	Managerial stream	94
Current organizational tenure	1–5 years	290
	6–10 years	37
	11–15 years	6
	16 years and above	7
	Total	340
Overall work experience	1–5 years	185
	6–10 years	98
	11–15 years	26
	16 years and above	31
	Total	340
Department of respondent	Human resources and business development	43
	Sales and Marketing	35
	Purchasing	39
	Operations	125
	Logistics	33
	Accounting	22
	Audit	10
	Others	33
	Total	340

the study's findings can be greatly impacted by refusing to assess construct validity. The construct validity must be assessed using two indicators: convergent and discriminant validity. To assess the discriminant validity of the correlations between these eight constructs (as represented in Table 4). Each of these was consequently authorized, and the bootstrapping analysis stage started. To ensure that the measurements of the constructs created for the current inquiry are not very closely related, discriminant validity was used. Therefore, the convergent validity coefficients should be significantly larger than the discriminant validity coefficients. Finally, discriminant validity assesses the significance of the relationships between the research's constructs. It uses the square root of AVE of a particular construct to compare its relationship to other constructions. Using two different techniques, we evaluated the constructs' discriminant validity. Afterward, component-squared correlations and AVE values were evaluated for each construct for each factor [30]. The AVE values for each factor, which are shown in Table 3 and are higher than their squared correlations with other factors, corroborate the discriminant validity.

4.3. Structural model assessment: hypothesis testing

The study then moved forward to evaluate the research hypotheses in the structural model evaluations by implementing the bootstrapping process after finishing the evaluation of the measurement model and checking that the results met all the criteria. The operation was done with the suggested settings in place. Whereby, 10,000 subsamples, a 0.05 significance threshold, and the bias-corrected and accelerated confidence interval approach [42] were used. Assessment of collinearity, significance testing, model's explanatory capacity (R^2), and model's predictive power are all included in the full presentation of structural simulated results (Q2 predict). Due to this, all these positive Q^2 predictive power values were compiled and shown in Table 5.

Two out of the seven hypotheses were not supported. With t-values smaller than 1.65 in a one-tailed test, supply chain contracts (SCC), and technology utilization (TU) showed no statistically significant impact on agile supply chain performance (ASCP). Meanwhile, facility management (FM), supplier relationship (SR), supply chain responsiveness (SCR), strategic management (SM), and customer involvement (CI) showed a significant effect on agile supply chain performance (ASCP). The structural model assessment was completed with the publication of the PLS forecast findings. Out-of-sample predictions, also known as model predictive power, may be generated using PLS predict [33,43]. Table 6 shows that the structural model results supported the study's hypothesis and that the independent variables strongly influenced the dependent variables. The indicators of the study's primary endogenous construct on ASCP also showed the model's high predictive ability ([43, 117]). Further evidence that the interpretation of the model's explanatory power contrasts between PLS-SEM was valid as provided by Q^2 predicts values across both levels, indicator and latent, which were both above 0.

5. Discussions and findings

The study shows how agile supply chain practices have an impact on the overall supply chain performance of manufacturing organizations. The variables considered cover the whole ambit of the supply chain from the point of suppliers to the customers and these would add to the overall performance. Through the analysis of the model, it is found to be fit and reliable with the values exceeding the required level. As shown in Table 6, five out of seven hypotheses are supporting the study whereas the other two are not i.e., Customer involvement (CI), Facility management (FM), Supply chain responsiveness (SCR), Strategic management (SM), Supplier relationship (SR) are supporting the study whereas, Technology utilization (TU) and Supply chain contracts (SCC) are not supporting. Maintaining good relations with suppliers would help the company in reducing the cost, and lead time and getting good quality materials. Suppliers are the starting point in the supply chain and a good start would positively impact the overall performance (Liu et al., 2024). The capabilities of suppliers are used to aid in the production processes, viewed as stepping stones to attaining Agile Manufacturing [96,68]. Once the materials arrive at the location, the facility needs to be managed well so that there won't be any disruption in the process, and this would in turn help the organization meet the requirements of the customer. Strategically decision-making in terms of innovation, adoption, and training would help the company be competitive in the market as the competency of the organization as a whole would improve over the period which agrees with comparable findings by [129] and lends credence to the claims of [132] that agility is a crucial SCM capability.

Once the competency increases, the responsiveness also increases as any demand can be met strategically. All of these along with customer involvement in the processes would satisfy the customer and improve the relationship. Customer involvement was found to affect the Agile Supply chain insignificantly. The result is inconsistent with some previous studies. Before a supply chain can react quickly to shifts in consumer demand, its business operations must be connected and coordinated at every node in the chain. Manufacturers need to implement an ASC to stay competitive due to the rapid evolution of both consumer preferences and available technologies [136].

The degree to which a company adopts and makes use of new technologies and the nature of the task at hand determines the nature of the impact. Cost-cutting features, like incentives and buy-back procedures, are essential in supply chain contracts. Contracts in the supply chain need to be considered because of the possible impact they have on

Table 3
Evaluation of the Measurement Model with Reliability and Validity Test of Factors (N= 340).

	Reliability (α)	Factor Loading	Mean	S.D.	AVE	CR	VIF
ASCP	0.914		4.231	0.828	0.661	0.916	
ASCP1		0.819	4.271	0.81			2.293
ASCP2		0.865	4.297	0.831			2.978
ASCP3		0.803	4.338	0.775			2.237
ASCP4		0.84	4.285	0.842			2.651
ASCP5		0.816	4.141	0.877			2.271
ASCP6		0.796	4.191	0.82			2.172
ASCP7		0.746	4.1	0.841			1.831
CI	0.747		4.229	0.844	0.798	0.747	
CI1		0.893	4.268	0.824			1.553
CI2		0.894	4.191	0.865			1.553
FM	0.819		4.178	0.843	0.648	0.826	
FM1		0.797	4.088	0.873			1.737
FM2		0.824	4.271	0.81			1.718
FM3		0.819	4.282	0.802			1.806
FM4		0.777	4.074	0.89			1.653
SCC	0.76		4.028	0.91	0.806	0.764	
SCC1		0.907	4.068	0.932			1.6
SCC2		0.888	3.988	0.888			1.6
SCR	0.872		4.181	0.841	0.662	0.873	
SCR1		0.821	4.212	0.838			1.97
SCR2		0.797	4.188	0.857			1.871
SCR3		0.833	4.147	0.82			2.121
SCR4		0.794	4.182	0.838			1.83
SCR5		0.823	4.179	0.854			2.049
SM	0.917		4.195	0.844	0.668	0.918	
SM1		0.827	4.212	0.866			2.386
SM2		0.846	4.224	0.859			2.566
SM3		0.815	4.147	0.882			2.252
SM4		0.813	4.188	0.874			2.274
SM5		0.827	4.224	0.792			2.401
SM6		0.795	4.159	0.811			2.125
SM7		0.798	4.215	0.828			2.132
SR	0.879		4.243	0.828	0.674	0.879	
SR1		0.831	4.268	0.783			2.166
SR2		0.824	4.253	0.854			2.076
SR3		0.806	4.232	0.838			1.931
SR4		0.827	4.224	0.842			2.107
SR5		0.816	4.241	0.826			2.01
TU	0.795		4.139	0.824	0.709	0.795	
TU1		0.848	4.162	0.763			1.709
TU2		0.837	4.088	0.87			1.661
TU3		0.842	4.168	0.839			1.689

flexibility. Not every company is fine with the incentive mechanism, or the supplier won't be willing to buy back the left material as this would affect their cash flow. This again depends on the level of relationship and executing abilities of the companies which vary from one another. Companies are increasingly investing in vertical integration as it is benefitting the larger corporations, and this also affects the supply chain contracts. Overall, in this study supply chain contracts and technology utilization failed to influence ASC, as their impact on performance may be limited if other factors such as contract flexibility, technology integration and collaboration and coordination issues are not adequately addressed in the supply chain practices.

5.1. Theoretical implications

The study looks into the variables or factors affecting the supply chain performance where five out of seven hypotheses are supported which shows how supplier relationship, strategic management, facility management, supply chain responsiveness, and customer involvement are supporting the overall supply chain performance. These show that the constructs are leading to better supply chain performance. Various challenges arise in this dynamic world, but managing the supply chain effectively would take the organization toward growth [90].

5.2. Managerial implications

The results of the research show managers how many factors influence supply chain efficiency. If managers want to successfully plan the strategic, tactical, and operational tasks and goals, they will need input from a wide range of the company. Thorough familiarity with their suppliers, strategies, facilities, responsiveness, technologies, contracts, and consumers can help them better fulfill market demand and boost performance generally, with each of these factors having a unique effect on the business. In today's world, business managers often encounter disruptions happening and there is always a need to assess the market and align the objectives accordingly. Being equipped with such understanding would help them prepare well.

5.3. Societal implications

Focus on customers is increasing and satisfying them is considered important as in the business world, customers determine the market demand. Being responsive to the market demand by understanding the underlying factors would help the organization cater better to its needs. Society is also affected by the supply chain and its activities. An effective and efficient supply chain would always have a positive impact on society as all the stakeholders are taken good care of. COVID-19 has been very instrumental in negatively impacting society and the supply chain so, understanding the importance would help the organization better

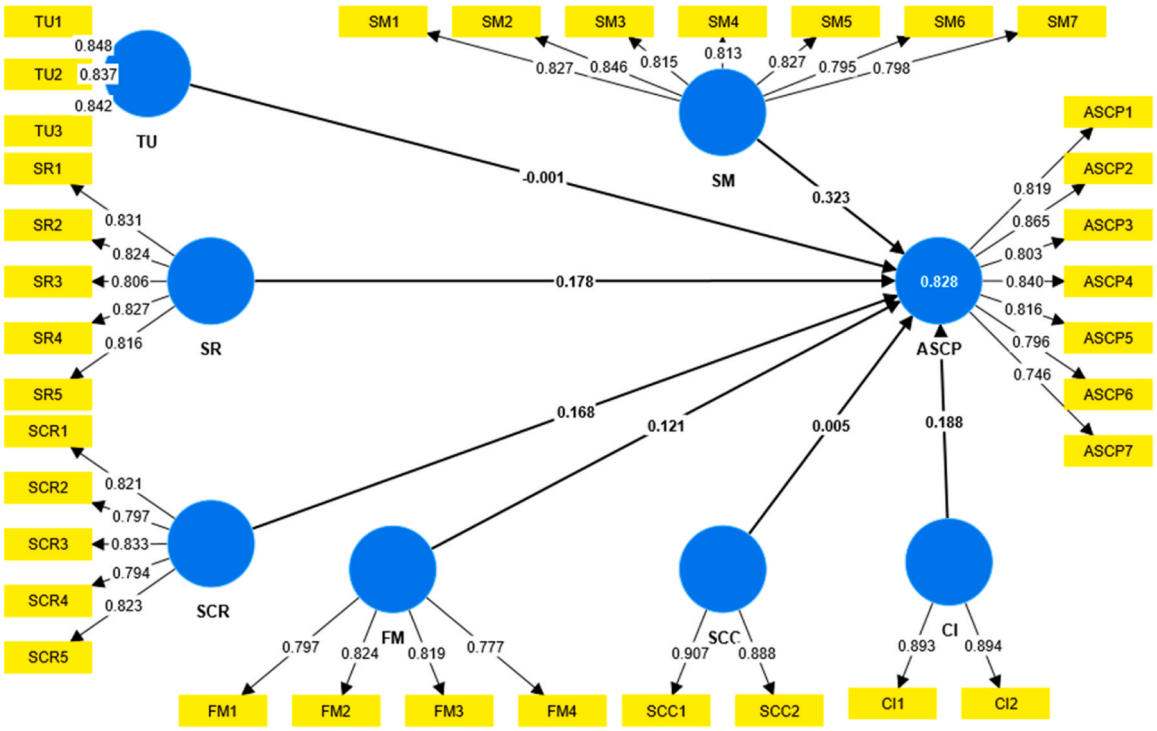


Fig. 3. Measurement Model Statistics.

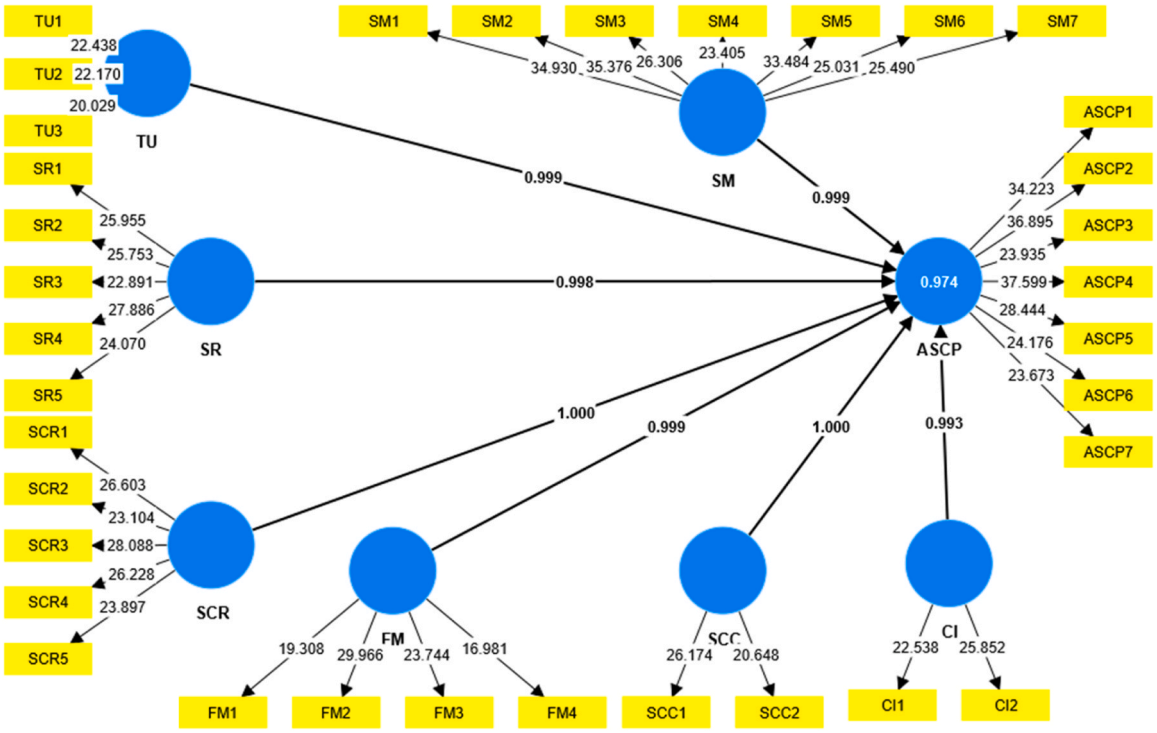


Fig. 4. The Structural Model.

comprehend and integrate.

6. Conclusions

Research done so far has mostly focused on determining how to measure agility (KPIs). Therefore, it is crucial to differentiate between the needs of the strategic, tactical, and operational levels of any supply chain to make more informed judgments. The current study looks at the effects of agile principles throughout the supply chain and how they are being adopted by manufacturing organizations in India. The results imply that strengthening core capabilities and attaining a competitive advantage is crucial to obtaining a sustained competitive advantage over time. If companies want to achieve better in these areas, they need to start using agile methods. Businesses may maximize their resources,

Table 4
Discriminant validity analysis from CFA.

	ASCP	CI	FM	SCC	SCR	SM	SR	TU
ASCP	**0.813**							
CI	0.808	**0.894**						
FM	0.818	0.736	**0.805**					
SCC	0.731	0.676	0.736	**0.898**				
SCR	0.855	0.779	0.869	0.757	**0.814**			
SM	0.878	0.819	0.836	0.805	0.883	**0.818**		
SR	0.82	0.74	0.782	0.69	0.819	0.829	**0.821**	
TU	0.774	0.711	0.765	0.634	0.814	0.813	0.817	**0.842**

Table 5
Prediction Relevance of the Model.

	Q^2 (=1-SSE/SSO)
ASCP	**0.536**
CI	**0**
FM	**0**
SCC	**0**
SCR	**0**
SM	**0**
SR	**0**
TU	**0**

save expenses, and increase efficiency by adopting agile techniques, which allow them to adapt more swiftly to shifting market needs. The study also underlines the relevance of decision-making in creating lasting competitive advantage. The study offers stands in the inclusion of agile practices in manufacturing organizations, and the factors that are taken into consideration for this study will span the entirety of the supply chain. This demonstrates that the respondents had the same opinion of the variables that are impacting the supply chain in both directions. The ability to make decisions concerning the aforementioned criteria is the most important factor in achieving a sustained competitive advantage and becoming the industry leader. Furthermore, they need to stand apart from the competition by providing something no one else can: superior value to clients.

According to the findings, businesses that embrace agile techniques are better able to maintain a competitive edge over the long term because they are quick to respond to market changes and more creative in their approach to problem-solving. To conclude, Indian manufacturing companies may gain a durable competitive advantage by adopting agile principles.

7. Limitations and scope for future studies

The study covers agile practices in the manufacturing industry in India which can be further extended to other industries on a much larger scale. The responses cannot be generalized to other industries and other relevant variables can be considered for future studies. The level of technology adoption and supply chain contracts in place can also be considered in future studies as they can further align with the latest trends in the industry as per the study's requirements.

CRediT authorship contribution statement

NSB Akhil: Conceptualization, Investigation, Methodology, Writing – original draft. **Tanmoy De:** Supervision, Writing – review & editing. **Phanitha Kalyani Gangaraju:** Conceptualization, Investigation, Validation, Writing – review & editing. **Vimal Kumar:** Supervision, Validation, Writing – original draft, Writing – review & editing. **Rohit Raj:** Conceptualization, Investigation, Methodology, Resources, Writing – original draft.

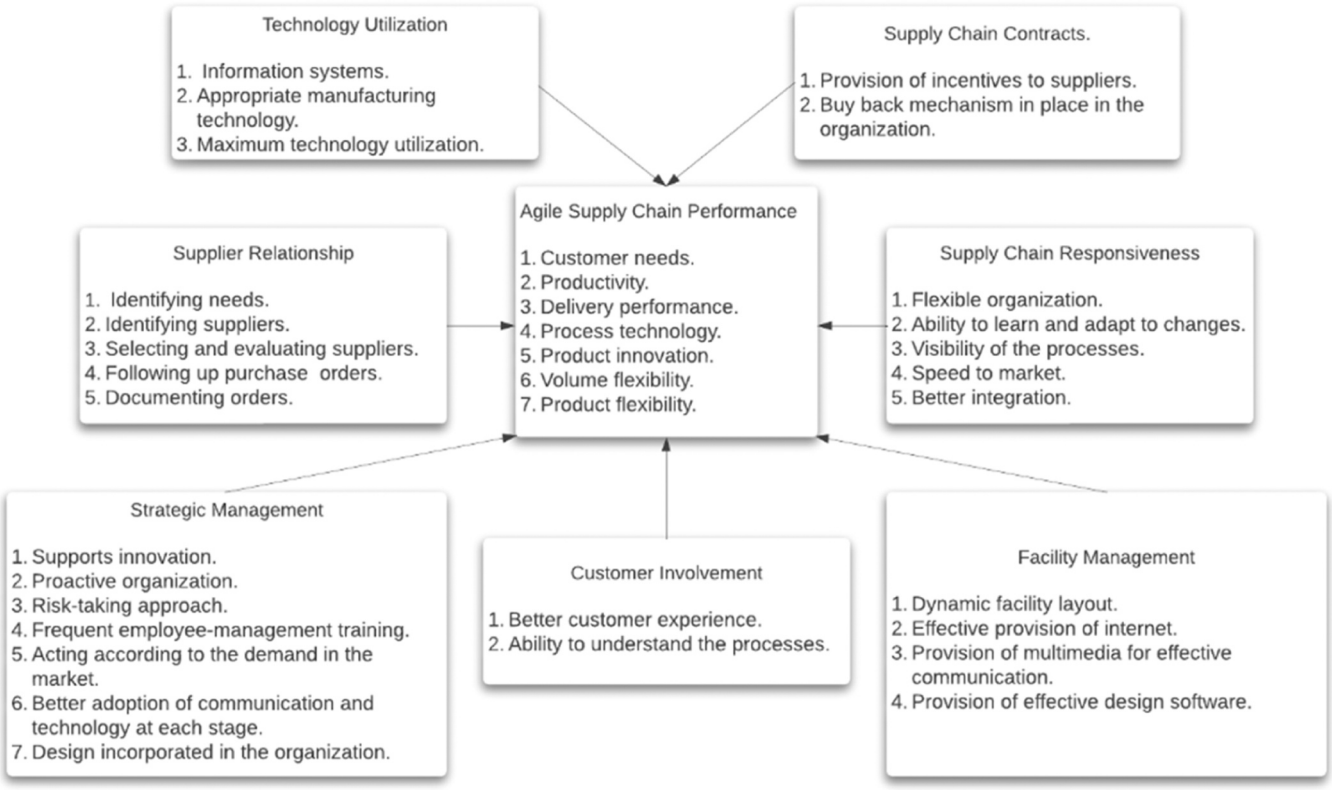
Declaration of Competing Interest

The current manuscript titled "***Agile Supply Chain Management and Performance Analysis of Manufacturing Companies***" is original work and never published before in any form anywhere. There is no conflict of interest associated with this manuscript with anyone to its publication. All the authors have given their significant contributions to this manuscript. I corresponding author to the manuscript declare that the manuscript has been read and approved by all the associated authors of the manuscript and they all consented to its submission.

Appendix A. Variable view

Table 6
Hypothesis Results.

Hypothesis	*Relationship*	*Estimates*	*S.E.*	*β*	*t-value*	*p-value*	*Result*
H1	CI -> ASCP	0.188	0.051	0.188	3.659	0.000	supported
H2	FM -> ASCP	0.125	0.057	0.121	2.119	0.034	supported
H3	SCC -> ASCP	0.005	0.047	0.005	0.107	0.915	not supported
H4	SCR -> ASCP	0.169	0.077	0.168	2.186	0.029	supported
H5	SM -> ASCP	0.32	0.079	0.323	4.075	0.000	supported
H6	SR -> ASCP	0.178	0.051	0.178	3.514	0.000	supported
H7	TU -> ASCP	−0.001	0.056	−0.001	0.015	0.988	not supported



Appendix B. Questionnaire

Section 1: Demographic Details

Please take a few moments to answer the following questions that will assist in making inferences regarding the population of this study.

Gender

Male

Female

Age

21–30

31–40

41–50

51–60

61 and more

Your Designation

Supervisor

Manager

Senior Manager

Executive

Highest level of Education

Diploma

Bachelor's

Master's degree

Doctoral degree

What is your current job type?

Technical Stream

Managerial Stream

Current Organizational Tenure

1– 5 years

6–10 years

11–15 years

16 years and above

Overall Work Experience

1–5 years

6–10 years
11–15 years
16 years and above
Department of respondent
Human resources and business development management
Sales and marketing
Purchasing
Operations
Logistics
Accounting
Audit
Other

Section 2: Agile management and supply chain performance

A. Please indicate: 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree

S No	Code	Variables	Items	1	2	3	4	5
	TU		**Technology Utilization**					
1	**TU1**	Technology Utilisation 1	Information system					
2	**TU2**	Technology Utilisation 2	Manufacturing technology					
3	**TU3**	Technology Utilisation 3	Utilising the technology to its maximum potential					
	SR		**Supplier Relationship**					
4	**SR1**	Supplier Relationship 1	Identifying the need for materials					
5	**SR2**	Supplier Relationship 2	Identifying the suppliers					
6	**SR3**	Supplier Relationship 3	Selecting good suppliers					
7	**SR4**	Supplier Relationship 4	Follows-up the purchase orders					
8	**SR5**	Supplier Relationship 5	Documents the orders					
	SCR		**Supply Chain Responsiveness**					
9	**SCR1**	Supply Chain Responsiveness 1	Flexibility					
10	**SCR2**	Supply Chain Responsiveness 2	Learning ability					
11	**SCR3**	Supply Chain Responsiveness 3	Visibility of the processes					
12	**SCR4**	Supply Chain Responsiveness 4	Speed to market					
13	**SCR5**	Supply Chain Responsiveness 5	Integration					
	FM		**Facility Management**					
14	**FM1**	Facility Management 1	Dynamic facility layout					
15	**FM2**	Facility Management 2	Effective provision of internet					
16	**FM3**	Facility Management 3	Provision of multimedia for easy communication					
17	**FM4**	Facility Management 4	Effective design software like CAD/CAM					
	SCC		**Supply Chain Contracts**					
18	**SCC1**	Supply Chain Contracts 1	Incentives to the suppliers					
19	**SCC2**	Supply Chain Contracts 2	Buy back mechanism					
	SM		**Strategic Management**					
20	**SM1**	Strategic Management 1	Innovativeness in the organization					
21	**SM2**	Strategic Management 2	Proactive					
22	**SM3**	Strategic Management 3	Risk-taking approach					
23	**SM4**	Strategic Management 4	Frequent management employee training					
24	**SM5**	Strategic Management 5	Plan and act according to the demand					
25	**SM6**	Strategic Management 6	Better communication and adopts technology					
26	**SM7**	Strategic Management 7	Design incorporated					
	CI		**Customer Involvement**					
27	**CI1**	Customer Involvement 1	Better customer experience					
28	**CI2**	Customer Involvement 2	Ability to understand the processes					
	ASCP		**Agile Supply Chain Performance**					
29	**ASCP1**	Agile Supply Chain Performance 1	Satisfying the customer needs					
30	**ASCP2**	Agile Supply Chain Performance 2	Productivity					
31	**ASCP3**	Agile Supply Chain Performance 3	Delivery performance					
32	**ASCP4**	Agile Supply Chain Performance 4	Process technology					
33	**ASCP5**	Agile Supply Chain Performance 5	Product innovations					
34	**ASCP6**	Agile Supply Chain Performance 6	Volume flexibility					
35	**ASCP7**	Agile Supply Chain Performance 7	Product Flexibility					

References

[1] Aditi, D. Kannan, J.D. Darbari, P.C. Jha, Sustainable supplier selection model with a trade-off between supplier development and supplier switching, Ann. Oper. Res. 331 (1) (2023) 351–392.

[2] R. Agrawal, R. Raj, V. Kumar, A. Jha, An empirical investigation of alarming indicators of US retail giant, Int. J. Knowl. Manag. Tour. Hosp. 3 (4) (2024) 267–291.

[3] R. Agrawal, R. Raj, V. Kumar, A. Jha, An empirical study of the world's oldest airline company who filed bankruptcy during COVID-19 pandemic, Int. J. Knowl. Manag. Tour. Hosp. 3 (3) (2024) 220–244.

[4] W. Ahmed, A. Najmi, Y. Mustafa, A. Khan, Developing model to analyze factors affecting firms' agility and competitive capability: A case of a volatile market, J. Model. Manag. 14 (2) (2019) 476–491.

[5] N.S.B. Akhil, V. Kumar, R. Raj, T. De, P.K. Gangaraju, "Adoption of human resource sourcing strategies for managing supply chain performance during COVID-19 crisis: evidence from manufacturing companies", Int. J. Product. Perform. Manag., Vol. Ahead–Print. No. Ahead–Print. (2023), https://doi.org/10.1108/IJPPM-06-2023-0292.

[6] E. Al Humdan, Y. Shi, M. Behnia, A. Najmaei, Supply chain agility: a systematic review of definitions, enablers and performance implications, Int. J. Phys. Distrib. Logist. Manag. 50 (2) (2020) 287–312.

[7] M. AlKahtani, A.U. Rehman, A. Al-Zabidi, A. Choudhary, Agile supply chain assessment: an empirical study on concepts, research and issues, Arab. J. Sci. Eng. 44 (2019) 2551–2565.

[8] I.M. Ambe, J.A. Badenhorst-Weiss, Strategic supply chain framework for the automotive industry, Afr. J. Bus. Manag. 4 (10) (2010) 2110.

[9] H. Aslam, C. Blome, S. Roscoe, T.M. Azhar, Determining the antecedents of dynamic supply chain capabilities, Supply Chain Manag.: Int. J. 25 (4) (2020) 427–442.

[10] Atmar, H., Hudson, S., Koshy, A., Rickert, S., & Slelatt, R. (2020, June 24). The Next Normal in Consumer: Implications for Consumer Goods M&A, McKinsey & Company, p. Retrieved from ⟨https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/the-next-normal-in-consumer-implications-for-consumer-goods-m-and-a⟩.

[11] A. Barve, A. Kanda, R. Shankar, Making 3PL effective in agile supply chains, Int. J. Logist. Syst. Manag. 4 (1) (2008) 40–60.

[12] B.M. Beamon, Measuring supply chain performance, Int. J. Oper. Prod. Manag. 19 (3) (1999) 275–292.

[13] M. Cao, Q. Zhang, Supply chain collaboration: Impact on collaborative advantage and firm performance, J. Oper. Manag. 29 (3) (2011) 163–180.

[14] J.H. Cheng, M.C. Chen, C.M. Huang, Assessing inter-organizational innovation performance through relational governance and dynamic capabilities in supply chains, Supply Chain Manag.: Int. J. 19 (2) (2014) 173–186.

[15] S.B. Choi, H. Min, H.Y. Joo, H.B. Choi, Assessing the impact of green supply chain practices on firm performance in the Korean manufacturing industry, Int. J. Logist. Res. Appl. 20 (2) (2017) 129–145.

[16] M. Christopher, The agile supply chain: competing in volatile markets, Ind. Mark. Manag. 29 (1) (2000) 37–44.

[17] M. Christopher, R. Lowson, H. Peck, Creating agile supply chains in the fashion industry, Int. J. Retail Distrib. Manag. 32 (8) (2004) 367–376.

[18] J.G. Covin, D.P. Slevin, Strategic management of small firms in hostile and benign environments, Strateg. Manag. J. 10 (1) (1989) 75–87.

[19] H. Dadfar, S. Brege, S. Sarah Ebadzadeh Semnani, Customer involvement in service production, delivery and quality: the challenges and opportunities, Int. J. Qual. Serv. Sci. 5 (1) (2013) 46–65.

[20] B. Dahinine, A. Laghouag, W. Bensahel, M. Alsolamy, T. Guendouz, Evaluating Performance Measurement Metrics for Lean and Agile Supply Chain Strategies in Large Enterprises, Sustainability 16 (6) (2024) 2586.

[21] A. Diamantopoulos, J.A. Siguaw, "Formative versus reflective indicators in organizational measure development: a comparison and empirical illustration", Br. J. Manag. 17 (4) (2006) 263–282.

[22] S. Dowlatshahi, Q. Cao, The relationships among virtual enterprise, information technology, and business performance in agile manufacturing: An industry perspective, Eur. J. Oper. Res. 174 (2) (2006) 835–860.

[23] S. Duarte, V.C. Machado, Manufacturing paradigms in supply chain management, Int. J. Manag. Sci. Eng. Manag. 6 (5) (2011) 328–342.

[24] R. Dubey, A. Gunasekaran, S.S. Ali, Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: A framework for green supply chain, Int. J. Prod. Econ. 160 (2015) 120–132.

[25] D. Eckstein, M. Goellner, C. Blome, M. Henke, The performance impact of supply chain agility and supply chain adaptability: the moderating effect of product complexity, Int. J. Prod. Res. 53 (10) (2015) 3028–3046.

[26] D.A. Elkins, N. Huang, J.M. Alden, Agile manufacturing systems in the automotive industry, Int. J. Prod. Econ. 91 (3) (2004) 201–214.

[27] H. Emmons, S.M. Gilbert, Note, role Returns policies Pricing Inventory Decis. Cat. goods. *Manag. Sci.* 44 (2) (1998) 276–283.

[28] S. Fayezi, A. Zutshi, A. O'Loughlin, Understanding and development of supply chain agility and flexibility: a structured literature review, Int. J. Manag. Rev. 19 (4) (2017) 379–407.

[29] T. Feng, L. Sun, Y. Zhang, The effects of customer and supplier involvement on competitive advantage: An empirical study in China, Ind. Mark. Manag. 39 (8) (2010) 1384–1394.

[30] Fornell, C., & Larcker, D.F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics, 18(3), 382-388.

[31] P.K. Gangaraju, R. Raj, V. Kumar, A. NSB, T. De, M.S. Kaswan, "Financial Performance in Industry 4.0 Agile Supply Chains: Evidence from Manufacturing Companies", TQM J., Ahead–Print. (2023) https://doi.org/10.1108/TQM-07-2023-0214.

[32] P.M. García-Villaverde, J. Rodrigo-Alarcón, M.J. Ruiz-Ortega, G. Parra-Requena, The role of knowledge absorptive capacity on the relationship between cognitive social capital and entrepreneurial orientation, J. Knowl. Manag. 22 (5) (2018) 1015–1036.

[33] P. Garg, R. Raj, V. Kumar, S. Singh, S. Pahuja, N. Sehrawat, Elucidating the role of consumer decision making style on consumers' purchase intention: The mediating role of emotional advertising using PLS-SEM, J. Econ. Technol. 1 (2023) 108–118.

[34] B. Gaudenzi, M. Christopher, Achieving supply chain 'Leagility'through a project management orientation, Int. J. Logist. Res. Appl. 19 (1) (2016) 3–18.

[35] I. Giannoccaro, P. Pontrandolfo, Supply chain coordination by revenue sharing contracts, Int. J. Prod. Econ. 89 (2) (2004) 131–139.

[36] A.B. Goktan, V.K. Gupta, Sex, gender, and individual entrepreneurial orientation: evidence from four countries, Int. Entrep. Manag. J. 11 (2015) 95–112.

[37] A. Gunasekaran, Agile manufacturing: a framework for research and development, Int. J. Prod. Econ. 62 (1-2) (1999) 87–105.

[38] A. Gunasekaran, K.H. Lai, T.E. Cheng, Responsive supply chain: a competitive strategy in a networked economy, Omega 36 (4) (2008) 549–564.

[39] A. Gunasekaran, Y.Y. Yusuf, Agile manufacturing: a taxonomy of strategic and technological imperatives, Int. J. Prod. Res. 40 (6) (2002) 1357–1385.

[40] H. Gupta, S. Kumar, S. Kusi-Sarpong, C.J.C. Jabbour, M. Agyemang, Enablers to supply chain performance on the basis of digitization technologies, Ind. Manag. Data Syst. 121 (9) (2021) 1915–1938.

[41] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson. Multivariate Data Analysis, 7th ed., Prentice Hall, Englewood Cliffs, NJ, 2010.

[42] J.F. Hair, G.T.M. Hult, C.M. Ringle, M. Sarstedt. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), 3rd ed., SAGE Publications, Thousand Oaks, CA, 2022.

[43] J.F. Hair, J.J. Risher, M. Sarstedt, C.M. Ringle, When to use and how to report the results of PLS-SEM, Eur. Bus. Rev. 31 (1) (2019) 2–24.

[44] J.F. Hair Jr, M. Sarstedt, L. Hopkins, V.G. Kuppelwieser, "Partial least squares structural equation modeling (PLS-SEM): an emerging tool in business research", Eur. Bus. Rev. 26 (2) (2014) 106–121.

[45] Hansen, J.Ø., & Schütter, H.E.I.K.E. (2009). The resource-based view and transaction cost economics in managerial decision-making: A sequential approach. Accessed on 18th August 2023 from http://rbvandtce.com.

[46] A. Hasani, S.H. Zegordi, E. Nikbakhsh, Robust closed-loop global supply chain network design under uncertainty: the case of the medical device industry, Int. J. Prod. Res. 53 (5) (2015) 1596–1624.

[47] J. Henseler, G. Hubona, P.A. Ray, "Using PLS path modeling in new technology research: updated guidelines", Ind. Manag. Data Syst. 116 (1) (2016) 2–20.

[48] D. Hofman, L. Cecere, The agile supply chain. *Supply Chain*, Manag. Rev. 9 (8) (2005) 18–19.

[49] F. Jabeen, M.N. Faisal, M. I. Katsioloudes, Entrepreneurial mindset and the role of universities as strategic drivers of entrepreneurship: Evidence from the United Arab Emirates, J. Small Bus. Enterp. Dev. 24 (1) (2017) 136–157.

[50] M.A. Jamil, R. Mustofa, N.U.I. Hossain, S.A. Rahman, S. Chowdhury, A structural equation modeling framework for exploring the industry 5.0 and sustainable supply chain determinants, Supply Chain Anal. 6 (2024) 100060.

[51] S.K. Jauhar, M. Pant, V. Kumar, N.K. Sharma, P. Verma, Supply chain and the sustainability management: Selection of suppliers for sustainable operations in the manufacturing industry, Chapter 4, Sustainability in Industry 4.0: Challenges and Remedies, CRC Press, Taylor & Francis, 2021, pp. 75–93.

[52] A. Jha, R.R.K. Sharma, V. Kumar, P. Verma, Designing supply chain performance system: a strategic study on Indian manufacturing sector, Supply Chain Manag.: Int. J. 27 (1) (2022) 66–88.

[53] E. Katok, V. Pavlov, Fairness in supply chain contracts: A laboratory study, J. Oper. Manag. 31 (3) (2013) 129–137.

[54] K. Khalili-Damghani, M. Tavana, A new fuzzy network data envelopment analysis model for measuring the performance of agility in supply chains, Int. J. Adv. Manuf. Technol. 69 (2013) 291–318.

[55] Kioko, E.K. (2023). Covid-19 Disruptions and Resilience of Pharmaceutical Supply Chains in Nairobi County (Doctoral dissertation, University of Nairobi).

[56] S. Kulturel-Konak, Approaches to uncertainties in facility layout problems: Perspectives at the beginning of the 21 st Century, J. Intell. Manuf. 18 (2007) 273–284.

[57] V. Kumar, R. Raj, P. Verma, J.A. Garza-Reyes, B. Shah, Assessing risk and sustainability factors in spice supply chain management, Oper. Manag. Res. 17 (1) (2024) 233–252.

[58] V. Kumar, P. Verma, A. Mittal, J.A. Tuesta Panduro, S. Singh, M. Paliwal, N. K. Sharma, Adoption of ICTs as an emergent business strategy during and following COVID-19 crisis: evidence from Indian MSMEs, Benchmark.: Int. J. 30 (6) (2023) 1850–1883.

[59] V. Kumar, P. Verma, A. Mittal, P. Gupta, R. Raj, M.S. Kaswan, "Addressing the Kaizen business operations: the role of triple helix actors during COVID-19 outbreak", TQM J., Vol. Ahead–Print. No. Ahead–Print. (2024), https://doi.org/10.1108/TQM-08-2023-0253.

[60] V. Kumar, P. Verma, R.R.K. Sharma, A.F. Khan, Conquering in emerging markets: critical success factors to enhance supply chain performance, Benchmark.: Int. J. 24 (3) (2017) 570–593.

[61] K.K. Lai, P. Verma, V. Kumar, "Investigation on key drivers for sustainable supply chain management implementation: Empirical evidence from manufacturing industry", Int. J. Logist. Syst. Manag. Ahead–Print. (2023) https://doi.org/10.1504/IJLSM.2023.10058515.

[62] H. Lee, S. Whang, Decentralized multi-echelon supply chains: Incentives and information, Manag. Sci. 45 (5) (1999) 633–640.

[63] P. Leitão, A.W. Colombo, S. Karnouskos, Industrial automation based on cyber-physical systems technologies: Prototype implementations and challenges, Comput. Ind. 81 (2016) 11–25.

[64] Li, X., Chung, C., Goldsby, T.J., & Holsapple, C.W. (2008). A unified model of supply chain agility: the work-design perspective. *The International Journal of Logistics Management*.

[65] J. Lin, Y. Fan, Seeking sustainable performance through organizational resilience: Examining the role of supply chain integration and digital technology usage, Technol. Forecast. Soc. Change 198 (2024) 123026.

[66] P. Liu, M. Atifeh, M. Khorshidnia, S.G. Taheri, System dynamics: an approach to modeling supply chain performance measurement, Technol. Econ. Dev. Econ. 29 (4) (2023) 1291–1317.

[67] A. Liu, S. Lu, W. Wei, A new framework of ideation-oriented customer involvement, Procedia CIRP 21 (2014) 521–526.

[68] M. Lotfi, M.S. Sodhi, Resilient agility under the practice-based view, Prod. Plan. Control 35 (7) (2024) 670–682.

[69] H. Lu, G. Zhao, S. Liu, Integrating circular economy and Industry 4.0 for sustainable supply chain management: A dynamic capability view, Prod. Plan. Control 35 (2) (2024) 170–186.

[70] G.T. Lumpkin, G.G. Dess, Clarifying the entrepreneurial orientation construct and linking it to performance, Acad. Manag. Rev. 21 (1) (1996) 135–172.

[71] M.R. Mahmood, U.B. Perwez, A.A. Baqai, A.A. Salam, Importance of vendor and manufacturer relationship for effective lean practices (December). 2013 IEEE Tsinghua International Design Management Symposium, IEEE, 2013, pp. 217–224 (December).

[72] C. Martin, D.R. Towill, Supply chain migration from lean and functional to agile and customised, Supply Chain Manag.: Int. J. 5 (4) (2000) 206–213.

[73] K. Matz, K. Foerstl, R. Suurmond, Perfect couple or toxic relationship? A meta-analysis of the effects and interplays of lean and agile strategies to improve performance, J. Bus. Logist. 45 (3) (2024) e12390.

[74] McQuarrie, K.E. (1992). An empirical study of a just-in-time supplier program. MASc. thesis, University of Waterloo, Waterloo, Ontario, Canada.

[75] D. Miller, Miller (1983) revisited: A reflection on EO research and some suggestions for the future, Entrep. Theory Pract. 35 (5) (2011) 873–894.

[76] S.H. Mirghafoori, D. Andalib, P. Keshavarz, Developing green performance through supply chain agility in manufacturing industry: A case study approach, Corp. Soc. Responsib. Environ. Manag. 24 (5) (2017) 368–381.

[77] R.M. Monczka, K.J. Petersen, R.B. Handfield, G.L. Ragatz, Success factors in strategic supplier alliances: the buying company perspective, Decis. Sci. 29 (3) (1998) 553–577.

[78] B. Naghshineh, Additive manufacturing technology adoption for supply chain agility: a systematic search and review, Int. J. Prod. Res. (2024) 1–33.

[79] Naim, M., Naylor, J., & Barlow, J. (1999, July). Developing lean and agile supply chains in the UK housebuilding industry. In *Proceedings of IGLC* (Vol. 7, No. 0, pp. 159-170).

[80] M. Nazali Mohd Noor, M. Pitt, A critical review on innovation in facilities management service delivery, Facilities 27 (5/6) (2009) 211–228.

[81] H.A. Nimeh, A.B. Abdallah, R. Sweis, Lean supply chain management practices and performance: empirical evidence from manufacturing companies, Int. J. Supply Chain Manag. 7 (1) (2018) 1–15.

[82] A. NSB, V. Kumar, R. Raj, T. De, P.K. Gangaraju, "Adoption of Human Resource Sourcing Strategies for managing Supply Chain Performance during COVID-19 Crisis: Evidence from Manufacturing Companies", Int. J. Product. Perform. Manag. 73 (7) (2024) 2092–2115.

[83] J.L. Nunnally. Psychometric Theory, 2nd ed., McGrawHill, New York, NY, 1978.

[84] J.A. Ogden, P.L. Carter, The supply base reduction process: an empirical investigation, Int. J. Logist. Manag. 19 (1) (2008) 5–28.

[85] A. Özaşkın, A. Görener, An integrated multi-criteria decision-making approach for overcoming barriers to green supply chain management and prioritizing alternative solutions, Supply chain Anal. 3 (2023) 100027.

[86] M. Paliwal, R. Raj, V. Kumar, S. Singh, N.K. Sharma, A. Suri, M. Kumari, Informal workers in India as an economic shock absorber in the era of COVID-19: A study on policies and practices, *Hum. Syst. Manag.*, (Prepr.) (2023) 1–20.

[87] R.R. Panigrahi, D. Jena, J.R. Meher, A.K. Shrivastava, Assessing the impact of supply chain agility on operational performances-a PLS-SEM approach, Meas. Bus. Excell. 27 (1) (2023) 1–24.

[88] M. Park, N.P. Singh, Predicting supply chain risks through big data analytics: role of risk alert tool in mitigating business disruption, Benchmark.: Int. J. 30 (5) (2023) 1457–1484.

[89] B.S. Patel, M. Sambasivan, A systematic review of the literature on supply chain agility, Manag. Res. Rev. 45 (2) (2022) 236–260.

[90] D.K. Pathak, A. Verma, V. Kumar, "Analyzing barriers to sustainable supply chain management: a home appliances manufacturing case study", Int. J. Logist. Syst. Manag. Ahead–Print. (2023) https://doi.org/10.1504/IJLSM.2023.10056787.

[91] M. Peled, D. Dvir, Towards a contingent approach of customer involvement in defence projects: An exploratory study, Int. J. Proj. Manag. 30 (3) (2012) 317–328.

[92] J.C. Pereira, R. Bordeaux, L.P. Zotes, G.B. Lima, O.L.G. Quelhas, Probabilistic risk analysis of safety management system failure and impact on economic performance: the case of jet engine manufacturing, Int. J. Manag. Decis. Mak. 14 (4) (2015) 345–372.

[93] L. Piardi, P. Leitão, J. Queiroz, J. Pontes, Role of digital technologies to enhance the human integration in industrial cyber–physical systems, Annu. Rev. Control 57 (2024) 100934.

[94] G. Pisano, D. Teece, The dynamic capabilities of firms: an introduction, Ind. Corp. Change 3 (3) (1994) 537–556.

[95] D.J. Power, A.S. Sohal, S.U. Rahman, Critical success factors in agile supply chain management-An empirical study, Int. J. Phys. Distrib. Logist. Manag. 31 (4) (2001) 247–265.

[96] D.K. Prajapati, K. Mathiyazhagan, V. Agarwal, S. Khorana, A. Gunasekaran, Enabling industry 4.0: Assessing technologies and prioritization framework for agile manufacturing in India, J. Clean. Prod. 447 (2024) 141488.

[97] R. Primadasa, D. Tauhida, B.R. Christata, I.A. Rozaq, S. Alfarisi, I. Masudin, An Investigation of the Interrelationship Among Circular Supply Chain Management Indicators in Small and Medium Enterprises, Supply Chain Anal. (2024) 100068.

[98] L. Purdy, F. Safayeni, Strategies for supplier evaluation: a framework for potential advantages and limitations, IEEE Trans. Eng. Manag. 47 (4) (2000) 435–443.

[99] M. Rahiminezhad Galankashi, S.A. Helmi, A.R. Abdul Rahim, F.M. Rafiei, Agility assessment in manufacturing companies, Benchmark.: Int. J. 26 (7) (2019) 2081–2104.

[100] R. Raj, V. Kumar, B. Shah, "Big Data Analytics adaptive prospects in Sustainable Manufacturing Supply Chain", Benchmark.: Int. J., Accept. (2023) https://doi.org/10.1108/BIJ-11-2022-0690.

[101] R. Raj, V. Kumar, A. Mittal, P. Verma, K.K. Lai, A. Singh, "Practices and Strategies for Global Sourcing and Supply Chain Management: A Pareto Analysis and MOORA a mixed method approach", J. Glob. Oper. Strateg. Sourc., Ahead–Print. (2024) https://doi.org/10.1108/JGOSS-06-2023-0064.

[102] R. Raj, V. Kumar, N.K. Sharma, S. Singh, S. Mahlawat, P. Verma, The study of remote working outcome and its influence on firm performance, Soc. Sci. Humanit. Open 8 (1) (2023) 100528.

[103] Raj, R., Kumar, V., Sharma, N.K. and Verma, P. (2024c), "Industry 4.0 readiness: the impact of effective implementation of I4.0 on marketing performance", Journal of Business & Industrial Marketing, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JBIM-05-2023-0289.

[104] R. Raj, A. Singh, V. Kumar, P. Verma, Analyzing the potential benefits and use cases of ChatGPT as a tool for improving the efficiency and effectiveness of business operations. *BenchCouncil Transactions on Benchmarks*, Stand. Eval. 3 (3) (2023) 100140.

[105] Raj, R., Singh, A., Kumar, V., & Verma, P. (2024b). Challenges in Adopting Blockchain Technology in Supply Chain Management: A too Far Fetched Idea?. International Journal of Quality and Reliability Management, Ahead-of-Print, https://doi.org/10.1108/IJQRM-12-2022-0366.

[106] B.K. Rajak, R. Raj, V. Kumar, P. Singh, P. Verma, S. Mahlawat, S. Singh, K. V. Reddy, Torn ties and waning morale: Unravelling the link between family incivility, employee engagement and perceived supervisor support, Soc. Sci. Humanit. Open 8 (1) (2023) 100732.

[107] Ramayah, T., Cheah, J.H., Chuah, F., Ting, H. and Memon, M.A. (2018), Partial Least Squares Structural Equation Modelling (PLS-SEM) Using SmartPLS 3.0: An Updated Practical Guide to Statistical Analysis, 2nd ed., Pearson Malaysia Sdn. Bhd, Kuala Lumpur, Malaysia.

[108] J.A. Rana, S.Y. Jani, An integrated Industry 4.0-Sustainable Lean Six Sigma framework to improve supply chain performance: a decision support study from COVID-19 lessons, J. Glob. Oper. Strateg. Sourc. 16 (2) (2023) 430–455.

[109] H. Reefke, M.D. Ahmed, D. Sundaram, Sustainable supply chain management—Decision making and support: The SSCM maturity model and system, Glob. Bus. Rev. 15 (4_) (2014), 1S-12S.

[110] C. Ruppel, An information systems perspective of supply chain tool compatibility: the roles of technology fit and relationships, Bus. Process Manag. J. 10 (3) (2004) 311–324.

[111] S. Sachan, V. Kumar, S. Vardhan, A. Mittal, P. Verma, S. Bag, "Key Supply Chain Strategies for Post-COVID-19 Recovery: Evidence from an Indian Smart Furniture Industry", Int. J. Emerg. Mark. 18 (6) (2023) 1378–1396.

[112] A.K. Sahu, S.Y. Kottala, H.K. Narang, M.S. Rajput, Intertwining green SCM-and agile SCM-based decision-making framework for sustainability using GIVTFNs, J. Glob. Oper. Strateg. Sourc. 17 (2) (2024) 300–333.

[113] R.H. Salisbury, N. Gurahoo, Lean and agile in small-and medium-sized enterprises: Complementary or incompatible? South Afr. J. Bus. Manag. 49 (1) (2018) 1–9.

[114] M. Sarhadi, C. Millar, Defining a framework for information systems requirements for agile manufacturing, Int. J. Prod. Econ. 75 (1-2) (2002) 57–68.

[115] H. Sharifi, H.S. Ismail, I. Reid, Achieving agility in supply chain through simultaneous "design of" and "design for" supply chain, J. Manuf. Technol. Manag. 17 (8) (2006) 1078–1098.

[116] J.M. Sharp, Z. Irani, S.J.I.J. Desai, Working towards agile manufacturing in the UK industry, Int. J. Prod. Econ. 62 (1-2) (1999) 155–169.

[117] G. Shmueli, M. Sarstedt, J.F. Hair, J.H. Cheah, H. Ting, S. Vaithilingam, C. M. Ringle, "Predictive model assessment in PLS-SEM: guidelines for using PLSpredict", Eur. J. Mark. 53 (11) (2019) 2322–2347.

[118] A. Singh, V. Kumar, P. Verma, R. Bharti, "Can Suppliers be Sustainable in Construction Supply Chains? Evidence from a Construction Company using Best Worst Approach", Manag. Environ. Qual. 34 (4) (2022) 1129–1157.

[119] J. Soininen, M. Martikainen, K. Puumalainen, K. Kyläheiko, Entrepreneurial orientation: Growth and profitability of Finnish small-and medium-sized enterprises, Int. J. Prod. Econ. 140 (2) (2012) 614–621.

[120] S.B. Spillecke, M. Brettel, The impact of sales management controls on the entrepreneurial orientation of the sales department, Eur. Manag. J. 31 (4) (2013) 410–422.

[121] S.A. Starbird, Penalties, rewards, and inspection: provisions for quality in supply chain contracts, J. Oper. Res. Soc. 52 (1) (2001) 109–115.

[122] V.P.K. Sundram, A.R. Ibrahim, V.C. Govindaraju, Supply chain management practices in the electronics industry in Malaysia: Consequences for supply chain performance, Benchmark.: Int. J. 18 (6) (2011) 834–855.

[123] K. Tajeddini, Effect of customer orientation and entrepreneurial orientation on innovativeness: Evidence from the hotel industry in Switzerland, Tour. Manag. 31 (2) (2010) 221–231.

[124] M. Tarafdar, S. Qrunfleh, Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility, Int. J. Prod. Res. 55 (4) (2017) 925–938.

[125] J. Thakkar, A. Kanda, S.G. Deshmukh, Supply chain management in SMEs: development of constructs and propositions, Asia Pac. J. Mark. Logist. 20 (1) (2008) 97–131.

[126] Y.K. Tse, M. Zhang, P. Akhtar, J. MacBryde, Embracing supply chain agility: an investigation in the electronics industry, Supply Chain Manag.: Int. J. 21 (1) (2016) 140–156.

[127] S. Varma, S. Wadhwa, S.G. Deshmukh, Implementing supply chain management in a firm: issues and remedies, Asia Pac. J. Mark. Logist. 18 (3) (2006) 223–243.

[128] R. Vecchiato, Creating value through foresight: First mover advantages and strategic agility, Technol. Forecast. Soc. Change 101 (2015) 25–36.
[129] S.K. Vickery, C. Droge, P. Setia, V. Sambamurthy, Supply chain information technologies and organisational initiatives: complementary versus independent effects on agility and firm performance, Int. J. Prod. Res. 48 (23) (2010) 7025–7042.
[130] Q. Wang, X. Liu, M. Hu, B. Huo, A reductionistic or holistic approach? The impacts of fit patterns of supplier and customer integration on company and supply chain performance, Int. J. Prod. Econ. 273 (2024) 109265.
[131] G. Wang, S. Miller, Intelligent aggregation of purchase orders in e-procurement (September). Ninth IEEE International EDOC Enterprise Computing Conference (EDOC'05), IEEE, 2005, pp. 27–36 (September).
[132] G.D. Whitten, K.W. Green, P.J. Zelbst, Triple-A supply chain performance, Int. J. Oper. Prod. Manag. 32 (1) (2012) 28–48.
[133] D.T. Wong, E.W. Ngai, Linking data-driven innovation to firm performance: a theoretical framework and case analysis, Ann. Oper. Res. 333 (2) (2024) 999–1018.
[134] L.W. Wong, G.W.H. Tan, K.B. Ooi, B. Lin, Y.K. Dwivedi, Artificial intelligence-driven risk management for enhancing supply chain agility: A deep-learning-based dual-stage PLS-SEM-ANN analysis, Int. J. Prod. Res. 62 (15) (2024) 5535–5555.
[135] F. Wu, S. Yeniyurt, D. Kim, S.T. Cavusgil, The impact of information technology on supply chain capabilities and firm performance: A resource-based view, Ind. Mark. Manag. 35 (4) (2006) 493–504.
[136] Y.Y. Yusuf, A. Gunasekaran, E.O. Adeleye, K.J.E.J.O.O.R. Sivayoganathan, Agile supply chain capabilities: Determinants of competitive objectives, Eur. J. Oper. Res. 159 (2) (2004) 379–392.
[137] Z. Zhang, H. Sharifi, A methodology for achieving agility in manufacturing organisations, Int. J. Oper. Prod. Manag. 20 (4) (2000) 496–513.