

*Research Paper***Quality management and supply chain management hybrid approach to manufacturing firms' performance***Submitted in 20, May 2022**Accepted in 13, June 2022**Evaluated by a double-blind review system***EKPENYONG EKPENYONG UDOFIA^{1*}**
SULAIMON OLANREWAJU ADEBIYI²**ABSTRACT**

Purpose: Quality management and supply chain management hybrid literature is growing, however, there is a paucity of such studies from Africa and Nigeria specifically. The study seeks to establish supply chain practices that benefit the most from quality management implementation, as well as establish which supply chain practice acts as the most reliable mediator in the relationship between quality management and organisational performance. These are the literature gaps that have been exploited in this study.

Methodology: The study had a population of 804 manufacturing firms; and drew a sample of 267 firms. Analysis was done using percentages and a structural equation model.

Findings: Quality management as a strategy continues to prove relevant in manufacturing industries. Quality management had a significant effect on all measurement constructs of supply chain management except supply chain information sharing. The study reveals that quality management had the most impact on supplier partnership. Also, supplier relationship had the most mediating effect on the relationship between quality management and organisational performance.

Practical implications: – Practitioners interested in improving supplier partnership, materials handling and efficient utilisation of resources should consider the use of quality management in their pursuit. As the study findings support these claims. The application of other operations strategies might be considered when trying to improve supplier relationship and customer relationship as the model reveals that quality management effect on these practices are very minimal.

Originality: The study adds to the literature of quality and supply chain hybrid studies by considering the role of exclusive supply chain practices on quality management and organisational performance relationship in the Nigerian business context. The study also enriches the discussion by highlighting the effect of quality management on exclusive supply chain practices.

Keywords: Quality management, supply, supplier relationship, supply chain management, organisational performance.

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1. Introduction

The business environment keeps changing, organisations are desperately in need of ways to combat the ever-mutating challenges of the business environment in the contemporary world of globalisation, disruptive innovations, and supply chain disruptions of several magnitudes. It is no longer news that the economic state of most countries was badly hit by the novel corona virus and the performance of most organisations has been on a downward slope for the past 18 months, with many resulting to drastic measures just to stay afloat. Unfortunately, Nigeria has been dealing with poor organisational performances persistently for the last decade (Vanguard, 2013; The Nation, 2017), which is undeniably evident in the rise in unemployment (NBS, 2018a; NBS, 2019) and the corresponding rise in poverty (CNN, 2018). Going by the current economic state and crime rates in Nigeria, approaches towards organisational performance are critical to the very existence of the country before it implodes. Quality management (QM) and supply chain management (SCM) are two very established strategies towards improving organisational performance.

Owing to expanding and dynamic nature of competition among firms in manufacturing, the win or loss of the market rests on the supply chain (Vanichchinchai & Igel, 2011). Therefore, it is imperative to strengthen the supply chain of manufacturing firms for competitiveness. There are studies that have explored complementary strategies involving supply chain management to elevate supply chain and organisational performance ultimately. These include knowledge development and management, human resource, Information technology, and big data (Hult et al., 2007; Wong & Wong, 2011; Zhang et al., 2011; Gómez-Cedeño et al., 2015; Giannakis & Louis, 2016; Lim et al., 2017; Wamba et al., 2020), just to mention a few. Besides, the research on QM and SCM is another growing sphere of hybrid studies. While some highly referred publications had established the relevance of these (QM and SCM) strategies to manufacturing firms, they were empirically tested exclusively until recent years (Tan et al., 2002; Kaynak, 2003; Kim et al., 2012), perhaps because firms rarely implemented both due to complexities and cost implications (Vanichchinchai & Igel, 2011). Though executing hybrid strategies such as this can be very tasking on the resources of the firm, when successful, the effects can be very rewarding to the organisation (Vanichchinchai & Igel, 2011). Over the last decade, the exploration of QM and SCM hybrid strategy has grown, however, these studies are mostly domiciled in developed economies. To the best of the researchers' awareness, there is no hybrid study that examines the structural model of quality management and supply chain management on developing nations in Africa. This study therefore intends to explore the implication of implementing this hybrid concept on the organisational performance of firms in an African developing nation, specifically, Nigeria.

2. Literature review

2.1. Underpinning theory

The systems theory is anchored on the big picture when an organisational assessment is being carried out (Mele et al., 2010). The systems theory is deeply rooted in the principles of Aristotle where the study of parts does not deliver the same outcome as evaluating the whole (Bertalanffy, 1972). However, systems theory in management came to the fore

through Kenneth Boulding; who investigated the application of systems thinking in the management of manufacturing firms (Boulding, 1956). To buttress the essence of systems thinking, quality management philosophy tenets are also entrenched in systems thinking, as it views the organisation as one integrated system. Deming's teaching was anchored on re-engineering the thought process of practitioners to embrace quality goals as an organisational task as oppose to a departmental goal if superior quality was the target (Devor et al., 1992).

The relevance of the theory lies in its explanation of interactions and its complexities. The system theory is apt in explaining complexities, firstly, complexities that exist within the organisation, and secondly, complexities inherent in the interaction with other organisations (Bertalanffy, 1972; Cordon, 2013). Every organisation is a collection of specialised departments. The seamless integration of these departments plays a major role in the efficiency of a firm. In addition, organisations; however independent, do not exist in isolation. They are a part of a broader spectrum. Understanding the effect of decisions outside of managerial control on the firm's performances is crucial to successful supply chains and organisational performance.

2.2 Quality management

The essence of quality in the contemporary business world cannot be overemphasized. Quality management in itself is a process and not an end result, as it continues to provide the platform for organisations to be competitive through superior goods and services. As Aristotle once said, excellence is a habit, therefore, staying at the top through quality is the habit of constantly managing quality, and never forgoing it for any other goal. Organisations such as Toyota, known for quality, continue to experience quality issues, hence, the recall of several millions of their brands from the market periodically, 5.8 million in 2016, and 3.4 million in 2020 (BBC News, 2016; NBC News, 2020). This is a testament to the fact that an organisation cannot afford to consider quality management as an end game, rather, a continuum. Quality management is one of the philosophies in the sphere of management aimed at improving organisational effectiveness (Barker & Emery, 2006). In the study by Sadikoglu and Sahir (2010), it is described as a systematic process of steadily improving the quality outcomes of an organisation to achieve greater profitability, customer satisfaction, and organisational productivity. Though there is an ongoing discussion on if QM is a philosophy or strategy (Baird et al., 2011; Cho et al., 2017), the effect of its implementation has been researched across sectors, industries, and geographical regions (Baird et al., 2011; Zeng et al., 2015; Cho et al., 2017; Udofia et al., 2021). Also, while conflicting reports on the relevance of quality management exists, literature tilts toward favourable results (Kaynak, 2003; Cho et al., 2017; Udofia et al., 2021).

The leadership approach, long and mid-term planning, emphasis on customers, concentration on employees, and operational focus were used as measurements for quality management by Peng et al. (2020). Leadership commitment, information analysis, concentration on employees, customer focus, process management, non-stop improvement culture, training, and supplier management were adopted by Sadikoglu and Sahir (2010). The discretion in choice of measurement constructs by the studies above could be explained by the purpose of the study. Peng et al. (2020) focused on a very expansive range of performance including product, profit, corporate governance, strategy, ethics, and several others. This perhaps rationalise the addition of constructs such as strategic planning and operational focus to its measurement to capture how they could affect ethics or strategy. However, Sadikoglu and Sahir (2010) focused on employee and innovation performance. This explains its use of constructs that are anchored on staff

skills building, as well as innovation. In the case of Patyal and Koilakuntla (2017), QM measurements were employee management, top management, customer relationship, management of the production process, management of suppliers, quality information and analysis, and product design. However, this study adopts the QM measurements of Udofia et al. (2021), inclusive of top management commitment (leadership), focus on customers, focus on employees, supplier quality management, and process management. The study's decision is backed by the fact that it is a good representation of the most frequently used and recognised QM practices in research as comprehensively examined by the study of Talib et al. (2011) who identified six major QM practices (out of fifty) in literature between the 1980's and 2010. Two (training and employee involvement) of the six major QM practices by Talib et al. (2011) were merged by Udofia et al. (2021), and were duly captured in its research instrument items.

2.3. Supply chain management

Supply chain management is a management terminology that came to the fore roughly over three decades ago (Swanson et al., 2018), its core is to create and manage a chain of activities that are targeted at providing goods and services to the customer (Fawcett et al., 2013). In other words, the supply chain exists for one purpose only, to satisfy customers. Perhaps that is why it is often said that a great supply chain is the key to expansion (Gandhiet et al., 2017), because if the supply chain does its job subliminally, the customers will be satisfied, leading to loyalty, more patronage, and referrals at no extra cost to the firm. Which will lead to market share growth and profitability. SCM integrates the manufacturers, the suppliers, those involved in the distribution of goods, and finally, the end users into a framework to deliver superior customer experience and satisfaction (Koh et al., 2007). With globalisation comes competition like never before, shifting the bargaining power to the customers. This power shift means uncertainty for manufacturers, as customers' preference continue to evolve and manufacturers must equally match their new preference (Sahay & Mohan, 2003). There are several studies on supply chain management and there is a consensus that supply chain management is multifaceted with several practices that aid the coordination of business activities within and outside the organisation.

Supplier partnership, information sharing, customer relationship, lean practice, and postponement were adopted as measurements of SCM by Al-Shboul et al., (2017). The use of postponement stands out; though it is informed by prior literature, such as Ferreira et al. (2015), and Li et al. (2006). It entails the rescheduling of certain activities on the supply chain to enable the management of demand uncertainties. Postponement was appropriate because the study focus was supply chain performance, and it was imperative to understand if rescheduling activities to delay product finishing for demand certainty was a good decision. Prajogo et al. (2012) measured supply chain using management of the process, management of the suppliers, and management of the customer. While supplier relationship management, customer focus, goal congruence, and information sharing were adopted by Gandhi et al., (2017). Goal congruence is described as the alignment of the individual firms' goal with the supply chain goal to re-enforce the commitment towards supply chain goal. Relationship with customers, relationship with suppliers, the sharing of information across supply chain, and the quality of supply chain information were the practices adopted for supply chain by Amedofu et al. (2019). The practices adopted by Amedofu et al., (2019) are imbedded in the comprehensive assessment of SCM practices in business research (Talib et al., 2011). This study adopts

supplier relationship, customer relationship, supply chain information sharing, supplier partnership, and material management because they make up the most frequent and major SCM practices in research; as revealed by Talib et al. (2011).

2.4. Organisational performance

Organisational performance is a comparison of actual performance of an organisation vis-à-vis the objectives set out before the financial year began and every organisation has a means of measuring how well the organisation fared in a financial year. The ultimate pursuit of all strategies employed in an organisation is to ensure the achievement of organisational goals. These organisational goals become the standard by which the reality is measured. Hence, the establishment of periodic performance evaluation of employees and the organisation as a whole by most organisations. In research, there are several ways to measure the performance of organisations, among them are operational performance (Projogo et al., 2012), innovation performance (Zhou & Li, 2020), quality performance, employee performance, and customer satisfaction (Anil & Satish, 2019), supply performance (Vanichchinchai & Igel, 2011), environmental performance (Cousins et al., 2019), market share and financial performance (Al-Shboul et al., 2017), to mention a few. This study adopts innovation, operational, and quality dimensions as organisational performance measurement. These performance metrics were chosen because the comprehensive integration of performance dimensions in quality management related studies by Anil and Satish (2019) highlighted them as some of the most frequently used parameters.

2.5. Hypotheses development

2.5.1. QM and SCM

Literature on QM and SCM hybrid strategy are limited and mostly anchored on business environments outside the West African countries. Studies like Flynn and Flynn (2005), and Casadesus and Castro (2005) attempted to test the relevance of QM on SCM practices, however, their studies were based on developed nations. This study enhances that discussion, as it empirically tests the role of QM on SCM practices using the Nigerian business environment. Yeung (2008), and Vanichchinchai and Igel (2011) equally attempted researching the role of QM practices on SCM practices. However, both studies lump all practices of supply chain management, therefore, the impact of QM practices on the exclusive practices of supply chain was not discovered in their study. This study intends to fill that gap by empirically testing the impact of QM on the multi-dimensional view of supply chain management. It intends to highlight which supply chain management practice in particular is most influenced by QM. In line with the discussion above, the following hypothesis was formulated.

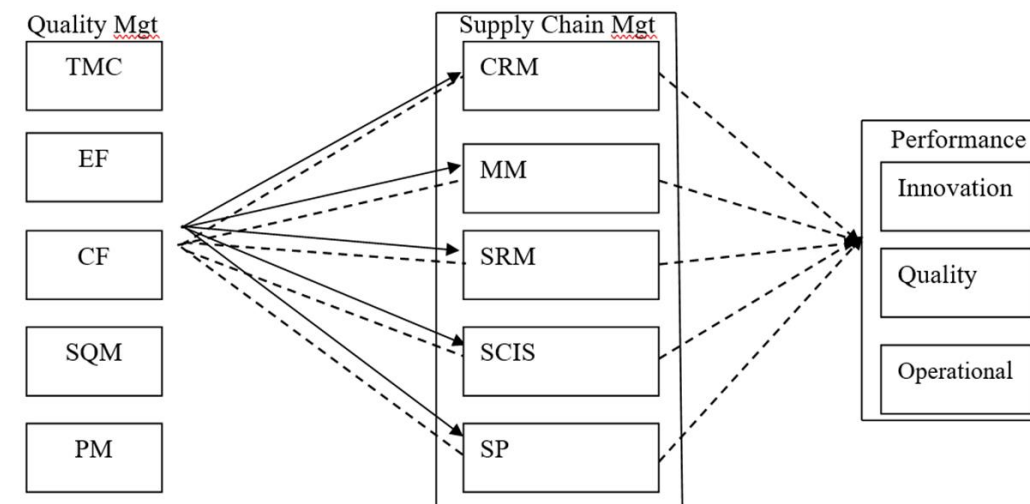
H1: QM practices have no significant effect on SCM practices of manufacturing firms in Nigeria.

2.5.2. Mediating role of SCM practices

Literature on hybrid strategies is growing, especially when QM and SCM hybrid is considered. While there have been some studies that attempt to merge these strategies into creating a singular strategy (supply chain quality management) and create a set of practices for its measurement (Sila et al., 2006; Zeng et al., 2013; Zeng et al., 2018), others have attempted the creation of a structural model to explain the relationship

between both strategies and how they might affect other variables (Lin et al., 2005; Yeung, 2008; Vanichchinchai & Igel, 2011; Zhou & Li, 2020). As far as this study's researcher is aware, most studies that approached the hybrid of QM and SCM using structural models did not consider testing the mediating role of SCM on QM and organisational performance relationship, though the structural models suggested such. In the study of Zhou and Li (2020), supply chain practice was modelled to affect quality management, while quality management affected performance, however, QM's mediating role on supply chain practices and organisational performance was not empirically tested. In the same manner, Lin et al., (2005), Yeung (2008), and Prajogo et al., (2012) all modelled quality management to directly impact supply chain practices, while supply chain practices directly impact performance, but none of these studies considered mediating roles of SCM practices on the QM and organisational performance relationship. These studies focused on establishing the direct effect of QM practices on SCM practices, and they also sort to establish the direct relationship between SCM and the performance dimensions. None of the above studies sort to establish a mediating relationship. Vanichchinchai and Igel (2011) is one study that considered the mediating role of supply chain management practices; however, its focus (dependent variable) was on supply chain performance only (not a robust consideration of organisational performance like this study), and it was domiciled in a developed business environment. It is therefore on this existing literature gap that this study intends to investigate the mediating role of supply chain practices on the relationship between QM and organisational performance in a structural model. The following mediating hypothesis was formulated for testing.

H2: SCM practices have no mediating effect on the relationship between QM and the performance of manufacturing firms in Nigeria.



Source: Developed by researcher, 2022

—→ Direct relationship
 - - - - -→ Indirect relationships

Legend: TMC= top management commitment, EF= employee focus, CF= customer focus, SQM= supplier quality management, PM= process management, CRM= customer relationship management, MM= material management, SRM= supplier relationship management, SCIS= supply chain information sharing, SP= supplier partnership.

3. Methodology

3.1. Research design, population, and sample size

In line with prior studies that have examined a structural model of quality management and SCM hybrid approach (Lin et al., 2005; Vanichchinchai & Igel, 2011; Zhou & Li, 2020), this study adopts the descriptive cross-sectional survey design. The study population was all big (above 149 staff) and medium sized (50-149 staff) manufacturing firms in Nigeria. Big firms were sourced from the Nigerian Exchange Group (formerly Nigerian Stock Exchange) database, while medium scale firms were sourced from the National Bureau of Statistics (NBS) database. The collation of manufacturing firms in both databases amounted to eight hundred and four (804) manufacturing firms, that is, thirty-three (33) big scale manufacturers and seven hundred and seventy-one (771) medium-scale manufacturing firms in Nigeria, (NBS 2018b; Nigerian Exchange Group, 2021). Using the Yamane (1967) formula, two hundred and sixty-seven (267) manufacturing firms was chosen as the sample size of the study. In addition to this, the quota sampling was employed to capture a proper representation of both big and medium scale firms. Therefore, eleven (11) big firms and two hundred and fifty-six (256) medium manufacturing firms were randomly chosen (in proportion to the big/medium manufacturing firm ratio 1:23.3) for the study sample.

Table 1. Population and Sample Table

Population	Population Breakdown	Sample Size	Quota Sample representation
804 firms	Big firms (33)	267 firms	Big firms (11)
	Medium firms (771)		Medium firms (256)

Source: Survey 2022.

Each firm chosen for the study was sent an email for consent to participate in the study. And a total of 3 copies of the questionnaire was sent to each company; meant for the managers of the Operations department, marketing department, and Production department. These departments were strategically chosen because of their vast knowledge and understanding of the variable under study. A total count of three hundred and eighty-two (382) questionnaire copies were retrieved from eight hundred and one (801) sent. This meant a 47.7 percent return rate. This is acceptable in studies involving only managers as stated in previous supply chain related studies like Kuei et al. (2001) and Dora et al. (2014). Both studies recorded a 20 percent and 15.2 percent respectively. It is believed that because of the busy schedule of practitioners, they rarely carve out time for research studies. The data retrieved from the survey was analysed using descriptive statistics (frequency) and structural equation model (SEM).

3.2. Research instrument development

The items used in the measurement scales of this study adapted from existing literature in the field of QM and SCM research. Items for QM practices were adapted from a mixture of studies inclusive of Kaynak (2003), Sila and Ebrahimpour (2005), Tari et al. (2007), Kim et al. (2012), and Zeng et al. (2015). Items for supply chain management practices were adapted from Faber et al. (2013), Al-Shboul et al., (2017), and Amefodu

et al., (2019). Items for organisational performance were adapted from Zhang et al., (2000), Kaynak (2003), Lakhal et al. (2006), Tari et al. (2007), and Kim et al. (2012).

Table 2. Measurement Items

Quality management practices	
Leadership (L)	
L1 Managers and supervisors support employees to make their own decisions.	(Tari et al., 2007)
L2 Quality related issues are given priority at management meetings	(Kaynak, 2003; Kim et al., 2012)
L3 The product quality always comes first in the heart of top management	(Sila & Ebrahimpour, 2005)
L4 Top management periodically and constantly assesses the quality performance	(Kaynak, 2003; Kim et al., 2012)
Customer focus (CF)	
CF1 Customer feedback is leveraged for improvements in product to archive customer satisfaction	(Tari et al., 2007)
CF2 Managers and supervisors encourage employee discretions that increase customer satisfaction	(Tari et al., 2007)
CF3 There is an established mechanism for customer feedbacks, and the customers know it	(Kim et al., 2012)
CF4 Frequent meetings between the organisation and customers	(Tari et al., 2007; Kim et al., 2012)
Employee focus (EF)	
EF1 All employees are involved in decision making	(Kaynak, 2003)
EF2 Employees are provided with feedback on their quality performance	(Kim et al., 2012)
EF3 Employees are trained in problem-solving skills	(Tari et al., 2007)
EF4 Interdepartmental teams are instituted to tackle issues and expand knowledge	(Tari et al., 2007)
EF5 Employees are surveyed to determine their satisfaction levels and understanding of our quality standards	(Sila & Ebrahimpour, 2005)
Supplier quality management (SQM)	
SQM1 Suppliers have programs to assure quality of their products	(Sila & Ebrahimpour, 2005)
SQM2 We are more interested in developing a long-term relationship with our suppliers than reducing prices	(Kim et al., 2012)
SQM 3 Quality is a more criterion than price in selecting suppliers	(Kim et al., 2012)
SQM4 We have a small number of high-quality suppliers	(Kaynak, 2003)
Process management (PM)	
PM1 We focus more on preventive measures to reduce errors	(Zeng et al., 2015)
PM2 There are explicit documented processes to achieving desired quality results	(Sila & Ebrahimpour, 2005)
PM3 We make good use of statistical process control tools to reduce variation	(Sila & Ebrahimpour, 2005)

PM4 We constantly invest in technology to improve the process and minimise employee errors	(Kaynak, 2003)
Supply Chain Management Practices	
Supplier relationship management	
SRM1 We consider quality as our number one criterion in selecting suppliers	(Amefodu et al.,2019)
SRM2 We regularly solve problems jointly with our suppliers	(Amefodu et al.,2019)
SRM3 We have helped our suppliers to improve their product/service quality	(Amefodu et al.,2019)
SRM4 We have continuous development/growth programs that include our key suppliers	(Amefodu et al., 2019)
Customer relationship management	
CRM1 We frequently measure and evaluate customer satisfaction	(Amefodu et al., 2019)
CRM2 We frequently determine future customer expectations	(Amefodu et al., 2019)
CRM3 We help customers' seek assistance from us	(Amefodu et al., 2019)
CRM4 We periodically evaluate the importance of our relationship with our customers	(Amefodu et al., 2019)
Supply chain information sharing	
SCIS1 We inform trading partners (suppliers and customers) in advance of changing needs	(Amefodu et al., 2019)
SCIS2 Our trading partners (suppliers and customers) share proprietary/ exclusive information with us	(Amefodu et al., 2019)
SCIS3 Our trading partners (suppliers and customers) keep us fully informed about issues that affect our business	(Amefodu et al., 2019)
SCIS4 Our trading partners (suppliers and customers) share business knowledge of core business processes with us	(Amefodu et al., 2019)
Strategic partnership	
SP1 our firm considers quality factor one of main criterion in selecting our suppliers	(Al-Shboul et al., 2017)
SP2 our firm provides any help to improve the quality of suppliers' products	(Al-Shboul et al., 2017)
SP3 Our firm has continuous improvement programmes that include our key suppliers	(Al-Shboul et al., 2017)
SP4 Planning and goal-setting activities in our firm are included in our key suppliers	(Al-Shboul et al., 2017)
SP5 New product development processes in our firm is included in our key suppliers	(Al-Shboul et al., 2017)
Material management	
MM1 There is a system that helps to monitor inventory turnover	(Faber et al., 2013)
MM2 We have a system that produces reliable forecast of demand for the long-term using orders of the past.	(Faber <i>et al.</i> , 2013)

MM3 We have invested in modern information systems to minimize delays and waste	(Faber <i>et al.</i> , 2013)
MM4 Suppliers are integrated into our information system framework, which immediately notifies them when there's an order, which reduces redundant inventory	(Faber <i>et al.</i> , 2013)
Organisation performance dimensions	
Operational performance (OP)	
OP1 There is significant improvement in our competitiveness	(Tari <i>et al.</i> , 2007)
OP2 There is significant improvement in our productivity	(Lakhal <i>et al.</i> , 2006)
OP3 There is significant reduction in inventory waste levels	(Lakhal <i>et al.</i> , 2006)
OP4 There's a reduction in operating costs	(Yan <i>et al.</i> , 2019)
OP5 Improvements in cycle time	(Kim <i>et al.</i> , 2012; Yan <i>et al.</i> , 2019)
Quality performance (QP)	
QP1 Quality initiatives have reduced error rates	(Zhang <i>et al.</i> , 2000)
QP2 Quality initiatives have reduced our customer complaints	(Tari <i>et al.</i> , 2007)
QP3 There is significant improvement in product quality	(Kaynak, 2003)
QP4 The conformance of finished goods to specification is very high	(Zhang <i>et al.</i> , 2000)
QP5 There is a significant reduction in warranty claims	(Zhang <i>et al.</i> , 2000)
Innovation performance (IP)	
IP1 Our organization implemented new or improved existing computer-based administrative applications	(Kim <i>et al.</i> , 2012)
IP2 Our new products differ substantially from our existing products	(Kim <i>et al.</i> , 2012)
IP3 We introduce radical product innovations into the market more frequently than our competitors	(Kim <i>et al.</i> , 2012)
IP4 Our customers recognise our brand for product innovations	(Kim <i>et al.</i> , 2012)
IP5 The percentage of total sales from radical product innovations is up substantially	(Kim <i>et al.</i> , 2012)

4. Data Analysis and Results

4.1. Measurement model

A measurement model for the data set when employing the structural equation model is important, as it highlights the fitness of the data set for the analysis. The model measurement for this study was done by conducting a series of test including the unidimensionality test, multivariate normality test, reliability, multicollinearity test, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA). The unidimensionality analysis was executed to observe the factor loadings of all items of the major constructs in this study. This was done by assessing the factor loadings of all items, while constraining the highest factor loading of each construct to 1. Results are displayed in Table 3. Multivariate normality was done through a Mahalanobis test to reveal a range

of 10.9-125.8. The critical value of the data set was calculated as 41.96. 22 items were therefore expunged from the data set due to excessive Mahalanobis figures. That is, their figures were higher than the critical value of the data set. Assessing the reliability of the major constructs proved positive, as all constructs had well above .70 (see Table 3) score, making it acceptable (Fornell & Larcker, 1981). Multicollinearity was assessed through the Tolerance and VIF figures of the items. The items had Tolerance values above .2 and VIF values below 5.

Table 3. Construct assessment

Construct	items	Factor loading	CFI	GFI	RMR	NFI	<i>p</i>	Cronbach α	AVE	CR
Leadership	L1	.675	.904	.955	.048	.899	.046	.724	.506	.795
	L2	.609								
	L3	.663								
	L4	.700								
Customer focus	CF1	.767	.928	.955	.074	.908	.081	.702	.501	.772
	CF2	.609								
	CF3	.890								
	CF4	.382								
Employee focus	EF1	.446	.974	.985	.039	.969	.030	.870	.505	.834
	EF2	.929								
	EF3	.885								
	EF4	.779								
Supplier quality management	SQM1	.600	.894	.970	.066	.973	.102	.794	.540	.813
	SQM2	.897								
	SQM3	.372								
	SQM4	.629								
Process management	PM1	.532	.933	.955	.052	.930	.003	.731	.508	.801
	PM2	.857								
	PM3	.698								
	PM4	.789								
Supplier relationship management	SRM1	.663	.939	.961	.038	.936	.062	.773	.502	.799
	SRM2	.798								
	SRM3	.920								
	SRM4	.783								
Customer relationship management	CRM1	.644	.992	.994	.017	.985	.116	.739	.569	.838
	CRM2	.873								
	CRM3	.679								
	CRM4	.456								
Supply chain information sharing	SCIS1	.779	.917	.918	.072	.916	.050	.844	.622	.861
	SCIS2	.924								
	SCIS3	.914								
	SCIS4	.440								
Strategic partnership	SP1	.670	.899	.907	.056	.906	.003	.856	.544	.853
	SP2	.791								
	SP3	.799								
	SP4	.895								
	SP5	.878								
	MM1	.590	.990	.989	.035	.988	.053	.777	.554	.820

Materials	MM2	.993								
Management	MM3	.876								
	MM4	.474								
Operating performance	OP1	.900	.928	.939	.026	.915	.010	.835	.552	.856
	OP2	.843								
	OP3	.519								
	OP4	.710								
	OP5	.774								
Quality performance	QP1	.875	.941	.950	.034	.938	.061	.862	.584	.872
	QP2	.566								
	QP3	.932								
	QP4	.812								
	QP5	.626								
Innovation performance	IP1	.390	.924	.936	.045	.920	.007	.789	.543	.840
	IP2	.839								
	IP3	.799								
	IP4	.790								
	IP5	.875								

Source: Field Survey, 2022

The EFA was done to examine if there exist a violation of the assumption of positive definiteness. The test was conducted with the extraction factor set at 13 to reflect the number of constructs employed, while rotation was placed in varimax and suppressed coefficients was at 0.3. The data set did not violate the positive definiteness assumption because it had a determinant value of 8.090 which is acceptable because it is greater than zero (Lowry & Gaskin, 2014). The Kaiser-Meyer-Olkin (KMO) was .502 with a significance value of .000.

CFA was conducted to test convergent validity and discriminant validity. The convergent validity was satisfied via the average variance extracted (AVE) values and the composite reliability (CR) values. The AVE values for each construct were above 0.50; revealing a presence of convergent validity (Fornell & Larcker, 1981; Flynn Huo, & Zhao, 2010). The CR values of each construct were above 0.70, this further emphasises the presence of convergent validity (Fornell & Larcker, 1981; Dubey et al., 2019). The discriminant validity of the construct was assessed via a comparison of the squared root AVE values and the squared correlation values of all major constructs (see Table 4). When the Squared root AVE value for a construct is greater than all squared correlation values, discriminant validity is satisfied (Fornell & Larcker, 1981).

Table 4. Correlation of major constructs and squared root AVE values for Discriminant Validity

Constructs	Mean	SD	Lead	CF	EF	SQM	PM	SRM	CRM	SCIS	SP	MM	OP	QP	IP
Lead	4.042	0.603	0.711												
CF	3.815	0.451	0.428**	0.708											
EF	3.814	0.268	0.308***	0.209**	0.711										
SQM	4.062	0.447	0.412***	0.344**	0.127***	0.735									
PM	4.005	0.335	0.152***	0.685**	0.38***	0.471***	0.713								
SRM	3.688	0.194	0.187***	0.379**	0.090***	0.411***	0.245***	0.709							
CRM	3.759	0.441	0.762***	0.480**	0.279***	0.221***	0.160***	0.380***	0.754						
SCIS	3.609	0.396	0.447***	0.540**	0.308***	0.262***	0.216***	0.696***	0.732***	0.788					
SP	3.450	0.719	0.271***	0.629**	0.297***	0.419***	0.432***	0.569***	0.484***	0.651***	0.738				
MM	3.461	0.392	0.388***	0.198**	0.152***	0.129***	0.210***	0.234***	0.617***	0.503***	0.468***	0.744			
OP	3.644	0.604	0.539***	0.316**	0.223***	0.264***	0.305***	0.573***	0.682***	0.689***	0.612***	0.666***	0.743		
QP	3.719	0.550	0.576***	0.572**	0.316***	0.284***	0.311***	0.693***	0.645***	0.865***	0.708***	0.643***	0.632***	0.764	
IP	3.494	0.460	0.507***	0.247**	0.230***	0.550***	0.255***	0.674***	0.667***	0.655***	0.542***	0.548***	0.615***	0.703***	0.737

*** ≤ .001 significant value, ** ≤ .01 significant value, and * ≤ .05 significant value

4.2. Non Response Bias

For a test on non-response bias, the study employed several procedures. The study made sure the items of the study was drafted in a very comprehensive manner to ensure that all respondents understood the statement items totally. The study also confined the study respondents to only managers to ensure that all respondent was very conversant with the study variables and items to be answered. Finally, on the statistical front, a comparison of early and late submission of responses were analysed using the paired sample t-test. This was limited to fifty respondents, that is, the first fifty and the last fifty submissions. This was done line with several operation management studies (Mishra, 2016; Huo et al., 2020; Yu et al., 2020) who tested for non-response bias. The t test revealed that there was no significant difference between the first fifty responses and the last fifty responses, thus, establishing that non-response bias was not a concern for this study.

4.3. Common Method Bias

Literature posits that data anchored on self-report is susceptible to common method bias (Podsakoff & Organ, 1986). Therefore, a common method bias (CMB) test was conducted using Harman's one-factor test via SPSS. Extraction was done by constraining the number of factors to one, while the rotation is set at none for this test. The one-factor result revealed that only 19.411 percent of the total variance was explained. Thus, it is acceptable because it is less than 50 percent (Podsakoff & Organ, 1986). However, the argument on the insufficiency of Harman's one-factor test to establish minimal CMB (Ketokivi & Schroeder, 2004), led to an additional test, using the correlation marker variable technique (Lindell & Whitney, 2001), in line with prior studies in supply chain resilience. Such as Dubey et al. (2019) and Gu et al. (2020). To apply the correlation marker variable technique, SCF which had the lowest positive correlation with any other variable (.046) was chosen to adjust major construct correlations. The result proved that CMB was not a concern in the study's data.

Table 5. Description of respondents' bio-data

		Frequency	Valid Percent	Cumulative %
Gender	Male	348	90.6	90.6
	Female	36	9.4	100
	Total	384	100	
Age	20-30	43	11.2	11.2
	31-40	167	43.5	54.7
	41-50	135	35.2	89.9
	Above 50	39	10.1	100
	Total	384	100	
Department	Production/Supply Chain	96	25	25
	Marketing	120	31.3	56.3
	Operations	168	43.7	100
	Total	384	100	
Qualification	BSc/HND	204	53.1	53.1
	Postgraduate	180	46.9	100
	Total	384	100	
Manufacturing industry	Oil Refining	24	6.3	6.3
	Cement	23	6.0	12.3
	Food, Beverages and Tobacco	148	38.5	50.8
	Textile, Apparel and footwear	11	2.9	53.7
	Pulp paper and paper products	23	6.0	59.7
	Chemical products	33	8.6	68.3
	Electrical and electronics	35	9.1	77.4
	Motor vehicles and assembly	47	12.2	89.6
	Pharmaceuticals	18	4.7	94.3
	Other Manufacturing	22	5.7	100
	Total	384	100	

Source: Field Survey, 2022

For the hypotheses testing, the following items were expunged because of their very low factor loadings. CF4, EF1, SQM3, CRM4, SCIS4, MM4, and IP1 were expunged from the data set, totalling seven (7) items.

Table 6. Hypotheses Results

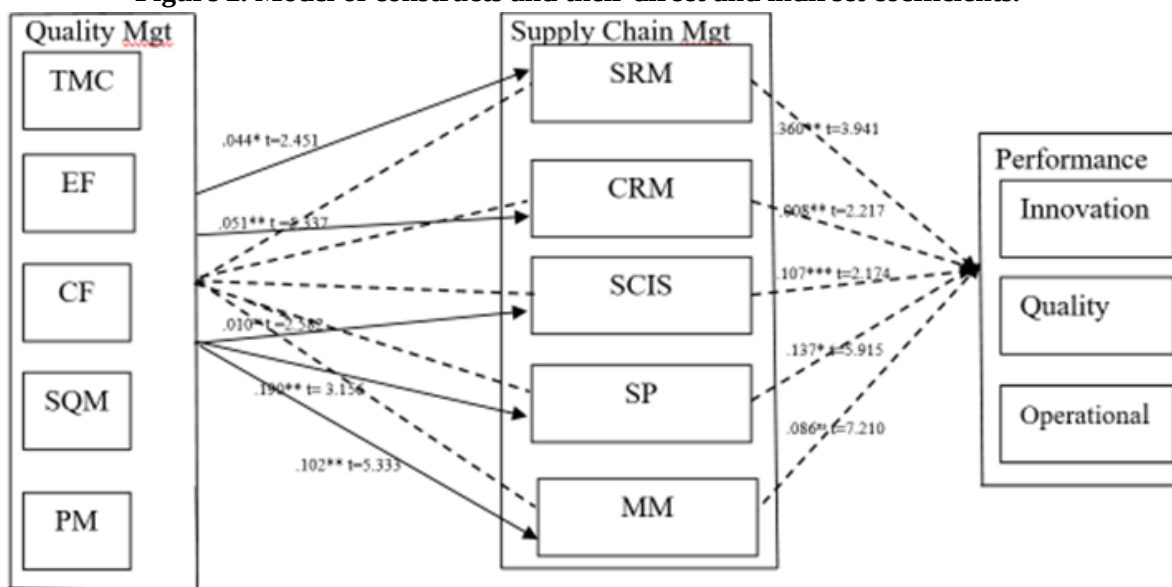
Hypothesis	Path	Standardised Coefficient	Lower Bound	Upper Bound	t-values	Result
H1	QM → SCM	.315**			5.233	Supported
H1a	QM → SRM	.044*			2.451	Supported
H1b	QM → CRM	.010 ^{ns}			2.582	Not Supported
H1c	QM → SCIS	.051**			5.337	Supported
H1d	QM → SP	.190**			3.156	Supported
H1e	QM → MM	.102**			5.333	Supported
H2	QM → SCM → PERF	.412**	.190	1.14	2.198	Supported
H2a	QM → SRM → PERF	.360**	.002	.044	3.941	Supported
H2b	QM → CRM → PERF	.008**	.232	.576	2.217	Supported
H2c	QM → SCI → PERF	.107***	.092	.914	2.174	Supported
H2d	QM → SP → PERF	.137*	.479	1.72	5.915	Supported
H2e	QM → MM → PERF	.086 ^{ns}	-.014	.002	7.210	Not Supported

*** ≤ .001 significant value, ** ≤ .01 significant value, * ≤ .05 significant value, and ^{ns} = Not Significant

There are a few indicators that assert how fit a model is in SEM. These indicators have recommended thresholds. CFI ≥ 0.90 (Bagozzi & Yi, 1988; Ahmadi 2019), GFI ≥ 0.90 (Ahmadi, 2019), IFI ≥ 0.90 (Bagozzi & Yi, 1988; Ahmadi, 2019), NFI ≥ 0.90 (Bagozzi & Yi, 1988), RMR ≤ 0.08 (Hair et al., 2010; Tomic & Spasojevic, 2019), RMSEA ≤ 0.08 (Hair et al., 1998; Ahmadi, 2019), $\chi^2/df \leq 5$ (Guimaraes et al., 2016; Ahmadi, 2019).

The results of the study reveal that all the practices of quality management selected for this study had an impact on supply chain management, except the customer focus practice. The results show that quality management had 4.4 percent influence on the outcomes of supplier relationship management in manufacturing firms in Nigeria. The study also revealed that quality management had a 5.1 percent effect on customer relationship management, while quality management had an insignificant relationship though could influence supply chain information sharing minimally (1 percent). The test of quality management on supplier partnership proved significant, influencing about 19 percent of the change in supplier partnership. Quality management predicted 10.2 percent of material management practice. The overall effect of quality management on supply chain management practices also proved significantly positive, with quality management practices accounting for 31.5 percent of the outcome in supply chain management.

Figure 2. Model of constructs and their direct and indirect coefficients.



Model fit: CMIN/DF 2.999, NFI .925, RFI .936, IFI .997, TLI .990, CFI .957, RMSEA .081

*** $\leq .001$ significant value, ** $\leq .01$ significant value, * $\leq .05$ significant value, and = Not Significant

The study also tested the indirect relationship between quality management and performance metrics through supply chain management practices. The overall and exclusive mediating capacities of the practices of supply chain management were tested to satisfy the second hypothesis. The study finding reveal that all supply chain practices except the material management practice proved to be good conductor of the effect between quality management and organisational performance. Specifically, the study reveals that quality management through supplier relations management influenced 36

percent of organisational performance, while quality management through customer relationship could only affect .8 percent of the outcomes in organisational performance. This makes customer relationship management the least effective route to influence and improve organisational performance when considering mediation between quality management and organisational performance. Supply chain information sharing and supplier partnership as mediator variables both produced 10.7 and 13.7 percent impact respectively on the performance of manufacturing firms. Material management proved an insignificant mediator to quality management and organisational performance. On a holistic view, supply chain management proved to be a good mediator to quality management and performance in manufacturing firms in Nigeria. This is as a result of its total mediating impact of 41 percent on performance. Supplier relation had the most effect as a mediator, therefore it proves to become a more reliable path to improved organisational performance.

5. Discussion of Findings

The study had two major hypotheses. Firstly was to test the effect of quality management on supply chain management practices, and secondly, test the mediating capacity of supply chain practices on the relationship between quality management and organisational performance. The result shows that among all the practices of supply chain management employed in this study, quality management had the most impact on supplier partnership, followed closely by material management. While customer relationship and supplier relationship were also influenced by quality management practices though a reduced effect when compared to supplier partnership and material management. Quality management had no significant impact on supply chain information sharing. This finding are in tandem with the studies of Flynn and Flynn (2005), Casadesus and Castro (2005) and Vanichchinchai and Igel (2011). These studies concluded that quality management practices had the capacity to improve supply chain management practices. The study equally highlights that quality management has different impacts on exclusive parameters of supply chain management. It revealed that quality management had no impact on supply chain information sharing, while having higher effect on supplier partnership and material management. Though minimal studies test this empirically, Casadesus and Castro (2005) discussed that ISO 9000 quality management implementation and certification reduced customer complaints in their study, thus, establishing a relationship between quality management and customer relationship management. In this regard, this study finding do align with the finding of their study to some extent.

The study also had a mediation hypothesis, considering the mediating role of supply chain management practices on the relationship between quality management and organisational performance. This test proved significant and positive as the study revealed that quality management had the capacity to indirectly influence organisational performance through supply chain management. This study finding is in line with the work of Vanichchinchai and Igel (2011). Their study established the indirect relationship between quality management and supplier performance through supply chain management practices, though having different performance metrics, their study emphasised the indirect possibility of quality management on facets of performance. The study Prajogo et al., (2012) revealed that customer management did not have an effect on

performance though quality management had an impact on it. Implicitly, the study proposes no mediating capacity in customer relationship in the relationship between quality management and performance. This however is negative to the finding of this study, as this study reveals that customer relationship management mediated the relationship between quality management and organisational performance significantly and positively. On the other hand, material management had no mediating capacity, while supplier relationship management had the most mediating effect on the quality and performance relationship. This aligns with Prajogo et al., (2012) who found that quality management impacted supplier relationship, and supplier relationship equally had a direct effect on performance.

6. Conclusion

The essence of this study was to examine if quality management practices had the capacity to influence supply chain management practices. There were two major hypotheses for testing, and both were tested with results positive and significant. Quality management had a direct significant impact on all parameters of supply chain management except supply chain information sharing. That is quality management practices had a positive significant effect on supplier relationship management, customer relationship management, supplier partnership and material management. Which aligned with prior studies by Casadesus and Castro (2005), and Vanichchinchai and Igel (2011). The study also tested the mediating role of supplier relationship practices on the relationship between quality management and performance. The study test proved that supply chain management practices had mediating effect on the relationship, except material management. The mediating capacity of other supply chain practices aligned with the study of Vanichchinchai and Igel (2011) and partially supported some findings in the study of Prajogo et al., (2012).

This study gives a contribution in the quality management and supply chain management studies. While most studies are on western and Asian nations, this study proffers empirical evidence from the Nigerian viewpoint. The study reveals that the most impacted practice of supply chain management by quality management is supplier partnership. Therefore, for improvements in supplier partnership efforts, manufacturing firms are encouraged to pursue implementation of quality management practices. The study equally reveals that the best mediating variable (among supply chain practices) between quality management and organisational performance is supplier relationship management. Hence, manufacturers must strengthen their efforts in achieving elevated performance in innovation, operations and quality. Earlier studies in the study of quality management and supply chain management did not establish which concept of supply chain management benefits the most from quality management practices. In addition, prior literature did not evaluate which supply chain practice will have the most mediating effect on quality management and organisational performance relationship. This study filled those gaps.

For the practitioners in the business of manufacturing, especially the Nigerian business environment, this study provides a possible template for the achievement of specific supply chain management practices, as well as the improvements in organisational performance. The study proposes that practitioners interested in improving supplier partnership should consider the use of quality management in their pursuit. In addition if

the firm is interested in achieving improved materials handling and efficient utilisation of resources, then it can implement quality management practices. That said, when pursuing the improvement in other practices like supplier relationship and customer relationship, practitioners might consider other approaches as the model did not deliver a strong effect on these practices, instead the model reveals that the effect on these practices are very minimal. Therefore, practitioners must apply other strategies to get the best in those areas of supply chain. Overall, practitioners should consider strengthening supplier partnership and supplier relationship practices in supply chains, as these practices had the most mediating capacities on organisational performance.

As all studies that employ respondents' self-reported data, the limitations of this study include bias of the respondents towards their manufacturing systems and the will to disclose the right information and honest opinion of their systems. Further studies may consider a more robust investigation into how each supply chain management practice affects each exclusive parameter of organisational performance. Subsequent studies can also look at expanding the practices of supply chain adopted for the study to test for mediation possibilities.

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