

The Impact of Strategic Flexibility, Manufacturing Flexibility, and Supply Chain Agility on Manufacturing Performance: Evidence from South Africa

Charles Mawuena Gates^{1*}, Wu Mengyun²

^{1*,2}School of Finance & Economics, Jiangsu University, Zhenjiang, Jiangsu 212013, PR China

DOI: <https://doi.org/10.5281/zenodo.13907248>

Published Date: 09-October-2024

Abstract: This study investigates the impact of strategic flexibility, manufacturing flexibility, and supply chain agility on the performance of South African manufacturing firms. Using a structured survey of 350 respondents across various sub-sectors, the research employs structural equation modeling (SEM) to explore the relationships between these key variables. The results reveal that both strategic and manufacturing flexibilities significantly enhance supply chain agility, which in turn positively influences overall manufacturing performance. Strategic flexibility allows firms to rapidly realign strategies in response to external market conditions, while manufacturing flexibility facilitates the adaptation of production processes. Moreover, supply chain agility is shown to mediate the relationship between these flexibilities and performance, emphasizing its critical role in sustaining operational efficiency and competitiveness in a volatile business environment. The findings offer practical insights for managers and policymakers, advocating for investments in flexible and agile practices to bolster the resilience and adaptability of the South African manufacturing sector.

Keywords: Strategic flexibility, Manufacturing flexibility, Supply chain agility, Manufacturing performance, South Africa.

I. INTRODUCTION

The manufacturing sector plays a vital role in South Africa's economy, contributing significantly to employment, GDP growth, and industrial development. However, the sector faces numerous challenges, including market volatility, global competition, and supply chain disruptions. These challenges have been exacerbated by factors such as shifts in global trade, technological advancements, and economic disruptions, notably the COVID-19 pandemic. To remain competitive, South African manufacturing firms must adopt strategies that enhance their ability to respond to these dynamic conditions.

Flexibility has emerged as a critical factor in navigating these challenges. Strategic flexibility enables firms to adjust their business strategies in response to changing market conditions, regulations, and external pressures. Manufacturing flexibility allows companies to adapt their production processes and systems to meet fluctuating demand and technological changes. Additionally, supply chain agility the ability to adjust supply chain operations quickly and effectively has become indispensable in a globalized market where disruptions are frequent and costly.

Despite the recognition of these concepts globally, little is known about how South African manufacturing firms apply strategic flexibility, manufacturing flexibility, and supply chain agility to improve performance. Understanding how these flexibilities operate in the South African context is crucial, given the country's unique economic environment, characterized by supply chain vulnerabilities, high competition, and unpredictable market dynamics.

This study aims to fill this gap by examining the relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and the performance of South African manufacturing firms. The research focuses on how these

flexibilities contribute to enhancing resilience and competitive advantage within the sector. By exploring these relationships, the study provides practical insights that can inform both business strategies and policymaking, promoting growth and sustainability in South Africa's manufacturing industry [1, 2].

The findings from this research are not only relevant to South Africa but also have broader implications for other emerging economies facing similar industrial challenges. The study seeks to contribute to the global discourse on supply chain management, manufacturing strategies, and economic resilience, offering a context-specific analysis of the South African manufacturing landscape.

II. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Theoretical Foundation

This study draws on several theoretical perspectives to understand the role of strategic flexibility, manufacturing flexibility, and supply chain agility in improving the performance of manufacturing firms in South Africa. The underlying theories that guide this research include Dynamic Capabilities Theory, Resource-Based View (RBV), and Contingency Theory. These theories offer insights into how firms can leverage flexibility and agility to respond to market volatility and improve performance.

Dynamic Capabilities Theory

The Dynamic Capabilities Theory posits that an organization's ability to integrate, build, and reconfigure internal and external competencies is critical for adapting to rapidly changing environments [3]. This theory is particularly relevant in volatile environments like the South African manufacturing sector, where firms must constantly adjust their strategies and operations to maintain competitiveness. Dynamic capabilities enable firms to modify their resource base, allowing them to respond more effectively to external shocks and opportunities.

In the context of this study, strategic flexibility and manufacturing flexibility represent dynamic capabilities that allow firms to realign their strategies and production processes in response to market shifts. Teece (2007) highlights the importance of these capabilities in enabling firms to achieve sustained competitive advantage in turbulent environments. Additionally, supply chain agility acts as a critical capability, enhancing a firm's ability to respond to changes in demand, customer needs, and supply chain disruptions [4]. By focusing on the interplay between flexibility and agility, this study applies the dynamic capabilities framework to explore how South African manufacturing firms can achieve superior performance.

Resource-Based View (RBV)

The Resource-Based View (RBV) emphasizes that firms' resources and capabilities are the key drivers of competitive advantage [5]. According to RBV, resources that are valuable, rare, inimitable, and non-substitutable (VRIN) provide a sustained competitive advantage. Strategic flexibility and manufacturing flexibility can be considered valuable resources under this framework because they enable firms to adapt to changes in their external environment.

Barney (1991) argues that firms with superior internal resources can outmaneuver competitors, particularly in volatile markets. This study extends the RBV by examining how flexibility and agility resources that can be considered dynamic in nature—enhance manufacturing firms' ability to achieve performance gains. The ability of South African manufacturing firms to effectively reconfigure resources (such as production processes and supply chain operations) to match market demands demonstrates the relevance of RBV in explaining the performance outcomes associated with flexibility.

Contingency Theory

Contingency Theory argues that there is no one-size-fits-all approach to management; rather, the optimal course of action depends on the specific circumstances a firm faces [6]. According to this theory, firms must tailor their strategies and operations to fit the environment in which they operate. Contingency theory is particularly applicable in the South African manufacturing context, where firms face unique challenges such as market volatility, supply chain disruptions, and infrastructural constraints.

In line with Donaldson (2001), this study posits that the effectiveness of strategic flexibility, manufacturing flexibility, and supply chain agility depends on the specific environmental conditions of the South African market. For example, firms that operate in highly volatile sectors, such as automotive or textiles, may require greater levels of flexibility and agility to

remain competitive. The findings of this study highlight the contingent nature of the relationships between these variables, suggesting that firms need to adapt their strategies and operational practices based on the external conditions they face.

Integrating Theories

Together, these theoretical perspectives provide a comprehensive framework for understanding how firms can leverage flexibility and agility to improve performance. The Dynamic Capabilities Theory explains the need for firms to reconfigure their resources in response to environmental changes, while the Resource-Based View highlights the importance of flexibility as a valuable internal resource. Contingency Theory further emphasizes that the effectiveness of these capabilities depends on the specific context in which a firm operates. By integrating these theories, this study offers a holistic understanding of how flexibility and agility contribute to manufacturing performance in a dynamic and volatile environment like South Africa.

Literature Review

The performance of manufacturing firms, particularly in volatile environments, hinges on their ability to adapt through strategic flexibility, manufacturing flexibility, and supply chain agility. This section reviews key literature on these concepts, exploring how they are understood and applied within the manufacturing industry, with a focus on the South African context.

Strategic Flexibility

Strategic flexibility refers to a firm's capacity to adapt its strategies in response to environmental changes and uncertainties. It allows companies to pivot quickly when market conditions shift, enabling them to remain competitive [7]. Strategic flexibility encompasses various dimensions, including the ability to reallocate resources, adjust organizational goals, and realign strategic initiatives to respond to external pressures [8].

In the context of the South African manufacturing sector, strategic flexibility is crucial for dealing with the unique challenges posed by global competition, regulatory changes, and economic instability. As market conditions evolve, firms need to make rapid strategic decisions, such as entering new markets, modifying product lines, or adjusting business models. The ability to effectively manage these shifts can determine a firm's long-term survival and growth.

Previous studies have emphasized that firms with higher levels of strategic flexibility can better align their operations with changing environments [9]. In industries with high market volatility, such as those found in South Africa, this flexibility enables organizations to react swiftly to external shocks, maintain competitiveness, and even capitalize on new opportunities. Thus, strategic flexibility is a cornerstone of effective manufacturing performance in turbulent markets.

Manufacturing Flexibility

Manufacturing flexibility refers to the ability of a firm to adapt its production processes in response to changes in product demand, design, or technology [2]. This type of flexibility is critical in industries where consumer preferences, technological innovations, and market conditions fluctuate frequently.

Manufacturing flexibility is typically categorized into several types, including product flexibility (the ability to switch between different products), process flexibility (the ability to modify production processes), and volume flexibility (the ability to adjust production volume efficiently). These flexibilities enable firms to manage disruptions in the supply chain, respond to customer demands, and optimize production efficiency.

In South Africa, where the manufacturing sector faces infrastructure challenges and fluctuating demand, the importance of manufacturing flexibility is heightened. Gupta and Jain (2016) highlighted the need for firms to quickly adapt their production systems to remain competitive. The literature also suggests that organizations capable of integrating advanced manufacturing technologies and flexible systems are better equipped to thrive in volatile markets [10].

Supply Chain Agility

Supply chain agility refers to the ability of supply chains to rapidly respond to changes in market conditions, customer demands, and external disruptions while maintaining operational efficiency [4]. In a globalized economy, where supply chains are often exposed to unpredictable risks such as geopolitical tensions, economic shifts, and natural disasters, agility is critical for maintaining continuity and competitiveness.

The concept of supply chain agility is particularly relevant in the South African manufacturing sector, where firms must navigate complex logistical challenges, such as unreliable infrastructure and fluctuating demand. Braunscheidel and Suresh (2009) argue that supply chain agility is a key enabler of superior performance, particularly in environments prone to disruption. Agility allows firms to respond quickly to supply chain disruptions, minimize operational delays, and optimize resource allocation.

Furthermore, Gligor (2018) found that supply chain agility is enhanced by strong collaboration between supply chain partners and the ability to leverage technology for real-time decision-making. For South African firms, building agile supply chains is essential for maintaining their competitive position in global markets, particularly in the aftermath of events such as the COVID-19 pandemic, which exposed the fragility of global supply chains [11].

Interrelationship between Flexibility and Agility

The literature establishes a clear relationship between strategic flexibility, manufacturing flexibility, and supply chain agility. Swafford et al. (2006) identified that the more flexible a company is in its manufacturing and strategic decisions, the more agile its supply chain becomes. This is because flexible firms can quickly adjust their operations and supply chains to accommodate new market realities.

Strategic flexibility enables firms to respond to market shifts through operational adjustments, while manufacturing flexibility allows them to modify production capabilities. Together, these flexibilities enhance supply chain agility, allowing firms to react swiftly to changes in demand, supply chain disruptions, or competitive pressures. In South Africa's manufacturing industry, where market and supply chain uncertainties are high, these interrelated flexibilities are critical for improving overall performance.

Manufacturing in the South African Context

The manufacturing industry in South Africa has undergone significant changes, particularly as the country has transitioned from an apartheid economy to a more globally integrated one. Historically, the sector has relied heavily on mining and agriculture, but over time, industries such as automotive, chemicals, and food and beverages have become critical contributors to GDP and employment [12]. However, persistent challenges such as high unemployment, energy supply issues, and infrastructure deficits continue to constrain the sector's growth.

In response to these challenges, South African manufacturing firms have increasingly turned to strategies that emphasize flexibility and agility. Government initiatives such as the Industrial Policy Action Plans (IPAP) have sought to support local production, enhance competitiveness, and promote innovation in manufacturing (Department of Trade and Industry, 2021). Nonetheless, the sector must still contend with external pressures, including global economic shifts, trade dynamics, and technological advancements.

Manufacturing Industry Performance

Manufacturing Industry Performance refers to the overall effectiveness and efficiency of a manufacturing sector in achieving its operational and strategic objectives, including factors such as production output, quality, innovation, and competitiveness (Anderson, 2003). It involves assessing the industry's ability to meet market demands, adopt advanced technologies, optimize resource utilization, and adapt to changing economic and technological landscapes. Evaluating Manufacturing Industry Performance provides insights into the sector's contribution to economic growth, employment, and its position in the global market.

The total accomplishment of key performance indicators (KPIs) in the manufacturing sector is referred to as the manufacturing industry performance. Metrics like cost effectiveness, product quality, time to market, market share, profitability, and customer satisfaction may be included in these KPIs. It represents the general efficacy and competitiveness of manufacturing companies in each sector, showing their capacity to satisfy consumer demands and accomplish long-term goals.

Summary

This review highlights the importance of strategic flexibility, manufacturing flexibility, and supply chain agility in enhancing the performance of manufacturing firms, especially within the challenging South African context. By leveraging these flexibilities, firms can improve their resilience, adaptability, and competitiveness in a rapidly changing market. The next section presents the conceptual framework and research hypotheses that will guide this study.

III. CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

This study aims to explore the relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and the overall performance of the South African manufacturing industry. The conceptual framework developed for this study integrates these key constructs and examines their interrelationships, proposing a model to better understand how flexibility and agility contribute to enhancing manufacturing performance. The following sections outline the hypotheses developed based on the literature review and the proposed conceptual model.

Conceptual Framework

The conceptual framework of this study is built upon the premise that strategic flexibility, manufacturing flexibility, and supply chain agility are interconnected and collectively influence manufacturing industry performance. Strategic flexibility allows organizations to reconfigure their strategies to address dynamic market conditions. Manufacturing flexibility ensures that companies can adjust production processes to respond to changes in demand, product designs, or external disruptions. Supply chain agility acts as a mediating factor that enables organizations to manage uncertainties in the supply chain, ensuring resilience and responsiveness.

In this framework, supply chain agility is conceptualized as the key mechanism through which the effects of strategic and manufacturing flexibilities are realized. It is proposed that both forms of flexibility have a direct influence on supply chain agility, which in turn enhances manufacturing performance. Additionally, strategic and manufacturing flexibilities are hypothesized to have a direct positive effect on manufacturing industry performance. This framework highlights the interdependence of these constructs and posits that the interplay between flexibility and agility is crucial for optimizing performance in the South African manufacturing sector.

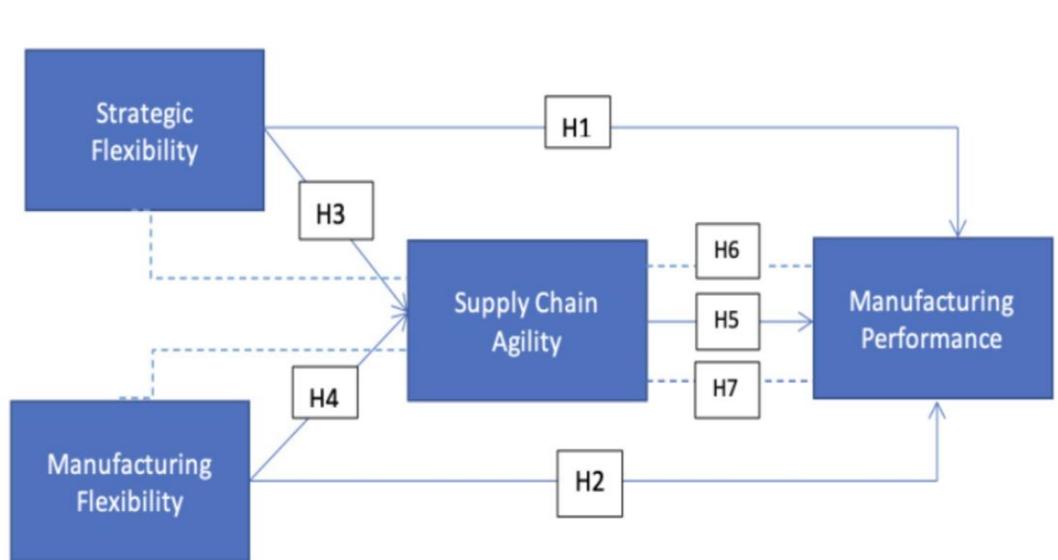


Figure 3.1 Conceptual Framework

Hypotheses Development

Based on the review of existing literature and the conceptual framework, the following hypotheses are proposed to explore the relationships between the key variables:

Strategic Flexibility and Supply Chain Agility

Strategic flexibility is characterized by an organization's ability to adapt its strategies in response to external changes. It allows firms to quickly realign their operational goals and approaches, enabling them to respond effectively to shifts in the external environment. Previous research suggests that strategic flexibility is a key enabler of supply chain agility, as it provides firms with the strategic capacity to make timely decisions and implement changes in their supply chains [7]. Firms that are strategically flexible are better equipped to manage disruptions and align their supply chain strategies with changing market conditions. Therefore, we hypothesize:

H1: Strategic flexibility positively influences supply chain agility in the manufacturing industry.

Manufacturing Flexibility and Supply Chain Agility

Manufacturing flexibility, which encompasses process, product, and volume flexibility, is essential for firms to respond to variations in customer demand, technological advances, and market fluctuations [2]. Manufacturing flexibility allows companies to adjust their production processes efficiently, minimizing delays and disruptions in the supply chain. Research indicates that greater manufacturing flexibility improves the ability of firms to cope with supply chain uncertainties, enabling quicker and more effective responses to supply chain disruptions [4]. Thus, we propose:

H2: Manufacturing flexibility positively influences supply chain agility in the manufacturing industry.

Supply Chain Agility and Manufacturing Industry Performance

Supply chain agility reflects the ability of firms to quickly adapt to external disruptions, manage risks, and respond to changes in demand and supply conditions. Firms with agile supply chains can ensure smooth operations despite unpredictable market dynamics, ultimately contributing to enhanced overall performance (Swafford et al., 2006). In a volatile business environment such as South Africa's manufacturing sector, where disruptions are common, supply chain agility is crucial for maintaining competitiveness and operational efficiency [13]. Therefore, we hypothesize:

H3: Supply chain agility positively influences manufacturing industry performance.

Strategic Flexibility and Manufacturing Industry Performance

Strategic flexibility allows firms to anticipate and respond to environmental changes, such as market fluctuations, technological advancements, and regulatory shifts. Firms that are strategically flexible can better align their operations with changing external conditions, leading to improved performance [8]. In the manufacturing sector, strategic flexibility allows firms to make decisions that optimize resource allocation, align with customer needs, and respond to competitive pressures, all of which enhance performance. Therefore, we hypothesize:

H4: Strategic flexibility positively influences manufacturing industry performance.

Manufacturing Flexibility and Manufacturing Industry Performance

Manufacturing flexibility enables firms to adjust their production processes to meet changes in demand, product design, and technology, thus ensuring that they can meet customer requirements efficiently [2]. Firms with high manufacturing flexibility can rapidly switch between products, alter production volumes, and modify processes, which enhances their ability to remain competitive in a volatile market. This operational adaptability is directly linked to improved performance outcomes such as increased profitability, market share, and customer satisfaction. Hence, we propose:

H5: Manufacturing flexibility positively influences manufacturing industry performance.

Supply Chain Agility Mediates Flexibility and Manufacturing Industry Performance

While strategic flexibility enables firms to adjust their strategies, its impact on performance is often realized through its influence on supply chain operations. By enhancing supply chain agility, strategically flexible firms can ensure that their supply chains remain responsive to external shocks and shifts in demand [14]. As supply chain agility increases, firms are better positioned to achieve operational excellence and enhance overall performance. Thus, we hypothesize that supply chain agility mediates the relationship between strategic flexibility and performance:

Supply chain agility mediates the relationship between strategic flexibility and manufacturing industry performance.

Supply Chain Agility Mediates Manufacturing Flexibility and Manufacturing Industry Performance

Manufacturing flexibility allows firms to adjust production processes quickly, but its full effect on performance is often realized through improved supply chain operations. Firms with flexible manufacturing capabilities can create agile supply chains that respond quickly to changes in market conditions and customer demands. As supply chain agility improves, firms experience better operational efficiency, reduced costs, and enhanced performance. Therefore, we hypothesize:

H7: Supply chain agility mediates the relationship between manufacturing flexibility and manufacturing industry performance.

Conclusion

The conceptual framework and hypotheses developed in this section aim to explore the interconnected relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing performance in the South African context. The hypotheses suggest that both strategic and manufacturing flexibilities play critical roles in enhancing supply chain agility, which in turn mediates their effect on manufacturing performance. This research framework provides a comprehensive approach to understanding how flexibility and agility drive performance in a highly dynamic manufacturing environment.

IV. METHODOLOGY

This section outlines the research design, data collection, and analysis methods employed to explore the relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing industry performance in the South African context. The study adopts a quantitative approach to test the proposed hypotheses, using a structured survey to collect data from managers and decision-makers within South Africa's manufacturing sector.

Research Design

This research adopts a quantitative research design, which is appropriate for examining the relationships between key variables and testing the proposed hypotheses. The study follows a descriptive-explanatory approach aimed at understanding the effects of strategic flexibility, manufacturing flexibility, and supply chain agility on manufacturing performance. The focus is on quantifying the degree of these relationships and drawing inferences that contribute to both academic literature and practical insights for the South African manufacturing sector.

Data Collection and Sampling

Population

The target population for this study consists of manufacturing firms operating in South Africa. Given the diversity of the manufacturing sector, the study covers various industries, including automotive, chemicals, textiles, food and beverages, and machinery. This approach ensures the findings are representative of the broader manufacturing landscape in South Africa. The respondents are managers and decision-makers responsible for strategy, supply chain management, and production processes, as they are best positioned to provide insights into the flexibilities and performance of their firms.

Sample Size

A sample size of 350 respondents was deemed sufficient for this study based on statistical power analysis and previous studies within similar research frameworks. The sample was selected using a stratified random sampling technique, ensuring representation across different sub-sectors of the manufacturing industry and firms of various sizes. Stratification helped capture the unique dynamics of small, medium, and large firms within the South African manufacturing sector.

Data Collection Instrument

A structured survey questionnaire was used as the primary data collection instrument. The questionnaire was designed to capture information on strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing performance. It consisted of closed-ended questions, with responses measured using a five-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." The questionnaire was pre-tested on a small sample to ensure clarity, relevance, and reliability before full-scale deployment.

The survey was administered via online platforms and direct distribution to ensure a higher response rate. The online method provided ease of access for participants, while direct distribution was used to target firms that preferred paper-based responses. A follow-up with non-respondents was conducted to minimize non-response bias.

Variables and Measurement

The variables in this study were measured using validated scales adapted from previous research. Each construct was operationalized as follows:

Strategic Flexibility: Measured using items related to a firm's ability to adapt strategies in response to external changes (e.g., product innovations, market shifts). The scale was adapted from the work of Teece (2007) and Wei et al. (2015).

Manufacturing Flexibility: Measured across dimensions such as product flexibility, process flexibility, and volume flexibility, based on scales developed by Ward and Duray (2000).

Supply Chain Agility: Measured using items that assess a firm's ability to adapt its supply chain processes to changes in market demand and disruptions. This scale was adapted from Swafford et al. (2006).

Manufacturing Industry Performance: Measured using key performance indicators such as operational efficiency, market share, profitability, and customer satisfaction. The measurement scale was adapted from Melia and Robinson (2010) and Mehrabi et al. (2019).

Data Analysis Techniques

The collected data were analyzed using several statistical techniques to ensure the robustness of the findings.

1. Descriptive Statistics

Descriptive statistics were employed to summarize the demographic characteristics of the respondents and to describe the general trends in the responses related to strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing performance.

2. Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was conducted to test the validity and reliability of the measurement model. CFA helps confirm that the observed variables represent the latent constructs of strategic flexibility, manufacturing flexibility, supply chain agility, and performance as intended.

The analysis was performed using AMOS software to assess the model fit and ensure that the data accurately reflects the theoretical constructs. Key fit indices such as Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) were used to evaluate the adequacy of the measurement model.

3. Reliability and Validity Testing

To ensure the reliability of the constructs, Cronbach's alpha was calculated for each of the study variables. A Cronbach's alpha value above 0.70 was considered acceptable, indicating a high level of internal consistency. Additionally, Composite Reliability (CR) and Average Variance Extracted (AVE) were calculated to assess construct validity. Convergent validity was tested by ensuring that the AVE values exceeded 0.50, while discriminant validity was confirmed by checking that the square root of the AVE for each construct was higher than the correlations with other constructs.

4. Correlation Analysis

Pearson correlation analysis was used to assess the strength and direction of the relationships between the variables. Correlation coefficients provided initial insights into how strategic flexibility, manufacturing flexibility, and supply chain agility are associated with manufacturing performance.

5. Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) was employed to test the hypothesized relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing performance. SEM allows for the testing of both direct and indirect effects and was used to assess the mediating role of supply chain agility in the relationships between the flexibilities and performance.

Direct Effects: The direct relationships between strategic flexibility, manufacturing flexibility, and supply chain agility on manufacturing performance were analyzed.

Mediating Effects: The indirect effects of strategic and manufacturing flexibilities on manufacturing performance, mediated by supply chain agility, were also examined.

Reliability and Validity of the Research Instrument

Ensuring the reliability and validity of the research instrument was a priority for this study.

Cronbach's alpha was used to assess the internal consistency of the constructs, with all values exceeding the recommended threshold of 0.70. Factor loadings were examined during CFA, and items with factor loadings below 0.60 were excluded to improve model fit and validity.

To ensure content validity, the questionnaire was reviewed by experts in supply chain management and manufacturing. Their feedback was incorporated into the final instrument to ensure that the items adequately captured the intended constructs.

Ethical Considerations

Ethical approval for the study was obtained from the relevant institutional review board. Informed consent was secured from all participants, who were assured of the confidentiality of their responses and the anonymity of their firms. Participation in the study was voluntary, and respondents were allowed to withdraw at any point without any repercussions.

Conclusion

The methodology employed in this study provides a comprehensive approach to understanding the relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing performance. By using a robust sampling method, reliable measurement instruments, and advanced data analysis techniques, the study ensures the validity and generalizability of its findings to the South African manufacturing sector.

V. EMPIRICAL RESULTS AND DISCUSSION

Introduction

This section presents the empirical findings derived from the analysis of data collected through surveys conducted among respondents from the South African manufacturing sector. The primary objective is to assess how strategic flexibility, manufacturing flexibility, and supply chain agility influence manufacturing industry performance. The results were analyzed using structural equation modeling (SEM) to test the hypotheses developed in the conceptual framework. The findings are discussed in relation to existing literature, providing a comprehensive understanding of how these flexibilities interact to improve performance.

Demographic Statistics

The sample consisted of 350 respondents, with key demographic variables such as gender, age, educational background, and years in business recorded. Of the respondents, 54% were male, and 46% were female, highlighting the significant participation of both genders in managerial roles within the manufacturing sector. Most respondents (51%) were between the ages of 41 and 50, indicating that mid-career professionals dominated the sample. Educational backgrounds varied, with 38% holding tertiary qualifications, while 34% had completed secondary education.

Table 5.1 Demographic Profile of respondents

Details	Measurement	Frequency	Percentage %
Gender	Male	190	54
	Female	160	46
Age	20-30 years	36	10
	31-40 years	74	21
	41-50 years	178	51
	Over 50	62	18
Education	Primary	96	27
	Secondary	120	34
	Tertiary	134	38
Experience	Less than 1 year	60	17
	2-4 years	79	23
	5-7 years	116	33
	Over 7 years	95	27

N=350

Descriptive Statistics

Descriptive statistics were used to summarize responses on strategic flexibility, manufacturing flexibility, and supply chain agility. The analysis indicated modest to high mean values across most variables, suggesting that the South African manufacturing sector leverages these flexibilities to enhance performance. For instance, strategic flexibility showed a mean score of 3.65, with firms frequently adapting strategic objectives based on market dynamics. Manufacturing flexibility and supply chain agility also reported notable means, with values reflecting the sector's reliance on these factors for competitiveness and adaptability.

Table 5.2 Descriptive Analysis of Measurement Statements

Description	Code	Mean	SD
Manufacturing Flexibility			
Our manufacturing processes can be quickly reconfigured to accommodate changes in product design.	MF1	2.68	1.314
We have the capability to adjust production volumes in response to market demand fluctuations.	MF2	2.77	1.29
Our organization encourages innovation and flexibility in manufacturing processes.	MF3	2.82	1.281
We prioritize the development of a skilled workforce capable of adapting to changing production needs.	MF4	2.78	1.313
Supply Chain Agility			
Our supply chain is responsive to changes in market demand and customer requirements.	SCA1	3.49	1.339
We have established collaborative relationships with our supply chain partners to enhance agility.	SCA2	3.46	1.366
Our supply chain processes are designed to quickly adapt to external disruptions.	SCA3	3.5	1.387
Information sharing within our supply chain is efficient and supports agile decision-making.	SCA4	3.54	1.355
Strategic Flexibility			
Strategic flexibility is a core element of our organization's decision-making process.	SF1	3.31	1.38
Our organization can swiftly adjust its strategic direction to respond to changing market conditions.	SF2	3.47	1.201
We continuously evaluate and adapt our strategic objectives based on market dynamics.	SF3	3.65	1.145
Our organization fosters a culture that encourages strategic flexibility and adaptability.	SF4	3.57	1.165
Manufacturing Industry Performance			
Our organization consistently achieves cost efficiency in manufacturing.	MIP1	3.75	1.167
Product quality is a top priority for our manufacturing operations.	MIP2	3.62	1.195
We excel in bringing new products to market within expected time frames.	MIP3	3.53	1.222
Our organization's profitability and market share reflect our competitiveness in the industry.	MIP4	3.59	1.197

Structural Model Results

The structural model was employed to test the relationships among the key variables, with hypotheses examined through path analysis. The model fit indices indicated a strong fit (CFI = 0.97, RMSEA = 0.016, SRMR = 0.026), confirming the robustness of the hypothesized model.

Table 5.3 Model Fit Assessment

Measure	Estimate	Acceptable Threshold	Interpretation
CMIN	109.607		
DF	98		
CMIN/DF	1.118	Between 1 and 3	
CFI	0.97	>0.95	Excellent
SRMR	0.026	<0.08	Excellent
RMSEA	0.016	<0.06	Excellent
Close	1	>0.05	Excellent

Hypothesis Testing

Table 5.4 Hypothesized Paths of the Main and Direct Effects

	Direct Path			Direct path with mediator included		
	Estimate (β)	C. R.	Sig. (P)	Estimate (β)	C. R.	Sig. (P)
MIP \leftarrow SF	0.269	4.933	***	0.215	3.990	***
MIP \leftarrow MF	0.242	4.483	***	0.214	4.060	***
Controls						
MIP \leftarrow Gender	-0.132	-2.556	0.011	-0.148	-2.954	0.003
MIP \leftarrow Age	-0.055	-1.061	0.289	-0.029	0.570	0.569
MIP \leftarrow Education	0.002	0.041	0.967	0.036	0.710	0.477
MIP \leftarrow Experience	-0.102	-1.968	0.049	-0.134	-2.672	0.008

NOTE: ***P<0.001

The results of the hypothesis testing are summarized in Table 5.9. The findings reveal significant positive relationships between the constructs under investigation.

H1: Strategic Flexibility Positively Influences Supply Chain Agility. The results supported this hypothesis, with a significant relationship between strategic flexibility and supply chain agility ($\beta = 0.231$, $p < 0.001$). Firms that exhibit strategic flexibility were shown to improve their supply chain agility, which is critical for responding to market changes and external disruptions.

H2: Manufacturing Flexibility Positively Influences Supply Chain Agility. Manufacturing flexibility was also found to have a significant positive effect on supply chain agility ($\beta = 0.138$, $p = 0.018$). This finding suggests that organizations that can adjust their production processes are better equipped to enhance the agility of their supply chains.

H3: Supply Chain Agility Positively Influences Manufacturing Industry Performance. There was a significant relationship between supply chain agility and manufacturing performance ($\beta = 0.210$, $p < 0.001$). Agile supply chains contribute to enhanced operational efficiency and market responsiveness, ultimately boosting overall firm performance.

H4: Strategic Flexibility Positively Influences Manufacturing Industry Performance. The direct effect of strategic flexibility on manufacturing performance was also significant ($\beta = 0.269$, $p < 0.001$). This highlights the importance of adapting strategic decisions to sustain and improve industry performance in a volatile environment.

H5: Manufacturing Flexibility Positively Influences Manufacturing Industry Performance. Manufacturing flexibility demonstrated a significant positive impact on performance ($\beta = 0.242$, $p < 0.001$). The ability to adjust production to meet fluctuating demand enhances firms' capacity to maintain competitive advantages in dynamic markets.

Mediation Analysis

The mediating role of supply chain agility was tested in hypotheses H6 and H7. The results indicate partial mediation, confirming that supply chain agility significantly mediates the relationships between strategic flexibility and manufacturing performance ($\beta = 0.046$, $p < 0.001$) and between manufacturing flexibility and performance ($\beta = 0.031$, $p < 0.001$). These findings suggest that while both forms of flexibility directly influence performance, their impact is further enhanced through improved supply chain agility.

Table 5.5 Structural Mediation Results

Hypotheses	Mediation Path	Estimates β	Sig (P)	Remarks
H6	SF → SCA → MIP	0.046	***	Partial Mediation
H7	MF → SCA → MIP	0.031	***	Partial Mediation

Discussion of Findings

The results of this study emphasize the critical roles of strategic flexibility and manufacturing flexibility in improving supply chain agility, which in turn enhances manufacturing industry performance. The findings are consistent with previous research, reinforcing the notion that adaptability in both strategic decisions and manufacturing processes is crucial for achieving agility in supply chains.

The positive relationship between strategic flexibility and supply chain agility highlights the importance of dynamic strategic decision-making. Firms that can quickly realign their strategies in response to market conditions are more likely to maintain agile supply chains, enabling them to respond effectively to disruptions and changes in demand.

Similarly, the positive relationship between manufacturing flexibility and supply chain agility underscores the need for adaptable production processes. Manufacturing firms that can adjust their processes quickly to accommodate changes in product design or production volumes are better equipped to maintain agile and responsive supply chains. This supports previous findings in the literature that link operational flexibility with enhanced performance outcomes.

The mediation effects of supply chain agility further emphasize the interconnectedness of these factors. By fostering both strategic and manufacturing flexibility, firms can enhance their supply chain agility, which acts as a catalyst for improving overall industry performance. The partial mediation effect suggests that while both forms of flexibility have direct impacts on performance, the full potential is realized through agile supply chain practices

VI. CONCLUSION AND IMPLICATIONS

Conclusion

This study aimed to examine the relationships between strategic flexibility, manufacturing flexibility, supply chain agility, and manufacturing industry performance in South Africa. Using empirical data from 350 respondents within the South African manufacturing sector, the findings highlight the critical roles of both strategic and manufacturing flexibilities in enhancing supply chain agility, which, in turn, positively affects manufacturing performance.

The study confirmed that strategic flexibility enables firms to align their strategic goals with market changes, improving their ability to respond quickly to external disruptions. Manufacturing flexibility, particularly in adapting production processes, plays a similarly important role in boosting supply chain agility, allowing firms to manage fluctuations in demand and supply chain disruptions more effectively. Supply chain agility was found to be a crucial mediator in these relationships, illustrating its importance in optimizing operational performance and maintaining competitiveness in a volatile business environment.

The results reinforce the need for South African manufacturing firms to adopt flexible and agile practices to remain competitive in a globally connected market characterized by frequent disruptions, such as those seen during the COVID-19 pandemic. Firms that can quickly adapt their strategies and operations in response to market shifts are better positioned to achieve sustained performance and growth.

Theoretical Implications

The study contributes to the broader literature on supply chain management, strategic flexibility, and manufacturing flexibility by providing empirical evidence from the South African context, an area where these concepts are underexplored. It extends the understanding of how these flexibilities interact and influence performance, particularly in an emerging market characterized by volatility and supply chain vulnerabilities.

This research enriches existing theoretical frameworks by confirming the mediating role of supply chain agility, which had been previously suggested but not widely tested in the context of manufacturing firms in emerging markets. The findings support the idea that supply chain agility serves as a critical mechanism through which both strategic and manufacturing flexibilities exert their influence on performance. This theoretical insight can guide future research that seeks to explore flexibility and agility in other emerging markets.

Practical Implications

From a practical perspective, this study offers valuable recommendations for managers, policymakers, and stakeholders in the South African manufacturing industry.

Managers should focus on investing in both strategic and manufacturing flexibilities to boost supply chain agility. This entails developing capabilities to rapidly shift production processes, adapt product lines, and realign strategies in response to evolving external market conditions. A strong emphasis on building agile supply chains is critical for effectively managing disruptions. To achieve this, managers need to enhance real-time decision-making capabilities and foster robust collaborations with suppliers to improve supply chain responsiveness. Additionally, integrating technology into operations will facilitate faster adjustments in both strategic and manufacturing processes, helping firms remain adaptable to changes in demand and supply.

Policymakers can play a significant role by encouraging policies that promote flexibility and agility within the manufacturing sector. This could include offering tax incentives for companies that invest in flexible manufacturing technologies or providing subsidies for research and development initiatives aimed at improving supply chain agility. Infrastructure development, particularly in transportation and logistics, should be prioritized to reduce supply chain disruptions and enhance overall manufacturing performance. Furthermore, there is a need for collaboration with educational institutions to create programs that equip workers with the necessary skills for flexible and agile manufacturing operations. This includes upskilling employees in advanced manufacturing technologies and supply chain management to meet the sector's evolving demands.

Limitations and Future Research

While this study provides valuable insights into the South African manufacturing sector, it has certain limitations. The study focused on a single geographic region, and the findings may not be fully generalizable to other emerging markets or different industrial sectors. Additionally, the study employed a cross-sectional design, limiting its ability to capture the long-term effects of strategic flexibility and agility on performance.

Future research could extend this study by exploring how these relationships evolve over time, using a longitudinal research design. Further research could also compare the South African manufacturing sector with those in other emerging markets to better understand how local conditions influence the adoption of flexibility and agility practices.

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