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Supply chain management antecedents of performance in small to medium scale enterprises

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Background: The failure rate of most small to medium enterprises (SMEs) in South Africa remains very high, with up to 70% of such businesses closing down within the first 5 years of operations. High business operating costs incurred by SMEs are often cited as one of the major causes of these failures. It may be argued that to reduce these costs, and hence improve the success rates of SME ventures, supply chain management (SCM) strategies should be adopted and implemented.

Aim: This article provides an analysis of the connection between SCM strategies, supply chain agility and supply chain performance among SMEs in South Africa.

Setting: A total of 407 owners, managers and professional employees of SMEs operating in Gauteng were recruited purposively to participate in the study.

Method: To test the proposed relationships, the collected data were analysed using exploratory factor analysis, Pearson correlations and regression analysis.

Result: The results of the study disclosed that all four SCM strategies (supplier collaboration, total quality management, technology adoption, supply chain integration) correlated with and predicted supply chain agility. Technology adoption (β = 0.54) emerged as the strongest predictor of supply chain agility. In turn, supply chain agility correlated with and predicted supply chain performance.

Conclusion: The article concludes by recommending specific interventions that may be employed by SMEs to ensure that the adoption of SCM strategies yields positive outcomes.

Keywords: buyer-supplier collaboration; supply chain integration; total quality management; IT adoption; supply chain agility; supply chain performance.

Introduction and background

The body of literature on South African small to medium enterprises (SMEs) continues to grow. Some researchers (Balogun, Nazeem & Agumba 2016; Ghebrihiwet 2019; Maduku, Mpinganjira & Duh 2016) have directed attention to the impact of SMEs on the South African economy. Others (Fatoki 2014; Makhitha 2017; Neneh & Van Zyl 2017) have concentrated on the challenges faced by SMEs in South Africa. Also, additional studies (Dzomonda, Fatoki & Oni 2017; Hove-Sibanda, Sibanda & Pooe 2017; Mathu & Tlare 2017) have placed emphasis on entrepreneurship factors determining the success of SMEs in the country. Yet other scholars (Aliyu, Modu & Tan 2018; Chakraborty, Mutingi & Vashishth 2019; Chingwaru 2015 three) have conducted comparative studies involving SMEs in South Africa and those in other parts of the world, such as Zimbabwe, Egypt and Nigeria, India and Namibia. Several common gears of observations bind these studies together. Firstly, the studies concur that SMEs are essential to the South African economy, contributing extensively to its growth and development. Secondly, most studies assent that the SME trajectory in the country is a difficult one and is riddled with numerous internal and external problems that have claimed the existence of numerous enterprises soon after their formation. Thirdly, the studies commonly accept that the path followed by SMEs in South Africa is neither unique nor isolated since similar enterprises in other developing countries face comparable problems.

The importance of SMEs to the South African economy is without dispute, having been documented in several studies (AlKhajeh & Khalid 2018; Bushe 2019; Leboea 2017; Maduku et al. 2016). Their most significant roles are in areas such as employment creation, innovation and productivity, with up to 91% of SMEs contributing about 52% to 57% to the country's gross domestic product (GDP) (Small Enterprises Development Association 2019). Yet conflicting evidence indicates that regardless of their importance, SMEs face numerous challenges, such as lack of capital, fierce competition in most sectors, shortage of skills, corruption, dependence on obsolete management models and negative economic development, among others, that impede their prospects of survival, growth and success (Molefe, Meyer & De Jongh 2018; Moos & Sambo 2018; Muriithi 2017). So pronounced are these challenges that between 70% and 80% of South African SMEs fail to reach their maturity stage (Dzomonda et al. 2017; Neneh & Van Zyl 2017; Small Enterprise Development Agency [SEDA] 2018). The existence of these challenges presents opportunities for further research to generate more information on how they may be overcome.

The current study investigated the connection between supply chain management (SCM) practices, supply chain agility (SCA) and supply chain performance (SCP) in South African SMEs. Although SMEs are important to the South African economy, their continued struggles and failures act as stimuli for further research, based on the view that empirical research is an avenue for the generation of lasting solutions to such business problems. The dependence of SMEs on ineffective business management strategies triggers the suggestion to identify scientifically those models that are applicable to the situation in South Africa. Governments, communities of practice, business owners and managers may then tap into such resources to identify and use relevant information to turn their businesses around and flatten the curve of failed SMEs in South Africa.

The current study approaches the management dilemmas facing SMEs from a SCM perspective. At most, SCM remains an emergent concept to most SMEs, yet has now become an activity of strategic importance that determines either the success or failure of a business (Kot 2018; Kot, Goldbach & Ślusarczyk 2018). It may further be argued that knowledge about the application of the SCM concept to SMEs in South Africa is still in its infancy, which increases the necessity of continual empirical studies directed to this critical sector. Using the SCM standpoint, the study identifies four practices relevant to SMEs. These include buyer-supplier collaboration (BSC), supply chain integration (SCI), total quality management (TQM) and information technology adoption (ITA) – practices that have been applied extensively in past studies (Basheer et al. 2019; Thai & Jie 2018). In line with evidence from prior literature (Ngai, Chau & Chan 2011; Prajogo & Olhager 2012; Revilla & Villena 2012; Yang 2013), the study links these SCM practices to SCA, which in turn enhances SCP in SMEs. Thus, the study presupposes that performance of SME supply chains in South Africa can be improved through the implementation of SCM practices.

Some evidence exists of previous research narrowed down to SCM practices in South African SMEs (e.g. Abualrejal et al. 2017; Eicker & Cilliers 2017; Fatoki 2019; Mofokeng & Chinomona 2019; Molefe et al. 2018). However, a comprehensive literature search made by the authors of the present article revealed that it is not easy to find any prior South African studies that tested the conceptual model evaluated in the current study. The current study is thus intended to occupy this gap.

Literature review

Supply chain management practices

Supply chain management practices are activities intended to manage the operations, as well as functions of a supply chain, ensuring a flow of goods, services money and information from sources to the end users (Shukla, Garg & Agarwal 2011). It is widely recognised that SCM practices are effective in providing core value to an organisation's strategic direction in terms of adhering to or meeting performance objectives (Chardine-Baumann & Botta-Genoulaz 2014). They are sets of practices that perform a strategic role in the competitive aspirations of businesses and contribute to improving the performance of an organisation's supply chain (Banerjee & Mishra 2015; Randall et al. 2011). Examples of SCM practices include SCI, customer service management, geographical proximity, just-in-time (JIT), business intelligence, logistics and distribution, supplier collaboration, and lean and green SCM (Banerjee & Mishra 2015; Govindan et al. 2014). The current study concentrates on four practices proposed by Wiengarten et al. (2010), namely BSC, ITA, SCI and TQM. Their selection is based on the rationale that these are fundamental aspects of the sustainable performance of SME organisations' supply chain environment (Banerjee & Mishra 2015).

Buyer-supplier collaboration

Buyer-supplier collaboration is the ability of two or more partner organisations to work together in joining supply chain-related activities, which is essential in meeting requirements and expectations of customers (Fawcett et al. 2011). Collaborative engagement between buyers and suppliers calls for a synergistic working engagement between supply chain partners, with the purpose of exchanging proprietary knowledge and information, expertise, as well as technologies (Osarenkhoe 2010). Factors such as the setting of mutual goals and objectives, an organisation's internal governance and mutual trust, as well as information exchange are essential in influencing buyer and supplier decisions to collaborate (Grudinschi, Sintonen & Hallikas 2014). Buyer-supplier collaboration may also be strengthened through the effective sharing of information and quality communication between supply network members, as this helps to establish inter-organisational learning (Claro & Claro 2010). In addition, innovation practices centred on new products and strategic, operational development play a critical part in allowing buyers and suppliers to join forces, to meet market and customers' requirements (Jajja et al. 2014). Within SMEs, an effective and efficient collaborative working engagement contributes significantly to the abilities of such enterprises to meet their performance objectives (Kwofie, Aigbavboa & Matsane 2017). Furthermore, alliances across SME supply chains are essential in optimising operational activities, in the process ensuring that customers' and consumers' requirements are met (Kwofie, Aigbavboa & Matsane 2017).

Supply chain integration

Supply chain integration is the combination of internal and external resources from both organisations' supply chain partners (Whipple, Wiedmer & Boyer 2015). According to Wong, Boon-Itt and Wong (2011), SCI is a multidimensional construct, consisting of internal and external integration factors. On the one hand, internal integration refers to the interconnectivity of all cross functions within an organisation's environment (Wiengarten et al. 2016). On the other hand, external integration involves integration between a firm's upstream (customers) and its downstream (suppliers) business associates (Wong et al. 2011). Supply chain integration aims to achieve effective synergy and cooperation in operations processes, which is crucial to attaining the ideal competitive advantage (Kumar et al. 2017). Hence, the concept is more of an interactive approach of different supply chain networks rather than separated and disjointed functions (Ataseven & Nair 2017; Whipple et al. 2015). In the context of SMEs, it could be argued that SCI is a strategic activity that contributes to competitive performance. To support this view, Madzimure (2019) found that the capabilities of SMEs to integrate their internal logistics and network activities, correlates with the effectiveness of their operations. Hence, conceivably, SMEs could benefit from adopting a more integrative approach to their business functions.

Total quality management

Total quality management is a business management strategy designed at enhancing the overall quality, management and performance of a firm to achieve competitive advantage (Lee et al. 2010). It is focused on ensuring sustained operations through the effort and contribution of an organisation's primary stakeholders, such as suppliers, top management, employees and customers, to meet the expectations and requirements of the customer (Teeravaraprug, Kitiwanwong & Tong 2011). It involves principles such as supplier quality management and improvement systems, customer focus, continual improvement, education and training, and benchmarking (Farish, Anil & Satish 2017). Agus and Hassan (2011) identified supplier relations, benchmarking activities and quality measurement as prominent precursors to positive TQM adoption, and as underlying factors in assuring competitive objectives. Application of TQM yields paybacks, such as the overall improvement of efficient and productive operation activities, enhanced employee morale, and further contributes to the achievement of a competitive advantage to the organisation (Aamer, Al-Awlaqi & Alkibsi 2017; Nasim 2018). From an SME perspective, most small businesses have been slow to adopt TQM. However, a recent study by Tolke and Kalpande (2020) confirms that TQM is equally beneficial to SMEs, leading to such advantages as minimisation of waste, reduction of lead and process time, and assuring production procedures are implemented swiftly.

Information technology adoption

Information technology adoption refers to multilevel applications that enable the sharing or exchange of input and output data between different organisations' networks (Kisielnicki, Grabara & Nowak 2005). It involves the sharing of formal, informal and technical information and data between two or more individuals or organisations (Beynon-Davies 2009). Strong strategic involvement from top-level executives can spark the implementation of IT-related practices and applications (Jin & Kang 2013). Examples of IT systems applicable to SCM include electronic data interchange, system handling of real-time orders, materials requirements planning and JIT, which are useful in facilitating the integration and coordination of information between supply chain partners (Dolci Maçada & Grant 2013). Implementation of IT systems can yield paybacks such as better availability of goods and services and higher performance in terms of speed and flexibility (Pan, Pan & Lim 2015). Within the SME environment, the importance of IT as a driver of business performance cannot be overlooked. For instance, evidence from a study by Mathu and Tlare (2017) suggests that ITA has been recognised as one of the most significant drivers of SME success through its effects on boosting the distribution, tracking and tracing of products and the effective management of inventories. Additionally, Enagi and Van Belle (2019) found that ITA leads to competitive advantage in SMEs. Small to medium enterprises could therefore stimulate their success by keeping abreast with technological changes and ensuring that their operations are IT-driven.

Supply chain agility

Supply chain agility refers to an organisation's ability and capability to detect and swiftly respond to changes in their markets (DeGroote & Marx 2013). It involves the effective and efficient implementation of performance indicators such as speed, responsiveness and flexibility of operations processes, which are aimed at addressing the business's challenges and changes in a sound manner (Gligor & Holcomb 2012). The most common determinant factors of SCA include information sharing, relationship partnerships, internal integrative processes and the use of IT (Bottani 2010; Chang, Tsai & Hsu 2013; Ngai et al. 2011). Firms that demonstrate agile attributes are better positioned to take advantages of market-related opportunities (Chan, Ngai & Moon 2017). This implies an adequate response to environmental changes allows agile firms to sustain their level of operational competitiveness. Likewise, SCA is one of many key success factors among SMEs. A study by Govuzela and Mafini (2019), found superior business performance in agile SMEs in South Africa. Hence, SCA is critical in enabling SMEs to respond quickly and swiftly to the market, as well as demands by consumers and customers for specific changes, which may facilitate the resilience of these businesses.

Supply chain performance

Supply chain performance refers to the effectiveness and efficiency of an organisation's entire supply chain activities (Gunasekaran, Patel & Tirtiroglu 2001). It may also refer to the assessment of tangible and intangible competitive performance factors in a supply chain (Eng 2004). Corsten and Felde (2005) view it as the return on both assets and sales derived from the effectiveness of operations. These varied views depict that SCP encompasses a variety of elements that characterise it. Higher SCP is vital in improving the firm's market share (Gunasekaran et al. 2017). It is also linked to the capability of businesses to reduce their operational costs through the timely delivery of the required quality and quantity of products or services (Qrunfleh & Tarafdar 2014; Whitten, Green & Zelbst 2012). Superior supply chain network performance facilitates a high level of synergistic activities across the value chain, thereby enabling businesses to meet and exceed the market requirements (Bayraktar et al. 2020). Thus, supply chains, among both SMEs and larger businesses, that perform optimally, respond better to meeting the needs of customers and other stakeholders.

Conceptual model and research propositions

Figure 1 presents the conceptual model of the study, which consists of four predicting constructs (BSC, SCI, TQM and ITA), one mediator (SCA) and the outcome (SCP).

Supply chain management practices and supply chain agility

Literature exists that links the SCM practices, considered in this study, to SCA. Several studies (Allred et al. 2011; Hofer et al. 2014; Revilla & Villena 2012; Yang 2013) found that BSC leads to enhanced SCA as it facilitates knowledge and information sharing and the flow of products and materials between buyers and suppliers, which enables them to respond rapidly to fluctuations in the market. Comprehensive engagement and interactions between buyers and suppliers in supply chains equips businesses to adapt to unforeseen supply disruptions (Srinivasan, Mukherjee & Gaur 2011). Further research-based evidence (e.g. Kocoglu et al. 2011; Leuschner, Rogers & Charvet 2013; Ngai et al. 2011) in different contexts has also found direct connections between SCI and SCA. Other studies (Lotfi et al. 2013; Prajogo & Olhager 2012) maintain that the integrated networks are characterised by an increase of performance objectives such as delivery, cost, quality and flexibility, enabling firms to adapt to disruptive changes in the environment.

The application of TQM procedures, such as the JIT, results in the reduction of cycle time, better inventory management

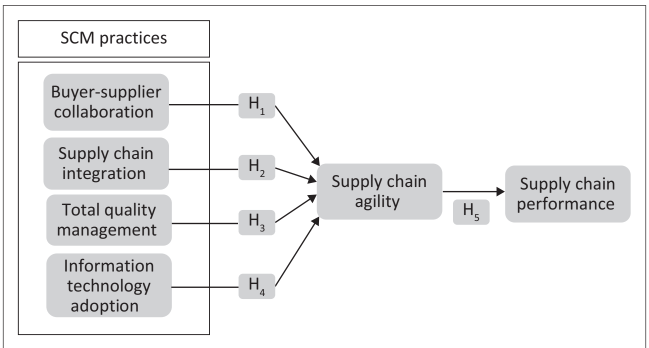

FIGURE 1: Conceptual model.

and minimisation of delivery dependability, which is linked to an increased operational response to customers' requirements in terms of prompt delivery and availability (Lee et al. 2010; Vanichchinchai & Igel 2011). Supply chains that adopt TQM tend to outperform their competitors in terms of innovation and manufacturing capabilities and operational readiness, as well as the superior quality of products and materials, making firms better placed to address any unpredictable changes (Konecny & Thun 2011; Wang, Chen & Chen 2012; Yunis, Jung & Chen 2013). Also, a number of studies (Acar & Uzunlar 2014; Fawcett et al. 2011; Jacques 2012) have confirmed the relationship between ITA and agility. Information technology is an important form of supply chain integrative efforts, as it facilitates information sharing and collaboration, and the lowering of transactional costs which are essential in nurturing organisational agility (Marinagi, Trivellas & Sakas 2014; Singh & Teng 2016). Use of advanced IT allows better flexibility to adjust to fluctuations in the markets (Acar & Uzunlar 2014). Based on these insights, the following propositions are put forward:

Proposition 1: BSC predicts SCA among SMEs in South Africa.

Proposition 2: SCI predicts SCA among SMEs in South Africa.

Proposition 3: TQM predicts SCA among SMEs in South Africa.

Proposition 4: ITA predicts SCA among SMEs in South Africa.

Supply chain agility and supply chain performance

The performance outcomes associated with SCA provide a clue to its connection with SCP. Supply chain performance increases responsiveness and awareness of perceived supply distortions in the market (Blome, Schoenherr & Rexhausen 2013). It is also linked to waste minimisation efforts in producing lean supply chains (Gligor, Esmark & Holcomb 2015). Agile supply chains are also suitable environments for joint engagements between supply chain partners in terms of risk-sharing, as well as business ventures (Gaur et al. 2011). Supply chain agility is also regarded as a strategic tool to achieving long-term sustainable competitive dominance through its effect on delivery time, quality products and dependability of services (Eckstein et al. 2015). Sukati et al. (2012) add that SCA is a crucial factor that defines the success and survival aspirations of any organisation that operates in a highly volatile and turbulent market. Betts and Tadisina (2009) found that SCA moderates the relationship between collaboration and performance. Additionally, a study by Govuzela and Mafini (2019), reveals that SCA is important in improving the performance of SMEs in South Africa. This leads to the following proposition:

Proposition 5: SCA predicts SCP among SMEs in South Africa.

Research methodology

Design and participants

The study followed a quantitative method using a survey design, anchored to deductive reasoning and a positivist paradigm, because it sought to test relationships between different constructs (Ang 2014).The target population of this study was owners, managers and professional employees of SMEs operating in Gauteng, South Africa. Since Gauteng is the economic nucleus of the country, it was anticipated that the results from the current investigation could provide a practical foundation of representation of the undercurrents in SMEs enterprises in South Africa. Owners, managers and professional employees of SMEs were deemed to be the most suitable group of respondents in this study because they have a better understanding and practical knowledge of and expertise in issues related to SCM in their respective industries. The list of these SMEs was obtained from the Small Enterprise Development Agency (SEDA). Using this list, 72 SMEs in different industries were identified and contacted. The SMEs were divided (stratified) by industry (retailing, construction, manufacturing, agriculture and service) and then random selections were made. Respondents were selected purposively from these SMEs. The use of a purposive sampling technique was intended to assist in selecting only those respondents that were relevant to the study. To be selected, respondents had to have at least a 'matric' education level and be familiar with the SCM constructs under consideration in the study. The final sample was made up of 407 respondents, and is in line with Green's (1991) rule of thumb that for a correlation or regression, the minimum number of sampling units can be calculated using the formula $N > 50 + 8m$ (where m is the number of independent variables). In applying Green's rule to the current study, the minimum number of respondents was supposed to be 370, since there were four independent variables. Therefore, the final sample size applied in this study ($n = 407$) is consistent with the general sample size recommendations for multivariate data analyses.

Data collection procedure

Data were collected using a structured and self-administered survey questionnaire. The questionnaires were distributed between July and September 2017 using a combination of email surveys and the drop-and-collect method. Respondents were given a period of 3 weeks to complete the questionnaire. Various ethical considerations such as informed consent, voluntary participation, confidentiality and anonymity, and the right to withdraw from the study were observed throughout the data collection process. Respondents were not given any incentives for participating in the study.

Research instrument

Measurement scales were operationalised from previous studies. Buyer-supplier collaboration was measured using a five-item scale adapted from Flynn, Huo and Zhao (2010) and Zacharia, Nix and Lusch (2011). To measure SCI, a five-item scale adapted from previous studies by Stank, Keller and Daugherty (2001), Narasimhan and Kim (2002) and Flynn et al. (2010) was used. Measurement of TQM was achieved with the use of a five-item scale adapted from Hung et al. (2011), while ITA was measured using a four-item scale derived from Jin et al. (2014). Moreover, SCA was measured using a five-item scale adapted from Goldman, Nagel and Preiss (1994), and Youndt and Snell (2004), while SCP was measured using a five-item scale adapted from Beamon (1999). All measurement scales were previously validated, having attained Cronbach's alpha values of least 0.7 in prior studies. Response options were presented on a five-point Likert-type scale that was anchored by 1 = strongly disagree and 5 = strongly agree to express the degree of disagreement or agreement.

Data analysis

The data collected in the study were analysed using the Statistical Package for Social Sciences (SPSS version 25.0). The main statistics employed in the study include an exploratory factor analysis (EFA), Pearson correlations and regression analysis.

Ethical considerations

Vaal University of Technology, HDC190815, received on 19 August 2015.

Research results

Demographic profile of respondents

A total of 700 questionnaires were issued to all targeted SMEs. From the initial 700 questionnaires, 456 were returned, of which 49 were discarded because they had errors. This culminated in 407 valid questionnaires available for use in the final analysis, representing a response rate of 58%, which is considered to be acceptable by McGuirk and O'Neill (2016). The demographic details of the final respondents are presented in Table 1.

TABLE 1: Demographic details of respondents.

Variable and category	Frequency (*n*)	%
Gender		
Male	243	59.7
Female	164	40.3
Total	407	100
Race		
Black people	200	49.1
White people	113	27.8
Indian and/or Asian people	60	14.7
Coloured people	34	8.4
Total	407	100
Age		
18–25 years of age	9	2.2
26–35 years of age	91	22.4
36–45 years of age	179	44
46–55 years of age	114	28
56+ years of age	14	3.4
Total	407	100
Highest level of education		
Matric	20	4.9
Diploma	116	28.5
Degree	176	43.2
Postgraduate	74	18.2
Other	21	5.2
Total	407	100
Occupational status		
Owner	84	20.6
Manager	120	29.5
Professional employee	203	49.9
Total	407	100

The results from Table 1 show that 243 (59.7%) of all respondents participating in this survey were male, while 164 (40.3%) were female. Regarding the race distribution of the respondents, 200 (49.1%) were African, followed by 113 (27.8%) that were White. In terms of age distribution, 179 (44%) of the respondents were aged between 36 and 45 years, followed by 114 (28%) that were aged between 46 and 55 years. With respect to their levels of education, 146 (43.2%) of the respondents were in possession of a degree, followed by 116 (28.5%) who were in possession of a diploma. Regarding the occupational status of respondents, 203 (49.9%) were professional employees (those individuals who possessed SCM-related qualifications, as well as more than 3 years industry experience), while 120 (29.5%) occupied managerial positions, and 84 (20.6%) were owners.

Exploratory factor analysis

Exploratory factor analysis using the principal components analysis procedure was performed to check the factor structure of all research constructs. To determine the factorability of the data, a Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity were computed. The smallest KMO value attained was 0.916, which is above the minimum cut-off value of 0.5 and all results for Bartlett's test were significant at 0.000, thereby signalling the factorability of the data (Bartlett 1951; Kaiser 1970). Communalities for all items were acceptable as they ranged between 0.403 and 0.843, which were above the recommended minimum threshold value of 0.3 (Child 2006). Only those factors with eigenvalues greater than 1 and items with factor loadings higher than 0.5 were retained, in line with the seminal recommendation by Kaiser (1960). The EFA procedure revealed that each of the six research constructs had a unidimensional structure. The results of the EFA, including the Cronbach's alpha, mean scores, standard deviations and tests for normality are presented in Table 2.

Table 2 reveals that the factor loadings derived from the EFA for all six constructs were acceptably high, surpassing the 0.5 minimum cut-off value. Eigenvalues were above the lowest prescribed cut-off value of 1.0 and ranged from a minimum of 2.604 (SCI) to a maximum of 3.976 (SCP). In terms of the cumulative percentage of variance explained, all six constructs exceeded the recommended minimum of 60% (Hair et al. 2014). Therefore, all six constructs were accepted and retained in the study, and no items were discarded from any scale.

The range for the overall mean scores for the scales (4.359–4.6430) signified an inclination towards the 'agree' and 'strongly agree' positions on the Likert scale. This result demonstrated that respondents generally answered in agreement with the questions on each measurement scale. Thus, respondents perceived that all four SCM practices were being implemented in SMEs. They also confirmed that their supply chains were agile enough and were performing optimally.

Standard deviations for all constructs were close to each other (0.517–0.633), indicating that, at most, data were normally distributed. Further tests for data normality were performed using D. Argostino's K-squared test. Most scores for skewness and kurtosis were within acceptable ranges, indicating that the data had satisfactory symmetry to assume a normal distribution. Hence, the data were considered to be normally distributed, allowing for the application of parametric statistics.

Validity and reliability

Validity is the degree to which the instrument measures the construct it purports to measure (Scholtes, Terwee & Poolma 2011). A set of measures were taken to establish the face and content validity of the measurement scales. To test for face validity, three academics who specialise in SCM at a South African university of technology, reviewed the questionnaire to ensure that the context of the study remains as transparent as possible in guiding the respondents in their understanding of the survey. After effecting the revision of the questionnaire, a pilot study was undertaken to test for content validity and reliability of the questionnaire. The pilot study involved testing the questionnaire using 40 conveniently chosen respondents who were in the Vaal Triangle region. This decision was taken to ensure that businesses operating in this region did not form part of the final survey. Constructive feedback was obtained from the returned questionnaires, which indicated a number of minor issues that still needed to be addressed. These ranged from complex and technical terminologies to acronyms that were used which made some questions vague. Further revisions were subsequently made in line with the feedback provided.

Construct validity was first tested using factor loadings derived in the EFA procedure. The fact that all factor loadings were higher than the recommended lowest cut-off value of 0.5 (Kang 2013), indicated that construct validity was acceptable. Construct validity was also tested using inter-factor correlations, in accordance with the recommendation by Polit and Beck (2012). As indicated in Table 3, positive inter-factor correlations were computed, further illustrating that construct validity was adequate in this study. Predictive validity was tested using regression analysis. Results in the two regression models (Table 4 and Table 5) indicate the existence of positive relationships between the dependent and independent constructs, thereby confirming that predictive validity was satisfactory in this study.

Reliability refers to the degree to which measures are free from errors and therefore yield consistent results (Ang 2014). Construct reliability was tested using the Cronbach's alpha coefficient. Alpha values (Table 2) ranged between 0.820 and 0.935, way above the minimum recommended threshold of 0.7 (DeVellis 2012; Kline 2000). Therefore, all measurement scales used in the study were considered to be reliable.

TABLE 2: Factor analysis, descriptive statistics and tests for data normality.

Supply chain management practices	Items	Factor loadings	Eigenvalue	% of variance	Chronbach's alpha	Descriptive statistics		Tests for data normality	
						Mean	Standard deviation	Skewness	Kurtosis
Buyer-supplier collaboration	-	-	3.263	65.254	0.908	4.388	0.633	-1.171	1.947
	BSC1	0.658	-	-	-	-	-	-	-
	BSC2	0.788	-	-	-	-	-	-	-
	BSC3	0.864	-	-	-	-	-	-	-
	BSC4	0.866	-	-	-	-	-	-	-
	BSC5	0.844	-	-	-	-	-	-	-
Supply chain integration	-	-	2.604	65.102	0.820	4.359	0.650	-1.184	1.782
	SCI1	0.634	-	-	-	-	-	-	-
	SCI2	0.833	-	-	-	-	-	-	-
	SCI3	0.871	-	-	-	-	-	-	-
	SCI4	0.867	-	-	-	-	-	-	-
Total quality management	-	-	3.361	67.217	0.869	4.604	0.517	-1.585	3.822
	TQM1	0.847	-	-	-	-	-	-	-
	TQM2	0.896	-	-	-	-	-	-	-
	TQM3	0.865	-	-	-	-	-	-	-
	TQM4	0.750	-	-	-	-	-	-	-
	TQM5	0.728	-	-	-	-	-	-	-
IT adoption	-	-	3.236	80.890	0.921	4.562	0.617	-1.877	4.460
	ITA1	0.895	-	-	-	-	-	-	-
	ITA2	0.897	-	-	-	-	-	-	-
	ITA3	0.912	-	-	-	-	-	-	-
	ITA4	0.893	-	-	-	-	-	-	-
Supply chain agility	-	-	3.530	70.598	0.895	4.557	0.538	-1.653	5.325
	SCA1	0.853	-	-	-	-	-	-	-
	SCA2	0.868	-	-	-	-	-	-	-
	SCA3	0.831	-	-	-	-	-	-	-
	SCA4	0.854	-	-	-	-	-	-	-
	SCA5	0.792	-	-	-	-	-	-	-
Supply chain performance	-	-	3.976	79.514	0.935	4.643	0.532	-1.787	4.158
	SCP1	0.841	-	-	-	-	-	-	-
	SCP2	0.902	-	-	-	-	-	-	-
	SCP3	0.901	-	-	-	-	-	-	-
	SCP4	0.916	-	-	-	-	-	-	-
	SCP5	0.896	-	-	-	-	-	-	-

Note: Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

Pearson correlations

Correlation analysis is intended to use available statistical data to test the strength and direction of the linear association between two or more quantitative constructs (Franzese & Iuliano 2019). In this study, correlations were tested using the Pearson correlation coefficient. Since data were normally distributed, the parametric Pearson correlation was preferred in place of its non-parametric equivalent, the Spearman correlation. The results of the Pearson correlations are presented in Table 3.

Table 3 reveals the correlations between the constructs. The matrix shows strong to very strong significant positive correlations between the different constructs. The lowest correlation (r = 0.502; p = 0.000) was observed between BSC and ITA while the highest correlation (r = 0.766; p = 0.000) occurred between BSC and SCI. By implication, an increase in any one of these constructs leads to increases in the other five, and the reverse is also true. Since there were significant positive correlations between the six constructs, it was necessary to perform a regression analysis in order to test for prediction between them.

Regression analysis

Regression analysis is a technique for modelling the causal or predictive relationship between a dependent variable and an independent variable (Angelini 2019). In the current study, regression analysis was used to estimate the relationship between SCM practices, SCA and SCP in SMEs. Using the enter method, which ensures that variables are entered into the model in only one step, two regression models were run.

The least squares regression equation for the first model was formulated as follows:

$$SCA = \beta0 + \beta1(BSC) = \beta2(SCI) = \beta3(TQM) + \beta4(ITA) \quad \text{[Eqn 1]}$$

In Equation 1:

- *β0* is the constant or intercept.
- *β1–4* are the coefficients of the independent variables.
- SCA is the dependent variable.

The results for regression model 1 are presented in Table 4.

Table 4 reveals that the four SCM practices (adjusted R^2 = 0.607) contributed to 60% of the variance in SCA. This result suggests that the remaining 40% is accounted for by other factors that influence SCA in SMEs but were not included in this study. The Durbin-Watson statistic fell within the recommended range of 1.5 to 2.5, indicating that there was no need to be concerned about autocorrelations in the data (Chatterjee & Simonoff 2013). With respect to testing for multicollinearity, all tolerance values were higher than the recommended lower threshold of 0.2 (Weisburd & Britt 2013), while all variance inflation factor values were less than the strict recommended upper limit of 5 (Ringle, Wende & Becker 2015). Thus, collinearity diagnostics indicated normal data in regression Model 1. Beta values were all positive, with ITA (β = 0.365) emerging as the greatest contributor to contributor to SCA.

The least squares regression equation for the second model was formulated as follows:

$$SCP = \beta 0 + \beta 1(SCA) \quad [Eqn\ 2]$$

In Equation 2:

- *β0* is the constant or intercept.
- *β1* is the coefficient of the independent variable (SCA).
- SCP is the dependent variable.

The results for regression model 2 are presented in Table 5.

As indicated in Table 5, SCA (adjusted $R^2 = 0.399$) contributed to nearly 40% of the variance in SCP. This result signifies that 60% of the variance in SCP is attributed to other influences that were not part of the present study. The Durbin-Watson statistic (1.949) fell within the recommended range of 1.5 to 2.5, indicating the unimportance of residual errors in this model. The tolerance (1.0) and variance inflation factor (1.0) values were both within the prescribed thresholds, thereby reducing any concerns regarding multicollinearity in this study. A positive relationship (β = 0.633) was observed between SCA and SCP.

Discussion of the results

This study aimed to investigate the connection between SCM practices, SCA and SCP in South African SMEs. Five propositions were put forward. The first four propositions suggested that each of the four SCM practices (BSC, SCI, TQM and ITA) predicts SCA. The fifth proposition suggested that SCA predicts SCP. This section discusses the individual results of each proposition.

Supply chain management practices and supply chain agility

The first proposition of the study suggested that BSC predicts SCA in South African SMEs. Results of the correlation analysis

TABLE 3: Correlation analysis.

Variable	Correlation	Buyer-supplier collaboration	Supply chain integration	Total quality management	IT adoption	Supply chain agility	Supply chain performance
Buyer-supplier collaboration	Pearson correlation	1	0.766**	0.566**	0.502**	0.582**	0.505**
	Significance (two-tailed)	-	0.000	0.000	0.000	0.000	0.000
Supply chain integration	Pearson correlation	0.766**	1	0.587**	0.553**	0.585**	0.514**
	Significance (two-tailed)	0.000	-	0.000	0.000	0.000	0.000
Total quality management	Pearson correlation	0.566**	0.587**	1	0.660**	0.693**	0.563**
	Significance (two-tailed)	0.000	0.000	-	0.000	0.000	0.000
IT adoption	Pearson correlation	0.502**	0.553**	0.660**	1	0.696**	0.543**
	Significance (two-tailed)	0.000	0.000	0.000	-	0.000	0.000
Supply chain agility	Pearson correlation	0.582**	0.585**	0.693**	0.696**	1	0.633**
	Significance (two-tailed)	0.000	0.000	0.000	0.000	-	0.000
Supply chain performance	Pearson correlation	0.505**	0.514**	0.563**	0.543**	0.633**	1
	Significance (two-tailed)	0.000	0.000	0.000	0.000	0.000	-

**, Correlation is significant at the 0.01 level (two-tailed).

TABLE 4: Regression model 1: Supply chain management practices and supply chain agility.

Independent variable: Supply chain management strategies	Dependent variable: Supply chain agility						
	Unstandardised coefficients		Standardised coefficients	*t*	Significance	Collinearity statistics	
	β	Standard error	β			Tolerance	Variance inflation factor
Constant	0.717	0.157	-	4.567	0.000	-	-
Buyer-supplier collaboration	0.139	0.042	0.164	3.290	0.001	0.391	2.556
Supply chain integration	0.060	0.043	0.072	1.406	0.161	0.365	2.737
Total quality management	0.329	0.047	0.316	7.026	0.000	0.478	2.094
IT adoption	0.319	0.038	0.365	8.485	0.000	0.522	1.917

Note: $R = 0.782$; $R^2 = 0.611$; Adjusted $R^2 = 0.607$; $F = 157.915$; Durbin-Watson = 1.919.

TABLE 5: Regression model 2: Supply chain agility and supply chain performance.

Independent variable: Supply chain agility	Dependent variable: Supply chain performance						
	Unstandardised coefficients		Standardised coefficients	*T*	Significance	Collinearity statistics	
	β	Standard error	β			Tolerance	Variance inflation factor
Constant	1.791	0.175	-	10.255	0.000	-	-
SCA	0.626	0.038	0.633	16.444	0.000	1.000	1.000

Note: R = 0.633; R^2 = 0.400; Adjusted R^2 = 0.399; F = 270.409; Durbin-Watson = 1.949.

revealed a significant strong positive association (r = 0.582; p < 0.01) between BSC and SCA. In the regression analysis, BSC was statistically significant SCA (β = 0.164; t = 3.290; p = 0.001). The second proposition highlighted that SCI predicts SCA. A significant strong positive correlation (r = 0.585; p < 0.01) was observed between SCI and SCA. Regression model 1, however, reveals that SCI was statistically insignificant (β = 0.072; t = 1.406; p = 0.161). The third proposition submitted that TQM predicts SCA. Consistently, a significantly strong correlation emerged between the two constructs (r = 0.693; p < 0.01). Likewise, TQM was statistically significant in the regression analysis (β = 0.316; t = 7.026; p = 0.000). The fourth proposition advanced that ITA predicts SCA. In the correlation analysis, there was a significant strong positive association (r = 0.543; p < 0.01) between the two constructs. In the regression analysis, ITA was also statistically significant (β = 0.365; t = 8.485; p = 0.000).

The results above suggest that improvements in collaborations between buyer and supplier businesses, the application of TQM and the adoption of IT have the effect of enhancing the agility of SMEs. These results are consistent with previous studies (Ferreira et al. 2011; Kumar, Singh & Shankar 2016; Lai, Yeung & Cheng 2012; Pan et al. 2015; Vanichchinchai & Igel 2011) that stress the importance of BSC, TQM, and ITA as drivers of SCA in small businesses. Thus, South African SMEs that engage in BSC, TQM and ITA are likely to have greater capabilities to respond rapidly to changes in the environment.

The results further indicate that SCI does not predict SCA, although the two are positively correlated. This is a novel result that contradicts previous evidence (e.g. Narasimhan, Swink & Viswanathan 2010; Ralston et al. 2015; Wiengarten et al. 2016) which suggests that integrative processes across business partners facilitate the sharing of knowledge, as well as other core competencies (inclusive of SCA), enabling businesses to develop competitive advantages. Perhaps, within the context of South Africa, most SMEs have not yet managed to integrate with their internal and external stakeholders. The operational environment is quite harsh and unpredictable (BusinessTech 2019), making it difficult for emerging enterprises to acquire the capital and other resources required to embrace and implement disruptive business practices such as SCI. Most SMEs in South Africa are faced with the possibility of failure early in their growth stage, due to adverse factors such as the lack of funding and technical know-how, capacity and ability (Small Enterprise Development Association 2018). As a result, most of the available resources are directed to sustaining the business, which is a priority, in the hope that other practices will only be adopted and implemented later, after the SME has weathered the early turbulence it faces. Most SMEs in the country only attempt to implement SCI later in their growth stage when they have amassed sufficient capitalisation and other resources necessary to do so successfully. Given these circumstances, it is logical that SCI did not predict SCA in the present study.

Further analysis of the results reveals that ITA (β = 0.365) emerged as the most robust predictor of SCA when compared to BSC, SCI and TQM. This result is not surprising, given the widespread acknowledgement of IT as a basic business tool in most commercial enterprises in South Africa. As a result of the drive by government and other relevant communities of practice, a large majority of SMEs in South Africa adopt IT early in their life cycle, making it part of their daily operations. There is, therefore, a widespread conviction among SMEs that IT can drive the operations and success of their businesses and that its adoption and implementation should take precedence over other SCM practices.

Supply chain agility and supply chain performance

The results of the correlation analysis revealed a significant strong positive association between SCA and SCP (r = 0.633; p < 0.01). Regression model 2 also indicated that SCA was statistically significant (β = 0.633; t = 16.444; p = 0.000). These results illustrate that these two constructs increase or decrease conjointly and that SCA leads to SCP in SMEs. This result is parallel to previous results (DeGroote & Marx 2013; Lavastre, Gunasekaran & Spalanzani 2012; Liu et al. 2013; Qrunfleh & Tarafdar 2014; Sayed & Sunjka 2016) that link SCA to SCP in business organisations. This result is reasonable, given the acclaimed benefits of agility to business organisations. These benefits include improved alertness, flexibility, risk mitigation, better inventory, supplier and customer management, and reduced costs, as well as the increased possibility of survival, among others (Eckstein et al. 2015; Mishra, Datta & Mahapatra 2014; Whitten et al. 2012). It could then be that SMEs in South Africa have realised some of these benefits and linked them to their own efforts to achieve agility within their supply chain networks.

Conclusions, theoretical and managerial implications

The study tested the connection between SCM practices, SCA and SCP in South African SMEs. The study suggests the importance of the application of SCM practices in South African SMEs. Collaboration between buying and supplying firms, a holistic approach to managing quality (TQM) and the use of IT are practices that facilitate better agility for SMEs as they operate within their supply chains. However, due to limited funding opportunities and the lack of technical capacity, most SMEs in South Africa have not yet realised the importance of SCI as an enabler to agility. In this sense, SCI failed to predict SCA. The study further revealed that agility in SMEs leads to better SCP, making it necessary for emerging businesses to direct their focus towards developing the ability to respond rapidly to environmental changes as a way of improving their performance.

Theoretically, the study generated new information on the nexus between SCM practices, SCA and SCP, which is specific to the SME sector in South Africa. The study is an essential source of information on how SCM practices, SCA and SCP relate to each other within SMEs, given that previous empirical evidence on this topic is rare within this context. Furthermore, this study constitutes an addition to the body of SCM literature, in that it provides some insights into relevant and key practices that are valuable to optimising SCP in SMEs.

Practically, the study provides information to owners and managers of SMEs regarding the dimensional considerations available to them when attempting to improve the performance of their businesses and shared networks. The study proposes that it is worthwhile to direct efforts towards improving BSC, TQM and ITA, as this will enhance the agility of a business, leading to the attainment of envisioned performance outcomes within SME supply chains. The study further confirms the importance of ITA as a superior practice that merits priority attention ahead of the other SCM practices considered in this study. In addition, the results of the study could be applied in the diagnosis of performance-related challenges in SMEs. For instance, the fact that ITA emerged as the most significant predictor of SCA implies that more attention should be directed to it than the other constructs considered in this study.

Limitations and suggestions for further research

Caution should be exercised when generalising the results of the study in other contexts since data were collected in only one province (Gauteng). The use of a non-probability purposive sampling technique made the study susceptible to sampling bias. However, sampling bias was reduced by collecting data from different regions of Gauteng. Future studies could be conducted using a mixed-methods approach to capture more in-depth information from respondents. The study could be extended to larger businesses since SCM practices, SCA and SCP are all relevant to businesses of various sizes. The study could also be extended to SMEs in other provinces of South Africa that were excluded in the current attempt.

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Authors' contributions

W.V.L.-O. was responsible for the data collection and wrote the literature review section. C.M. wrote the research methodology and results sections and made language additions to the manuscript.

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Data availability

Quantitative data used in this study are available for sharing.

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