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The influence of supply chain strategies on performance of South African manufacturing SMEs: The mediating effects of supply chain resilience

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Abstract

In South Africa, small and medium enterprises (SMEs) are acknowledged as a major contributor to national GDP and employment creation. Manufacturing SMEs are among the most dominant forms of SMEs in South Africa. However, their success is hamstrung by numerous challenges that affect their growth and sustainability. The main challenges facing SMEs in South Africa include leadership, marketing, management, social, political, human resources, and financial matters. Lack of supply chain management (SCM) strategies has been identified as the outstanding challenge contributing to the failure of many manufacturing SMEs in the country. The primary aim of this study was to explore the influence of SCM strategies on resilience and performance of South African manufacturing SMEs. The study followed a quantitative survey approach and a non-probability sampling method. A questionnaire was distributed to a purposively sampled 407 managers, owners and supply chain management (SCM) professionals drawn from 120 manufacturing SMEs in the Gauteng, Free State and North-West provinces of South Africa. The collected data were analysed using the Statistical Package for the Social Sciences (SPSS version 27.0). Hypotheses were tested using structural equation modelling (SEM) based on the SMART partial least squares (PLS) technique. The results reveal that reverse logistics (RL) and supply chain traceability (SCT) as forms of SCM strategies impacted positively on supply chain resilience (SCR), the latter of which, in turn, is linked to improved supply chain agility (SCA). However, SCR negatively impacted supply chain reliability (SCL), supply chain responsiveness (SR) and customer satisfaction (CS). Further, SCR significantly mediated the relationships between RL, SCT and supply chain performance. The study suggests that the implementation of supply chain strategies is vital in influencing SCR. This study contributes to SCM literature as it is one of the few studies exploring SCM strategies, resilience, and performance in the context of the South African manufacturing SMEs.

Keywords: Small, medium and enterprises (SMEs); manufacturing, supply chain strategies, resilience, performance

1. Introduction

Small and medium enterprises (SMEs) are essential drivers of economic growth and development in most developing countries around the world. Langton and Mafini (2023) note that SMEs contribute immensely to employment creation, enhanced living standards, wealth creation and gross domestic product (GDP). In South Africa, manufacturing SMEs account for nearly 55% of the GDP and have contributed more than 50% of employment creation in the last few decades (Ajayi & Laseinde, 2023; Enaifoghe & Vezi-Magigaba, 2023). However, the success of manufacturing SMEs has been marred by numerous challenges. Despite interventions by the government through the Ministry of Small Business Development (MSBD) to promote growth, sustainability, and viability, manufacturing SMEs in South Africa are facing numerous complex and dynamic micro and macro environmental challenges (Enaifoghe & Ramsuraj, 2023). Mugano (2024) observe that hurdles in business success are present far more in these modern times than previously. These challenges include lack of resources, political instability, lack of robust risk management (RM) practices, innovation, disruptions in supply chains, among others (Dzogbwu et al., 2023).

Lack of suitable supply chain management (SCM) strategies has emerged as one of the most leading challenges encountered by the manufacturing SMEs in South Africa (Langton & Mafini, 2023). Accordingly, management and leadership of manufacturing SMEs are faced with mounting pressure to formulate and implement SCM strategies that enables sustainable SCR and performance (Dzogbwu et al., 2023). Manufacturing SMEs are a primary form of business in South Africa. They have a more substantial economic influence than large businesses in developing economies; continuous research is essential in generating new information that promotes their growth and survival (Ajayi & Laseinde, 2023). Formulating and implementing supply chain strategies can be a source of resilience in manufacturing SMEs, and this can lead to improved performance (Dzogbwu et al., 2023). A supply chain strategy is a key plan for the projecting, designing, implementation, monitoring and controlling of supply chain activities. Ajayi and Laseinde (2023) contend that SCM strategies support supply chain resilience, guide the effective operations of organisations and brings about ideas that serve on main performance measures. Dey et al. (2024) reveal that implementation of strategies such as supply chain collaboration (SCC) leads to SCR, which in turn improves supply chain agility and responsiveness. Thus, supply chain resilience is the capacity to react swiftly to operational disruptions through adaptable contingency projecting and planning – from raw material procurement to transportation and the final distribution of goods.

Previous empirical research revealed a positive significant influence of supply chain strategies and supply chain resilience on organisational performance in both manufacturing SMEs (Hamidu et al., 2023; Dey et al., 2024) and large manufacturing corporations (Salam & Bajaba, 2023; Safari et al., 2024) Despite the results established by prior studies, the probability that a supply chain disruption may happen imminently entails that the relationship between supply chain strategies, supply chain resilience and performance be examined continuously in manufacturing SMEs. Nonetheless, little is known about whether positive relationship between SCM strategies and supply chain performance may possibly be upheld in the bearing of supply chain resilience, except for the research conducted by Safari et al. (2024), which was restricted to a developed country backdrop. It was revealed from the study that in the occurrence of an intricate supply chain disruption, manufacturing companies that put compelling recovery SCM strategies can realise supply chain resilience that leads to improved agility and customer satisfaction (Salam & Bajaba, 2023).

There is a lot of literature on strategies, but only a few emphasise on supply chain strategies. Furthermore, a review of SCM literature confirmed that most of these studies on SCM strategies were conducted in developed countries (for example, Alzubi & Akkerman, 2022; Aman & Seuring, 2023; Hugos, 2024) and concentrated more on large manufacturing firms than SMEs.Their results and findings cannot be generalised to emerging countries because these countries are proven to demonstrate less experience and exposure to extensive supply chain strategies and resilience practices comparative to developed countries (Hugos, 2024. It is not surprising since the customer and supplier base, as well as the distribution channels of developing countries, are few with the insufficiently competitive business environment in comparison to developed nations (Maware et al., 2022). However, because of inadequate resources in managing supply chain disruptions in most developing countries, the effect of implementing SCM strategies can be complex and difficult for the improvement of performance in manufacturing SMEs. As found by Maware et al. (2022), there was a substantial risk in the supply chain disruption of manufacturing SMEs in a developing country, South Africa, because of the failure to formulate robust strategies which may generate damaging effects on supply chain resilience practices and performance. It goes to reason that the possibility of incidence of disruptive events in developing countries may perhaps be low, but the effect is high triggering more studies on SCM strategies, supply chain resilience and performance of manufacturing SMEs in a South African background a necessary course of action.

Moreover, within South Africa, limited research (Acquah et al., 2020; Sibanda et al., 2020; Bag et al., 2022;) have investigated SCM strategies in various industries. In addition, evidence of previous studies on SCM strategies and supply chain resilience in South Africa's manufacturing SMEs is limited (Belhadi et al., 2022). Evidence of empirical research that tested the association between SCM strategies, supply chain resilience, and performance in manufacturing SMEs in South Africa remains scarce. Therefore, this study contributes to knowledge in this hitherto unexplored area within manufacturing SMEs in South Africa. Owners and managers of manufacturing SMEs in developing countries, particularly South Africa, can also use the results as a diagnostic tool when addressing SCM strategies, resilience and performance-linked issues in their businesses.

1.1 Research objectives

The primary objective of this current study was to investigate the relationship between SCM strategies, supply chain resilience and performance in manufacturing SMEs in South Africa.

1.1.1 Empirical objectives

1) To establish the effect of SCM strategies on supply chain resilience
2) To find out the influence of supply chain resilience on performance in manufacturing SMEs of South Africa.
3) To determine the mediating impact of supply chain resilience on the relationship between SCM strategies and performance.

1.2 Literature review

1.2.1 An Overview of the South African SMEs

There is not one agreed upon definition of SMEs that is known worldwide, in fact, there are numerous contradictions in how SMEs are defined across the world Small-Medium (Enaifoghe & Ramsuraj, 2023). The definition covers survivalists, micro, very small, small and medium-sized enterprises. SMEs are defined either according to their asset, value, turnover or most commonly but the number of employees according to industry or sector (Maware et al., 2022).

Microenterprises are those with fewer than five employees, 'small businesses have six to 20, small businesses have 21 to 50, and medium businesses have fewer than 300 employees. In South Africa, a 'small business' is on the record defined in Section one of the National Small Business Act of 1996 as amended by the National Small Business Amendment Acts of 2003 and 2004 (NSB Act) as:

"… a separate and distinct business entity, including co-operative enterprises and nongovernmental organisations, managed by one owner or more which, including its branches or subsidiaries, if any, is predominantly carried on in any sector or sub-sector of the economy..."

In South Africa, SMEs play a key part in the growth of the economy. They are drivers of innovation, economic growth, and wealth creation. These enterprises contribute substantially to national GDP and have proved to be important contributors to improved standards of livings and employment creation (Maware et al., 2022, Stats SA, 2024). The government of South Africa identifies the significance of this sector of business activity, so much so that a Ministry of Small Business Development was established in early 2014. The ministry is supported by agencies such as Small Enterprise Finance Agency (SEFA), Small Enterprise Development Agency (Seda), Technology and Innovation Agency (TIA). Furthermore, the National Youth Development Agency (NYDA), National Empowerment Fund (NEF), all of which play a different role in working towards the ministry's SME strategy of increasing financial and non-financial support for SMEs, creating a demand for the goods and services provided by SMEs and reducing regulatory constraints (Maware et al., 2022). In South Africa, manufacturing SMEs are reflected as organisations or companies that are registered and operate from a permanent business location or premise with a range of five to 250 permanently employed workforce (Maware et al., 2022). In this study, small and medium classes of manufacturing SMEs classifications are considered leaving out the micro and very small enterprises.

1.2.2 Supply chain management Strategies

A SCM strategy is an all-encompassing, broad proposal for the forecasting, designing, implementation, monitoring and evaluation of supply chain actions in an organisation (Frazelle, 2020). It promotes the smooth running of an organisation's operational activities and supports supply chain interventions that render to vital SCP measures such as responsiveness and supply chain reliability (Oliveira-Dias et al., 2022). It highlights the major supply chain systems, technologies, processes, and collaborations that the organisation may apply to enhance the productivity and success of its supply chain resilience practices, thereby leading to better performance (Khan et al., 2023). Various studies have revealed that strategies such as lean manufacturing have positive influence on resilience in organisations, which in turn promote robust SCP (Frazelle, 2020; Alipour et al., 2022; Khan et al., 2023). The strategies included in this study are reverse logistics, lean manufacturing, leveraged technology, supply chain collaboration and traceability and they are briefly explained below.

Reverse logistics or reverse distribution is a stage in the supply chain in which the product is returned from the point of sale to the manufacturer or distributor for recovery, repair, recycling, or disposal (Mishra & Singh, 2022). The fundamental purpose of reverse logistics is to oversee and control the movement of raw materials, and products from the end user to the supplier to extend their value and reduce their environmental impact (Khan et al., 2024). Namweseza et al. (2024) establish that reverse logistics have a positive influence on supply chain visibility and velocity in manufacturing organisations. Lean manufacturing is an approach that concentrates on reducing waste or excesses along the manufacturing or production processes while at the same time increasing productivity (Alipour et al., 2024). Abdullah et al. (2023) mention that lean manufacturing is based on the conception of persistently determined for

excellence, which lead to pursuing the root causes of quality concerns and flushing out and reducing waste throughout the supply chain. Alipour et al. (2022) reveals that lean manufacturing as a supply chain strategy promotes supply chain resilience and improve performance in terms of reducing supply chain costs.

Supply chain technologies comprise of digitalised processes and instruments that are implemented to promote organisations' efficiency and resilience of their supply chains (Nozari et al., 2023). At the centre of supply chain technological digitalisation sits a substantial data volume which is applied to make improvements in SCR and product traceability (Zeng & Yi, 2023). According to Marinagi et al. (2023), leveraging new technologies can improve operational efficiency, enhance decision-making and reinforce supply chains against disruptions. Technologies such as the Internet of Things (IoT) is primarily changing logistics by allowing real-time data collection (Nozari et al., 2023). IoT designs, such as radio frequency identification (RFID) tags and sensors, are critical for boosting operational visibility and SCT (Zamani et al., 2023). These technologies enable for the constant monitoring of materials and products across the entire supply chain, supplying essential information that supports manufacturing firms in optimising their logistics and lessen downtime thereby improving their supply chain performance (Marinagi et al., 2023). Machine Learning (ML) and Artificial Intelligence (AI) are also new technologies that employ considerable amounts of data, including product traceability and past performance, to forecast future demand precisely (Varriale et al., 2023). In addition, AI technologies promote sturdy risk management (RM) practices such as identification of prospective disruptive events and proposing mitigative measures, thereby supporting resilience initiative along the supply chains of manufacturing firms (Zeng & Yi, 2023).

Supply chain collaboration (SCC) is another strategy that can be employed by manufacturing SMEs in South Africa to support their resilience and improve their SCP. Veile et al. (2024) assert that SCC concerns the coordination of an organisation with its external environment and internal functions to maintain a smooth, augmented supply chain flow to resourcefully meet demand and guarantee on-time delivery of materials and goods. Al-Omoush et al. (2023) posit that by leveraging SCC practices to share knowledge and information from an incorporated structure and implementing the correct process and approach, manufacturing SMEs may perhaps address inadequacies and arrange their supply chains to certify a continuous movement of materials, information, and products.

Supply chain traceability is the ability to track and trace the movement of goods and materials throughout the supply chain, from raw materials to its destination (Blaettchen et al., 2024). It involves collecting and analysing data at every stage of the supply chain to ensure that products are made safely, ethically, and sustainably (Moysiadis et al., 2023). According to Razak et al. (2023), the main aim of SCT is to improve accountability, transparency and responsibility, making it simpler for manufacturing SMEs and other organisations to eliminate waste, control disruptive events, reduce distribution uncertainties, and guarantee that their goods and services are not harmful to consumers. SCT is important for several reasons. For one, it helps businesses manage risk by providing greater visibility (Blaettchen et al., 2024). Moysiadis et al. (2023) assert that traceability also helps manufacturing SMEs and other related companies to ensure that their products are made safely, using prescribed ethical standards, and sustainably, which can augment customer confidence, competitive advantage, reputation and SCR.

1.2.3 Supply chain resilience

Supply chain resilience is the organisation's capacity to return to normal by recovering and sustaining operations after a disruption happens (Belhadi et al., 2024). According to Dey et al. (2024), SCR involves the reducing of operational redundancies, improving real-time monitoring and evaluation, applying supply chain visibility processes, and implementing recovery and contingency strategies. Rashid et al. (2024) argue that when organisations give precedence to the enhancement of resilient supply chains, they gain the capability to proactively prevent detrimental supply chain disruptive events, improve operational control, minimise costs, and contribute to seamless flow of materials and products throughout the entire supply chain. Thus, Dey et al. (2024) contend that supply chain resilience can turn out to be a defence, protecting both consumers and organisations in cases of unforeseen disruptions. In the face of supply chain disruptions such as the recent COVID-19 and the Russia-Ukraine wars, causing global disruptions, the important for an adaptable and resilient approach becomes apparent (Rashid et al., 2024). In this study, supply chain resilience is defined as manufacturing firms' capacity to classify risks, lessen their effects, and promptly return to normal operational environment from any disruption incident (Belhadi et al., 2024). SCR practices include agility, visibility, flexibility and supply chain velocity.

1.2.3 Supply chain performance

Supply chain performance is the ability of the supply chain to provide products and services of appropriate quality in specific quantities and at the agreed time and to minimise the total cost of products and services to the final customer in the supply chain (Zailani et al., 2024). It is also defined as the ability of the supply chain to deliver the right product to the correct location at the appropriate time at the lowest cost of logistics (Emon et al., 2024). In this study supply chain agility, responsiveness, reliability and customer satisfaction are the dimensions selected to represent supply chain performance measurements. These dimensions were selected because of their relevance in the South African manufacturing SMEs, and they are appropriate in addressing the objectives of the study. Supply chain agility is the ability to respond to unanticipated changes (Ali et al., 2024). Ali et al. (2024) further define it as the capability of the supply chain process to react swiftly to deviations in the market. Some studies focus on SCA because it is the most essential capability that can be employed by manufacturing SMEs in South Africa as a factor that enhances resilience in their supply chains.

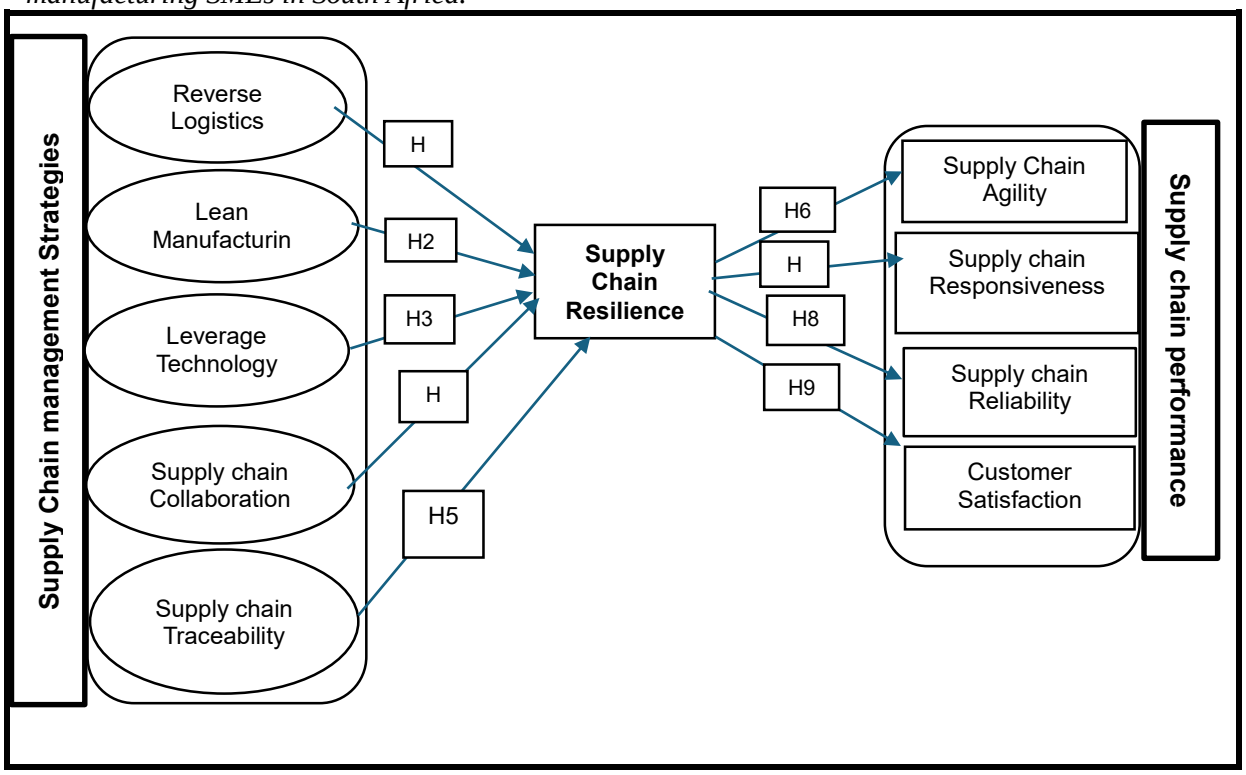
Supply chain reliability is the capacity of a supply chain process to undertake its binding activities under identified conditions for an indicated period (Hashim et al., 2024). Moreover, reliability focuses on the circumstances under which an action or a process is performed (Emon et al., 2024). Thus, the reliability of the supply chain emphasises whether the correct product gets to the correct place, in the correct quantity, at the correct time, with the correct documentation and to the right customer (Kanike, 2023). Supply chain responsiveness includes a supply chain's ability to respond to wide ranges of quantities demanded, meet short lead times and handle supply chain uncertainties and disruptions (Nayeri et al., 2023). For purposes of this study, responsiveness is the characteristic of manufacturing SMEs' supply chain system that endows it with the capability to perform a broad range of changing requirements of the end-product market (Nayeri et al., 2023). Lastly, customer satisfaction relates to customers' after consumption assessment of their expectations and perceptions performance of a product or service (Junejo et al., 2023). Annathurai et al. (2023) state that CS is the drive to manufacturing SMEs' growth and continued existence as it provides feedback on how good the whole supply chain process might have been. CS has been identified as the key indicator that differentiates between high or successful business performance and a low or unsuccessful business performance within the business environment in present-day South Africa (Mtotywa

& Kekana, 2023). In a nutshell, SCP is observed as a final product of a combination of SCM strategies and SCR. The study focuses on South Africa because it is one of the industrialised economy in Sub-Saharan Africa and boost a vibrant manufacturing sector producing products that are supplied in many African countries and beyond.

1.3 Research model and hypotheses formulation

Figure 1 demonstrates the research model that directs the current study. The research model postulates that employing SCM strategies in manufacturing SMEs of South Africa positively influences supply chain resilience which, in turn, significantly influences the supply chain performance.

Figure 2: Research model on supply chain strategies, supply chain resilience and performance of manufacturing SMEs in South Africa.



Source: Author's own compilation.

1.3.1 Supply chain management strategies and supply chain resilience

In today's dynamic, volatile and interlinked worldwide business operating landscape, SCRes has appeared to be an important factor for organisations seeking to navigate supply chain disruptions, uncertainties and risks. This study explores the pivotal role of SCM strategies in sustaining SCRes on a South African manufacturing SMEs level. While supply chains become progressively more involved, intricate and susceptible to innumerable uncertainties, including pandemics, wars and natural disasters, leveraging SCM strategies such as reverse logistics, leverage technologies, lean manufacturing and SC collaboration becomes important for organisations aiming to build and maintain resilience (Alipour et al., 2024). Some manufacturing firms have realised considerable benefits from implementing SCM strategies such as reverse logistics and SC collaboration (Veile et al., 2024). For example, Abdullah et al. (2023) highlight the requirement of sharing knowledge and information of failure and success to address challenges, underscoring the applied benefits obtained through SC collaborative programs. Furthermore, Blaettchen et al. (2024) discuss how digitalisation in terms of SCT practices based on design values contribute to broadening the probabilities of collaboration and

information sharing, showcasing the tangible resilience benefits comprehended by manufacturing firms leveraging traceability and lean manufacturing platforms. Some studies provide concrete examples of organisations benefiting from SCM strategies, thereby highlighting their practical utility and impact on agility and flexibility as element of SCR (Moysiadis et al., 2023). However, employing SCM strategies for SCR presents some general challenges. These include the lack of commitment of collaborating partners to share information for mutual benefits (Blaettchen et al., 2024), the lack of consideration on new technologies to use programs (Razak et al., 2023), and the need for ethical lean manufacturing, reverse logistics and environmental orientation to make a difference in SCR and performance (Moysiadis et al., 2023). Moreover, there is a worldwide pattern concerning digitalised SCT, and the materialisation of ethical and principled consumerism is buttressing the propensity of customers to be subtle to SC transparency (Alipour et al., 2024). Given such a background**,** the study proposes the following hypotheses:

H1: Reverse logistics positively affects SCRes
H2: Lean manufacturing positively affects SCRes
H3: Leverage technology positively affects SCRes
H4: SC collaboration positively affects SCRes
H5: SC positively affects SCRes

1.3.2 Supply chain resilience and supply chain performance

Supply chain resilience is an emerging research area, which plays a critical part in safeguarding against small- to large-scale SC disruptions. Over the past few years, several scholars have concentrated on extending SCR strategies that have noticeably contributed to abating supply chain interruptions (Belhadi et al., 2024). SCR is "the features of a well-designed SC system with reactive and proactive abilities, which empowers organisations in minimising the possibility of disruptive events (or to condense their detrimental effects) to take the organisation to a determined and more maintainable operational level" (Dey et al., 2024). The focus of SCR is on the process's adaptive capacity to curb some disruptive events (Rashid et al., 2024). A resilient supply chain should contain perturbation, given the current supply chain's instability and irregularity worldwide (Belhadi et al., 2024). Cautiously, Ekpudu and Udofia (2023) theorise resilience as proactive and reactive capabilities, related to three aspects that is, agility, visibility and flexibility. Another vital consideration for developing resilience is velocity within the SC, which combines SC resources to provide an enhanced SC performance (Adeleye et al., 2024). Some studies have recorded that SC visibility as a measure of resilience seems to enhance SC agility and responsiveness in manufacturing firms (Ekpudu & Udofia, 2023; Adeleye et al., 2024). Salam and Bajaba (2023) further, through empirical observation, established that SCR practices are positively related to customer satisfaction and agility. The end-to-end SC visibility, traceability and flexibility affords appropriate, precise data around demand forecasting, inventory management and ability to empower SC partners with assurance in decision making on SCM strategies to minimise risk and guarantee stability of operations, thus improving SC performance (Belhadi et al., 2024). Given the above discussion the following hypotheses are proposed:

H6: SCRes positively affects SC agility
H7: SCRes positively affects SC responsiveness
H8: SCRes positively affects SC reliability
H9: SCRes positively affects customer satisfaction

1.4 Research Methodology

Research methodology is a configured and methodical approach applied in research to collect, analyse, and interpret data. It is a broad plan that is also used to address research objectives or test hypotheses. A quantitative research method and a cross-sectional survey design were adopted in this study and were employed to collect, analyse and interpret quantitative data. In this study a quantitative approach is applicable in the sense that it is intended to make predictions, realise evidence and test the formulated hypotheses. Moreover, cross-sectional survey design is less expensive and time-consuming than many other types of study (Savitz & Wellenius, 2023). This design can provide valuable insights and understandings into respondent's characteristics and reveal correlations for future studies (Savitz & Wellenius, 2023).

1.4.1 Sampling Method, Population and Sample Size

In this study, the non-probability sampling method was used. Respondents were selected using the the purposive sampling technique, to ensure that only those individuals that possessed the desired knowledge were included in the study. The target population included owners, managers and SCM professionals in manufacturing SMEs the Free State, Gauteng and North-West Provinces of South Africa. This target population (i.e., owners, managers and SCM practitioners) is largely responsible for handling logistics and SCM matters, formulating strategies and the implementation of SCRes practices and improve performance, hence, were central to this study. A survey questionnaire was employed as the primary data collection instrument. A questionnaire is considered an inexpensive and efficient technique of gathering data in a properly designed and convenient form from a huge pool of respondents, which makes it suitable for this study (Zou & Xu, 2023). Self-completion survey questionnaires were emailed, and hand delivered, to purposely sampled respondents in manufacturing SMEs in the three selected Provinces. A final sample size of 407 (n=407) sufficiently characterises the chosen respondents. This sample size was deemed applicable, as suggested by Dehalwar (2024).

1.4.2 Measurement Items, Data Collection

The measurement scales of the study were adapted from renowned scales in the previous studies. SCM strategies were measured using five items each and were adapted from Alipour et al. (2022) and Khan et al. (2023). SCR was measured using five items adapted from Blaettchen et al. (2024). SCP dimensions were measured using five items and were adapted from Zailani et al. (2024). A self-administered survey questionnaire was employed in the process of data collection. Data were collected between January 2024 and June 2024. The extended period of six months was ascribed a lot of questionnaires distributed. Measurement scales in the questionnaire were presented on a five-point, Likert scale having choices ranging from 1=strongly disagree and 5 = strongly agree.

1.4.3 Ethical Considerations

The following ethical considerations guided the collection of data and the study, that is, clearance to conduct the study was acquired from the Central Research Ethics Committee at Vaal University of Technology. Furthermore, respondents participated in the study at their convenience and the study also informed consent, warranted privacy, anonymity and confidentiality of the respondents by not necessitating names or other identities of the respondents on the questionnaire. Lastly, the data was analysed according to the objectives and the report on the results were done free of bias.

1.4.4 Data analysis

Descriptive and inferential statistics were used to analyse collected data. Structural equation modelling (SEM) and Path analysis were employed to examine the linear correlations' strength and direction between the constructs. Hypothesis analysis was used to determine the predictive relationships between the constructs. The Smart partial least squares (SMART PLS) and Statistical Package for the Social Sciences (SPSS version 27.0) were used to analyse data.

2. Results and discussions

The response rate for this study is presented in Table 1.

Table 1: Response rate

Description	**Frequency**
Total amount of distributed questionnaires	500
Total amount of returned questionnaires	464
Discarded questionnaires	57
Retained useful questionnaires	407
Response rate (%)	**81.4%**

Source: Author's compilation

Table 1 outlines the general distribution of the questionnaires for this study. Five hundred questionnaires were distributed to the selected respondents. From the 500 questionnaires distributed, a total of 464 came back and from these, 57 had errors and were deemed not valid for data analysis. The retained questionnaires amounted to 407, translating to 81.4 percent response rate. According to Lund (2023), this response rate is appropriate for data analysis in quantitative research.

2.1 Demographic Results

Table 2 presents the demographic results which constitute the first part of the analysis of results.

Table 2: Descriptive statistics results

Variable and category	**Frequency (N)**	**Percentage (%)**
Gender		
Male	297	73.0
Female	110	27.0
Total	*N* = 407	100
Race		
African	261	64.1
White	90	22.1
Indian/Asian	36	8.9
Coloured	20	4.9
Total	*N* = 407	100
Age		
18-25 years of age	11	2.7
26-33 years of age	102	25.0
34-41 years of age	223	54.8
42-49 years of age	41	10.1
50> years of age	30	7.4
Total	*N*= 407	100
Highest level of education		
Matric	14	3.4
Certificate	67	16.5
Diploma	106	26.0
Degree/Honours	174	42.8
Master's and higher	46	11.3
Total	*N* = 407	100

Net monthly income		
Less than 15 000	21	5.2
Between 15 001 and 20 000	78	19.2
Between 20 001 and 25 000	109	26.8
Between 25 001 and 30 000	141	34.6
Above 35 000	58	14.2
Total	*N* = 407	100
Type of employment		
Permanent	349	85.7
Contract	58	14.3
Total	*N*=407	100
Number of years in the organisation		
Less than 1 year	23	5.7
1 to 3 years	77	18.9
4 to 6 years	204	50.1
7 to 9 years	71	17.4
10 years and above	32	7.9
Total	*N*=407	100

Source: Author's compilation

The results in Table 2 highlight that 297 were male respondents while 110 were female respondents. This transforms to 73% males and 27% females. Concerning the distribution of respondents by ethnicity, most of the respondents were black Africans (64.1%; n=261). Regarding the age distribution, most of the respondents were in the age group between 34-41 years (n=223; 54.8%). Concerning qualifications, most of the respondents (42.8%; n=174) had degrees and honours. About the monthly income, most of the respondents ranged from 25 001 to R30 000 (n=141; 34.6%). In addition, most respondents were employed on a permanent basis (n=349; 85.7%). Lastly, most of the respondents have been with their organisations for between 4 to 6 years (50.1%; n=204).

2.2 Measurement Scale Accuracy

The accuracy of construct items was determined by reliability and validity testing. The measurement scale outcomes are presented in Table 3.

Table 3: Constructs and measurement items

Construct	Item code	Standardised factor Loadings	VIF	Cronbach's alpha	CR	AVE	$\sqrt{AVE}$
Reverse Logistics	RL1	0,905	3.154	0.923	0.941	0.762	0.873
	RL2	0,837					
	RL3	0.901					
	RL4	0,888					
	RL5	0,832					
Lean manufacturing	LM2	0,864	3.216	0.916	0.940	0.797	0.893
	LM3	0,897					
	LM4	0,919					
	LM5	0,889					
Leverage Technology	LT1	0,886	1.503	0.733	0,882	0.789	0.888
	LT2	0,891					
Supply chain collaboration	SCC1	0,714	1.429	0,715	0.829	0.619	0.787
	SCC2	0,760					
	SCC4	0,876					
Supply chain traceability	SCT1	0,729	3.020	0.752	0.824	0.610	0.781
	SCT3	0,764					
	SCT5	0,840					
	SCR1	0.875	3.071	0.882	0.897	0.686	0.828

Supply chain resilience	SCR2	0.909					
	SCR3	0.924					
	SCR4	0.816					
	SCR5	0.801					
Supply chain Agility	SCA1	0,930	3.064	0.857	0.914	0.781	0.884
	SCA2	0,808					
	SCA3	0,907					
Supply chain responsiveness	SR2	0,783	2.623	0.882	0.897	0.686	0.828
	SR3	0,774					
	SR4	0,834					
	SR5	0,914					
Supply chain reliability	SCL3	0.932	1.182	0.763	0.809	0.682	0.826
	SCL5	0.716					
Customer satisfaction	CS1	0,943	1.584	0.756	0.885	0.795	0.892
	CS2	0,837					

Source: Authors' Compilation.

2.3 Exploratory factor analysis and common method bias

In SEM analysis, exploratory factor analysis (EFA) is a mathematical process applied to disclose the principal configuration of a reasonably huge set of variables. Nguyen and Waller (2023) confirm that EFA is a method within factor analysis whose main objective is to detect the fundamental associations between measured variables. From table 3, it can be observed that after subjecting the measurement items to EFA some of the items that is, LM1, LT3, LT4, LT5, SCC3, SCC5, SCT2, SCT4, SCA4, SCA5, SR1, SCL1, SCL2, SCL4, CS3, CS4 and CS5 were discarded as they unsuccessful to meet the least value of 0.7 as suggested by Nguyen and Waller (2023).

The data were collected using one survey source, that is a questionnaire. Consequently, there is the possibility of common method bias. Regarding the outcomes of EFA, which were obtained using SPSS version 27.0 package, the total variance of one factor unrotated matrix is smaller than 0.5 or 50 percent, which implies that the common method bias had no effect on the collected data (Podsakoff et al., 2023).

2.4 Analysis of reliability, validity and multi-collinearity

The measurement properties of the constructs were determined by conducting validity and reliability testing. Firstly, convergence validity was ascertained by the average variance extracted (AVE) scores. All the AVE values of constructs were greater than the cut-off point (0.5) (Cheung et al., 2024) indicating that convergence validity was acceptable in this study. Secondly, discriminant validity was tested using Heterotrait-monotrait ratio (HTMT) – Matrix. The correlation coefficients between each pair of constructs should be less than one (Ekinci et al., 2023). All the correlation coefficients in the Matrix presented in Table 4 were smaller than the one for each construct, thereby providing evidence of discriminant validity among the constructs. Item-to-total correlation analysis results provided in Table 4 suggest a reasonable fit of the latent factors to the data collected. Cronbach's alpha values for all factors were greater than 0.70, which ensured the internal consistency and reliability of the constructs (Fischer, Boone & Neumann, 2023). Reliability was also ascertained by the item factor loadings which were all more than the minimum 0.6 and acceptable as recommended by Cheung et al. (2024). Construct reliability was tested using the composite reliability (CR) scores. A CR greater than

0.80 would imply that the variance captured by the factor is significantly more than the variance indicated by the error components (Ekinci et al., 2023). As shown in Table 3, all constructs depicted CRs more than 0.820, which approves that construct reliability was acceptable.

Multi-collinearity denotes a condition where two or more independent variables are meticulously interrelated to each other. In addition, multicollinearity occurs when there is a correlation between many predictors constructs in a multiple regression model (Kyriazos & Poga, 2023). In this study variance inflation factor (VIF) was used to confirm the absence of collinearity from the collected data. VIF is an indicator or measurement of multi-collinearity in an established group of multiple regression variables (Streukens & Leroi-Werelds, 2023). The results in Table 3 indicate that VIF values for all constructs were less than 5 as recommended by Kyriazos and Poga (2023) illustrating the non-existence of multi-collinearity amongst the variables.

Table 4: Correlation between theoretical constructs

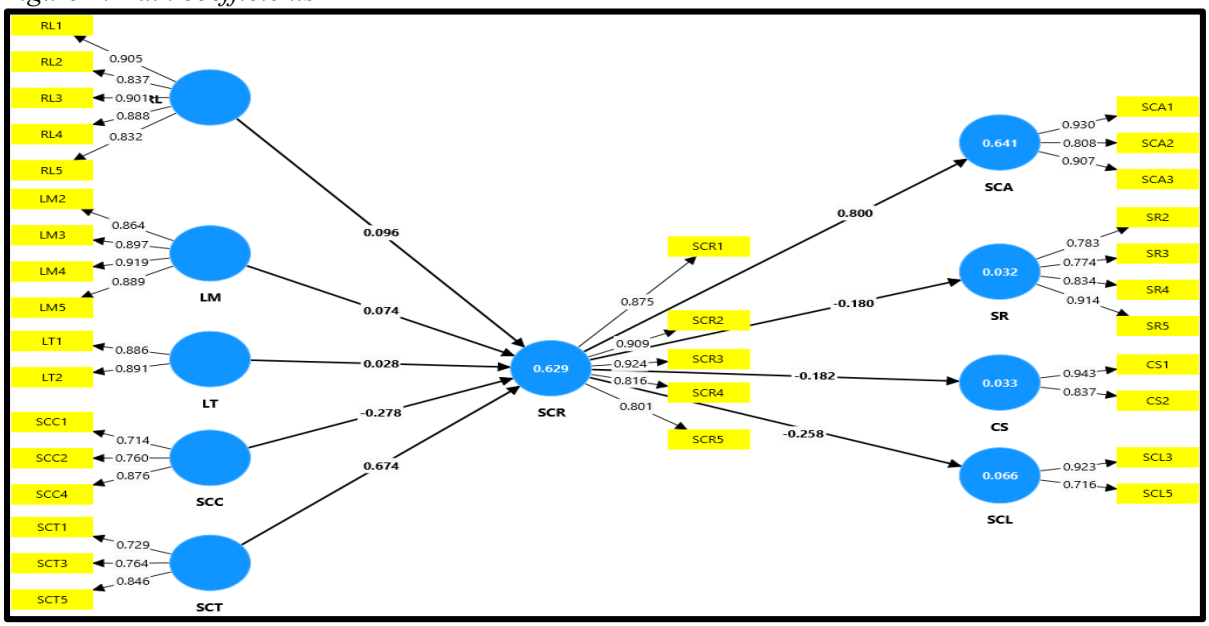
	CS	**LM**	**LT**	**RL**	**SCA**	**SCC**	**SCL**	**SCR**	**SCT**	**SR**
CS	1.000									
LM	0,150	1.000								
LT	0,099	0,929	1.000							
RL	0,095	0,156	0,152	1.000						
SCA	0,116	0,093	0,195	0,070	1.000					
SCC	0,159	0,080	0,072	0,059	0,348	1.000				
SCL	0,155	0,340	0,345	0,055	0,248	0,296	1.000			
SCR	0,210	0,112	0,171	0,130	0,898	0,457	0,339	1.000		
SCT	0,172	0,062	0,093	0,115	0,685	0,184	0,342	0,710	1.000	
SR	0,957	0,327	0,229	0,104	0,084	0,196	0,088	0,146	0,160	1.000

Source: Author's compilation

2.5 Path Analysis

In this study, path analysis was applied for hypotheses testing. The study considered two conditions under PLS model to accept or reject each hypothesis. The first condition uses the beta (β) coefficient to validate the relationship between the variables. For a hypothesis to be accepted, the beta value must either be positive or negative and mostly lie between 0.1 and 1 for positive relationships and between -0.1 and -1 for negative associations (Jollineau & Bowen, 2023). The next condition relates to the significance level values denoted by p-values of the variables. The significance values should be less than 5% or 0.05, that is $p<0.05$. The outcomes of the path analysis are presented in Figure 2.

Figure 2: Path coefficients



Source: Compiled from SMART PLS

The beta coefficients in figure 2 are between -0.278 and 0.800. RL(β=0.096) and SCT (β =0.674) have positive significant impact on SCRes. Other SCM strategies, that is LM ((β =0.0074) and LT (β=0.033) have insignificant influence on SCR. The interesting result shows that SCC has a negative significant impact on SCR. SCR (β = 0.800), has a positive significant influence on SCA. However, SCR has a negative significant influence on CS (β =-0.182). SCL(β =-0.256) and SR (β =-0.194) respectively.

2.6 Discussion of Results

The current addressed the following objectives by conducting a hypothesis testing on the study constructs.

1) To establish the effect of SCM strategies on SCRes
2) To find out the influence of SCRes on performance in manufacturing SMEs of South Africa.
3) To determine the mediating impact of SCRes on the relationship between SCM strategies and performance.

The hypothesis testing results of the study are highlighted in Table 5.

Table 5: Results of PLS hypotheses testing analysis

Hypothesis	Path	B-values	T-values	P values	Remark
H1	RL -> SCR	0.096	2.521	0.012	Accept
H2	LM -> SCR	0.074	1.398	0.162	Reject
H3	LT -> SCR	0.028	0.534	0.593	Reject
H4	SCC -> SCR	-0.278	9.230	0.000	Accept
H5	SCT -> SCR	0.674	30.240	0.000	Accept
H6	SCR -> SCA	0.800	41.842	0.000	Accept
H7	SCR -> SR	-0.180	4.198	0.000	Accept
H8	SCR -> SCL	-0.258	5.086	0.000	Accept
H9	SCR -> CS	-0.182	4.124	0.000	Accept

Source: Author's compilation

The study explored the relationship between SCM strategies, SCRes, and supply chain performance of manufacturing SMEs in South Africa. The results in Table 5 indicate that seven hypotheses (H1, H4, H5, H6, H7, H8 and H9) were accepted, while two hypotheses (H2, and H3) were rejected.

2.6.1 Supply chain management strategies and supply chain resilience

The results indicate that RL and SCT have a significant positive influence on SCR ($\beta = 0.096$; $t = 2.521$; $p = 0.012$; $\beta = 0.674$; $t = 30.240$; $p = 0.000$). This suggests that adopting RL and SCT practices have an impact on the SCR in South African manufacturing SMEs. These results are supported by the prior studies, which found a positive significant relationship between traceability practices (material and production tracking) and resilience of manufacturing companies (Abdullah et al., 2023; Veile et al., 2024). The results may perhaps imply that that South African manufacturers have adopted both RL and SCT practices in their supply chains and respondents were aware that their firms were implementing these two variables in enhancing their SCR. Remarkably, the same results shows that LM and LT as SCM strategies have no impact on SCR ($\beta = 0.074$; $t = 0.1398$; $p = 0.162$) ; ($\beta = 0.028$; $t = 0.1398$; $p = 0.162$). The results contrast the previous research which established the positive association between new technology adoption and resilience of supply chains. Alipour et al. (2024) specify that high preliminary costs associated with leveraging supply chain technologies and implementing LM practices may hinder their adoption, especially among manufacturing SMEs in South Africa. Another, result reveal that SCC as a SCM strategy has a negative significant influence on SCR (β =- 0.278; t = 9.230; p = 0.00). This implies that the more the firms push for collaboration initiatives the negative it affects the resilience of their supply chains. The result contradicts the study by Veile et al. (2024) who found a positive relationship between collaboration and SCR in different manufacturing firms. Though SCC is a well-known SCM strategy that was used by many organisations, it may not be a strategy that is considered by management of manufacturing SMEs in South Africa. Intricacy and inconsistency in manufacturing SMEs' supply chains may make attaining collaborations and alliances challenging. Furthermore, resilience is a new SCM concept that came into effect after the disruptions caused by COVID-19 and the Russia-Ukraine war. The concept is yet to be popularised in South Africa, worse of in South African manufacturing SMEs. Therefore, the results may further imply that the respondents may not be fully conversant on how SCC systems work, or they might not have all the information and knowledge on how they can harness the concept to enhance resilience in their supply chains. These mixed results may further reveal that manufacturing SMEs in South Africa are pushing for the implementation of RL and SCT strategies more than the other strategies in trying to configure resilient supply chains.

2.6.2 Supply chain resilience and supply chain performance

The results in Table 5 revealed that SCR significantly impacted SCA ($\beta = 0.800$; $t = 41.842$; $p = 0.000$) and inversely influence SR (β = -0.180; t = 4.198; p = 0.000); SCL (β = -0.258; t = 5.086; p = 0.000) and CS (β = -0.182; t = 4,124; p = 0.000) respectively. The first outcome indicates that having resilience initiatives enhances or improves agility in the supply chains of South African manufacturing SMEs. This result is supported by prior studies which confirm that pursuing SCR interventions in organisations results in enhancing supply chain agility (Sturm et al., 2023; Belhadi et al., 2024). Thus, the outcome complements previous studies' discourse those organisations with sustainable SCR (including robustness, velocity and responsiveness and other resource capabilities) can bounce back quickly after a disruption thereby improving the agility (Zhao et al., 2023). Fascinatingly, the same outcomes establish

that SCR has a significant negative effect on SR, SCL and CS as measures of the SCP. These results oppose the previous studies, which establish that SCP improves when organisations are more resilient throughout their supply chain processes (Cui et al., 2023; Zhao et al., 2023).

Firstly, the positive outcomes may imply that those manufacturing SMEs that are more resilient can swifty adjust to changes and disruptions and flexible in terms of making decisions during periods of interruptions. Sturm *et al*. (2023) note that the ability to respond to geopolitical events, pandemics and uncertainties by manufacturing SMEs with greater resilience than the competitors can result in enhanced agility when it comes to future disruptions and can bring cost advantages even if the manufacturing costs of addressing those disruptive events might higher. Furthermore, these mixed results may entail that SCR practices are yet to be completely accepted and implemented in some manufacturing SMEs because they may lack the resources equated to their larger counterparts within South Africa and beyond. Furthermore, SCR is a new phenomenon in SCM, and respondents might not be fully aware of it as a driver of performance in manufacturing SMEs of South Africa. Although most manufacturing SMEs in South Africa are better in terms of resilience in Africa, the globalisation of supply chains may weaken their resilience because of worldwide cut-throat competition posed by those firms in advanced economies, thereby affecting their overall SCP.

2.6.3 Mediation Analysis

Mediation was verified to determine the consequence of changes in SCR on the association between each SCM strategies and each of the four SCP dimensions. Table 6 presents the results of mediation.

Table 6: Mediation results

Path	B-values	T-values	P-values	Remark
LT -> SCR -> SCL	-0.007	0.517	0.605	No mediation
SCT -> SCR -> CS	0.123	4.087	0.000	Full mediation
RL -> SCR -> SCL	0.125	2.346	0.009	Full mediation
SCC -> SCR -> SCA	0.222	8.747	0.000	Full mediation
LM -> SCR -> SR	-0.013	1.179	0.239	No mediation
LT -> SCR -> SR	-0.005	0.474	0.635	No mediation
SCC -> SCR -> SCL	0.072	4.421	0.000	Full mediation
RL -> SCR -> SR	-0.017	2.020	0.043	Mediation
SCT -> SCR -> SCA	0.540	22.345	0.000	Full mediation
SCC -> SCR -> SR	0.150	3.654	0.000	Full mediation
SCT -> SCR -> SCL	0.174	5.014	0.000	Full mediation
SCT -> SCR -> SR	0.121	4.226	0.000	Full mediation
LM -> SCR -> CS	-0.014	1.303	0.192	No mediation
LT -> SCR -> CS	-0.005	0.501	0.617	No mediation
RL -> SCR -> CS	0.117	2.105	0.003	Mediation
LM -> SCR -> SCA	0.060	1.400	0.162	No mediation
SCC -> SCR -> CS	0.051	3.710	0.000	Full mediation
LT -> SCR -> SCA	0.022	0.535	0.593	No mediation
LM -> SCR -> SCL	-0.019	1.264	0.206	No mediation
RL -> SCR -> SCA	0.077	2.512	0.012	Full mediation

Source: Author's compilation

Supply chain resilience significantly and positively mediated the relationship between three SCM strategies (SCT, RL, SCC) and all their corresponding SCP dimensions (i.e., SCA, SCL, SR and CS). On the other hand, most mediating effects were weak, with the highest being observed between SCT -> SCR -> SCA (β = 0.540; t = 22.345; p = 0.000). This result suggests

that SCT has appeared as the most important SCM strategy that improves the SCA through the direct and indirect effect of SCR in South African manufacturing SMEs. In addition, this outcome implies that manufacturing SMEs intending to strengthen their agility in supply chains should focus more on implementing traceability practices as a supply chain strategy throughout the entire supply chain process. SCR practices may enable manufacturing SMEs to reconfigure their SCM strategies by improving agility in the supply chain processes.

3. Conclusion

This study employed a quantitative approach and SEM technique, using the SMART PLS analysing tool, to explore the association between SCM strategies, SCR, and SCP in the manufacturing SMEs of South Africa, selected from three provinces namely Gauteng, Free State and North-West. The study confirms that implementing some SCM strategies positively and inversely impact on resilience in the manufacturing SMEs. This current study further established that LM and LT have no influence on SCR. Moreover, SCR has both positive and negative significant relationships on SCA, SR, SCL and CS respectively. SCR significantly mediated the relationship between SCT, RL, SCC and all the SCP dimensions, namely SCA, SCL, SR and CS.

3.1 Managerial Implications

The principal purpose of the study was to explore the relationship between SCM strategies, SCR and SCP of the manufacturing SMEs in South Africa. Essentially, it was concluded that some SCM strategies RL practices and SCT aspects enhance manufacturing SMEs' capacity to improve SCR elements such as flexibility, robustness, responsiveness and sustainability. This inference advises supply chain managers to consider implementing traceability of supply chain activities and RL practices through its supply chain and to improve responsiveness, velocity and understanding of unpredicted disruptive events. In other words, managers, owners and SCM professionals of manufacturing SMEs in South Africa are obligated to design their supply chains to more resilient ones based on executing traceability strategies, recycling, repairing and remanufacturing (as RL strategies). Researchers, on the other hand, are requested to re-examine the effects of technology and LM on SCR as the present study discovered that these two SCM strategies had no significant influence on resilience of the manufacturing SMEs' supply chains. The above inferences also present the succeeding two thoughts for management practice. Firstly, they ideally and empirically confirm the significance of progressing SCR interventions through implementing SCM strategies thereby leading to enhanced SCP. Therefore, in practice, from the viewpoint of managers and owners on manufacturing SMEs, to reach the sustainable development of resilience in supply chains and SCP, the pertinent leadership should formulate and implement more traceability and RL strategies to deal with disruption risks, embed a resilient culture in supply chain processes and network, improve flexibility, agility and robustness in many scopes, and make complete provisions for improving SCP. From the perception of the entire manufacturing SMEs' sector, it has become an accord that competition among manufacturing SMEs has ascended to cut-throat and intensive competition amongst supply chains. Each manufacturing SME is a connection in the entire supply chain network. It is, therefore, an effective strategy to efficiently incorporate supply chain competition into

supply chain processes by implementing SCM strategies and creating a SCR culture in manufacturing SMEs and constantly modelling the agility of the manufacturing supply chains to improve SCP at the end. Further, the finding of the transitional role through which SCR affects SCP may perhaps support to clarify whether manufacturing SMEs should build and improve SCM strategies because, from the perception of owners and managers, formulating and implementing strategies and SCR practices comes with expenses, and the determination of SCR and strategies is to address disruptive events are operational.

In details, managers need to develop lean supply chains to achieve the operations objective of cost, quality, and delivery, in contrast, to develop agile supply chains to achieve the operations objective of flexibility. In addition, managers should work together to design SCM practices, SCR and pay attention to how they are linked to business performance. Most leaders and managers think that since such operational events have a low chance of happening, the cost is not worthy noticing, and that not spending on resilience measures leads to cost savings. This is one of the reasons why most manufacturing SMEs' senior managers are unwilling to act and invest in SCM strategies and SCR practices. In fact, the mediating role of SCR implies that, despite of low-frequency and high-loss operational disruptions, the resilience of supply chains influences SCP through the implementation of SCM strategies. Therefore, after acknowledging this relationship, management of manufacturing SMEs in South Africa must ascribe the significance of shaping and upgrading of SCR to a stage of strategic considerate and apply this in everyday management, to improve their SCP and make their supply chains more agile and resilience to any form of disruptions.

3.2 Study limitations and future research

This study features the subsequent limitations. The relationship between SCM strategies, SCR, and performance in different sectors of the economy was not examined. The study concentrated only on manufacturing SMEs in South Africa, selected from only three provinces namely Gauteng, Free State and North West. Despite that the research outcomes are applicable to some industries, they lack relevance. The study is also limited to a sample of owners, managers and SCM practitioners manufacturing SMEs, as well as examining the effect of five SCM strategies on SCR. Therefore, further studies are required to examine the effect of SCM strategies using other strategies such as supply chain redundancy, green SCM, Supply chain 4.0 or procurement 4.0 on SCP collecting data from other samples from different industries, provinces and other sub- Saharan countries. A mixed approach method can be utilised in future studies to enable in-depth findings and insights.

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