

Predictive analytics for supply chain collaboration, risk management and financial performance in small to medium enterprises

C. Mafini & A. Muposhi

ABSTRACT

Small to medium enterprises in emerging markets such as South Africa are continuously embracing supply chain management practices. This has been prompted by the ever-increasing importance of supply chain management as a tool for increasing business competitiveness and success. The purpose of this study was to investigate the connection between supply chain collaboration, supply chain risk management and financial performance in SMEs. Using a quantitative research approach, a survey questionnaire was administered to 243 managers and owners of SMEs in Gauteng Province, South Africa. Application of the Structural Equation Modelling approach to test hypotheses revealed two streams of observations: (1) two supply chain collaboration dimensions, namely supplier trust and supplier communication, predicted supply chain risk management, and (2) supply chain risk management predicted financial performance. These results demonstrate the importance of supply chain collaboration as a tool for improving both risk management practices and financial performance in SME supply chains. The theoretical and practical implications of the results are discussed.

Key words: Supply chain collaboration, supply chain risk management, financial performance, small to medium enterprises, supply chain management

Introduction

Research on small and medium enterprises (SMEs) continues to grow substantially and is mainly attributed to their economic contributions (Thun & Hoenig 2011; El-

Dr Chengedzai Mafini is the Head of the Department of Logistics in the Faculty of Management Sciences. Dr Asphat Muposhi is a senior lecturer in the Department of Marketing in the Faculty of Management Sciences at Vaal University of Technology. E-mail: chengedzai@hotmail.com.

Gohary, Eid & Huang 2013). It is widely accepted throughout the world that SMEs play a significant role in promoting economic growth and employment creation (Van Scheers 2011; Cant & Wiid 2013). In South Africa, statistics indicate that by January 2016, there were an estimated 2.25 million SMEs contributing an estimated 42 percent to the gross domestic product in the country (Statistics South Africa 2016). In terms of representation of SMEs, Gauteng Province accounts for approximately 46 percent of the total number of formal SMEs in South Africa (Statistics South Africa 2016). With respect to the distribution of SMEs per economic sector, a report by the Bureau for Economic Research (2016) indicates that the trade and accommodation sector has the highest number (944 467), followed by community services (305 624), construction (299 242), finance and business services (271 712) with manufacturing (201 459) being placed last. Given that these statistics represent documented SMEs, there are obvious possibilities that the actual numbers could be higher, if the contribution of undocumented enterprises is considered. It is logical then to presuppose that the contribution of SMEs to the South African economy eclipses that of any other category of business enterprises.

To demonstrate its commitment to support SMEs, the South African government formulated and implemented a number of initiatives, legislations and policies. These include, *inter alia*, the 1995 White Paper on SME Development, formation of the Small Enterprise Development Agency, the promulgation of the National Small Business Amendment Act of 2004, creation of the Small Enterprise Finance Agency, Technology and Innovation Agency and the formation of the Department of Small Business Development in 2014 (Bureau for Economic Research 2016). In addition, the Integrated Small Business Development Strategy was developed with a particular focus on providing financial and non-financial support to SMEs (Department of Trade and Industry 2013). However, despite these efforts, a constellation of challenges continue to threaten the survival of SMEs in South Africa (Mafimidiwo & Iyagba 2015). As of 2011, the failure rate of SMEs in South Africa was estimated at 75 percent, with 40 percent folding operations in the first year of operating and 90 percent not surviving beyond a period of ten years (Van Scheers 2011). Statistics further indicate that the SME mortality rate is greater in the manufacturing sector when compared to other sectors (Bureau for Economic Research 2016). For instance, the total number of SMEs in the manufacturing industry dropped from 267 817 in 2008 to 201 459 in 2015, representing an alarming decline of 24 percent (Bureau for Economic Research 2016). In addition, Herrington, Kew, Simrie and Turton (2011) noted the low competitiveness of South African SMEs as reflected by the total entrepreneurial activity (TEA) which fluctuates between 5.9 percent and 10.6 percent. These developments tend to paralyse the efforts by the South African

government to support SMEs and to water down the view that significant resources have been committed toward supporting such enterprises.

The challenges confronting SMEs in South Africa are both internal and external in addition to being multifaceted, since they encompass financial, operational and market-related facets (Fatoki 2014; Van Scheers 2011). In terms of internal factors, it may be argued that SME business failure in South Africa could be attributed to, in part, their inability to embrace and adopt recent/emergent best practices in business such as supply chain management (SCM), business process reengineering, knowledge management and innovation, amongst others. As argued by Salman, von Friedrichs and Shukur (2011) reliance on ineffective business models, demonstrated through functional fixedness, or simply the tendency to rely on traditional methods even when it is clear that change is necessary, is rife in SMEs. As a result, many SMEs are languishing in obsolete business models that could best be discarded if failure is to be averted (Ropega 2011). The adoption of either emerging or disruptive business best practices such as SCM could be a viable panacea to the challenges facing SMEs. As suggested by a number of scholars (Paik 2011; Chin, Abu Bakar, Amran & Rohaizat 2012; Hong & Jeong 2006), the use of SCM yields numerous returns such as lower overhead costs, delivery of ever-increasing customer value, flexibility with superior service, better efficiency, reduced product time to market and increased productivity, amongst others. Open-minded leaders of SME enterprises have since realised that in today's markets, competition occurs between supply chain networks rather than between individual firms (Koh, Demirbag, Bayraktar, Tatoglu & Zaim 2007; Chow, Madu, Kuei, Lu, Lin & Tseng 2008). Therefore, the adoption of SCM practices could form part of the solution to the challenges facing SMEs in South Africa.

The purpose of this study was to investigate the connection between supply chain collaboration (SCC), supply chain risk management (SCRM) and financial performance in SMEs. The study projected the perspective that the linkage between these constructs could unlock the potential to address operational challenges plaguing SMEs in South Africa. This view finds support in the results of a study conducted by Seeletse (2012) which found that SCC significantly improves operational efficiencies and reduces exposure to risk within supply chains, with obvious positive implications on firm financial performance. Besides, there is limited evidence of empirical studies that have sought to examine the interconnection between SCC, SCRM and financial performance within SMEs in South Africa. In fact, SCM research in the context of South African SMEs is still limited, generally, which creates the need for continued research efforts in this area. Thus, this study sought to develop and empirically test a conceptual model that attempts to address these existing research gaps.

The remainder of this article is organised as follows: The next section provides a theoretical overview of the research constructs, namely SCC, SCRM and financial performance. This is succeeded by an outline of the conceptual framework and hypotheses. Thereafter, the article delineates the research methodology employed in the study. The results, limitations and conclusions of the study as well as the managerial implications are presented in the final sections of the article.

Literature review

This section provides a brief theoretical overview of the constructs under consideration in this paper.

Supply chain collaboration

Collaboration is fast emerging as a strategic option in today's highly globalised and competitive supply chains (Cao & Zhang 2011; Hudnurkar, Jakhar & Rathod 2014; Hingley, Lindgreen & Grant 2015). This view has support from SCM scholars (Ramanathan & Gunasekaran 2014; Hingley et al. 2015) who observed a paradigm shift from a transactional to a collaborative operational mode. The main value proposition that drives the trend towards SCC is the synergistic benefit derived from networks between supply chain partners (Bolstorff & Rosenbaum 2012). From an operational standpoint, effective collaboration amongst supply chain partners results in shorter lead times in procurement, production efficiency and joint asset utilisation, which ultimately translates into improved financial performance (Nyaga, Whipple & Lynch 2010; Hudnurkar et al. 2014).

In its application, SCC is a broad concept encompassing joint planning, information sharing, communication, risk management and asset sharing (Fawcett, Jones & Fawcett 2012). It is, however, worth noting that not all collaborative relationships translate into long-term competitive advantage (Fawcett et al. 2012; Ramanathan & Gunasekaran 2014). In order to create sustainable competitive advantage and reduce risk exposure, relationship longevity, trust and communication are considered as critical success factors (Miocevic & Crnjak-Karanovic 2012; Kumar & Nath 2014; Hingley et al. 2015). Thus, as a point of departure, this study directs emphases on how SCC factors assist in risk management and whether they are related to financial performance, which will be discussed in the next section.

Supplier communication

In an era of intensive competition typified by time-based competition, the strategic role of communication in SCC collaboration is widely acknowledged (Wang, Ye &

Tan 2014; Han & Dong 2015). Communication within the supply chain encompasses transparent information sharing on procurement, inventory management, demand and sales forecasting, order processing and technical expertise (Lotfi, Mukhtar, Sahran & Zadeh 2013). In addition, communication reduces uncertainty and opportunistic behaviour, shortens new product development lead times and enables supply chain partners to be more responsive to market needs than competitors (Han & Dong, 2015; Wang et al. 2014). It is, however, important to note that competitive advantage may only be achieved if communication between supply chain partners is genuine, frequent and based on accurate up-to-date information (Miocevic & Crnjak-Karanovic 2012; Teller, Kotzab & Grant 2012). To achieve this, Prajogo and Olhager (2012) emphasised the need for an information-sharing policy and an accurate demand forecasting method. This therefore makes it imperative to ensure that effective information-sharing mechanisms are built into collaboration efforts between supply chain partners.

Supplier trust

Trust is regarded as one of the crucial relational factors that enhances the formation of long-term collaborative cooperation amongst supply chain partners (Yeung, Selen, Zhang & Huo 2009; Kumar & Nath 2014). Collaborative relationships that are embedded in trust engender honesty in information sharing, reduce opportunistic behaviour, exposure to risk and promote innovation amongst supply chain partners (Chen, Daugherty & Landry 2009). In addition, trustworthiness promotes collaborative planning in the supply chain which results in informed demand forecasting, reduction of uncertainty and management of conflicts of interest (Chowdhury 2012). According to Fawcett et al. (2012) trust is affirmed when collaborative relationships go beyond contractual obligations to include knowledge sharing, enhancing skills of supply chain partners and joint strategy formulation. These components must then be embedded in supply chain relationships to ensure that long term trust is developed.

Relationship longevity

Supply chain relationship longevity is a measure of the lifespan of the mutual association between buyers and suppliers (Liu, Luo & Liu 2008). In most markets, sustainable competitive advantages can be achieved by investing in long-term relationships with supply chain partners (Dyer & Singh 1998). In particular, long-term relationships allow supply chain partners to benefit from relationship outcomes such as knowledge and asset sharing (Cao & Zhang 2011). In addition,

a long-term relationship enables supply chain partners to test the robustness and resilience of the collaborative network, reduce operational costs, improve the quality of products and services and superior business as well as supply chain performance (Nyaga et al. 2010). Hence, the benefits of cultivating mutually beneficial long-term relationships with supply chain partners outstrip the risks by wide margins, making it a worthwhile business practice.

Supply chain risk management

In order to survive in a turbulent business environment, supply chain risk management is imperative (Kern, Moser, Hartmann & Moder 2012). Supply chain risk is defined as any factor that inhibits or constrains the free flow of information, raw materials or finished products among supply chain partners (Sodhi, Son & Tang 2012). The sources of supply chain risks are many and multifaceted, and include strategy misalignment, regulatory requirements, changes in consumer preferences and impairment of key assets (Lavastre, Gunasekaran & Spalanzani 2012). Other risks include skills shortages, unreliable suppliers, as well as economic, technological and social factors, as well as information security among others (Blome, Schoenherr & Eckstein 2014). Therefore, the essence of SCRM is that efforts should be directed towards managing each of these risks by minimising their impact on business success (Grose & Richardson 2014).

Financial performance

Financial performance is usually measured using numerous objective indicators such as Return on Investment (ROI), liquidity ratios, profitability ratios and gearing ratios, amongst others (Olawale, Lombard & Herbst 2010). However, subjective views on these indicators can be provided which give a *prima facie* perspective on the financial performance of any entity (Lasher 2010). In the present study, a subjective scale was used to measure financial performance (refer to Appendix A). SCC is linked to financial performance owing to the substantial amount of resources required to build effective long-term relationships (Ertimur & Venkatesh 2010; Huo 2012; Zhao, Feng & Wang 2015). The effect of SCC is two-fold. First, if successfully implemented, SCC will result in supply chain risk reduction, leading to improved financial performance (Huo 2012; Zhao et al. 2015). Conversely, if the collaboration is characterised by opportunistic behaviour, it leads to the increased exposure to risk and uncertainty, which is detrimental to financial performance (Ertimur & Venkatesh 2010). To avoid jeopardising the financial position of the organisation, effective risk management systems should be put in place, to avoid the expectation

that supply chain partners will respond favourably to each other as they collaborate (Zhao et al. 2015).

Hypotheses formulation and conceptual framework

This section discusses the conceptual framework directing this article and the formulation of hypotheses. The conceptual framework and the hypotheses are both based on the literature review. The conceptual framework is presented in Figure 1.

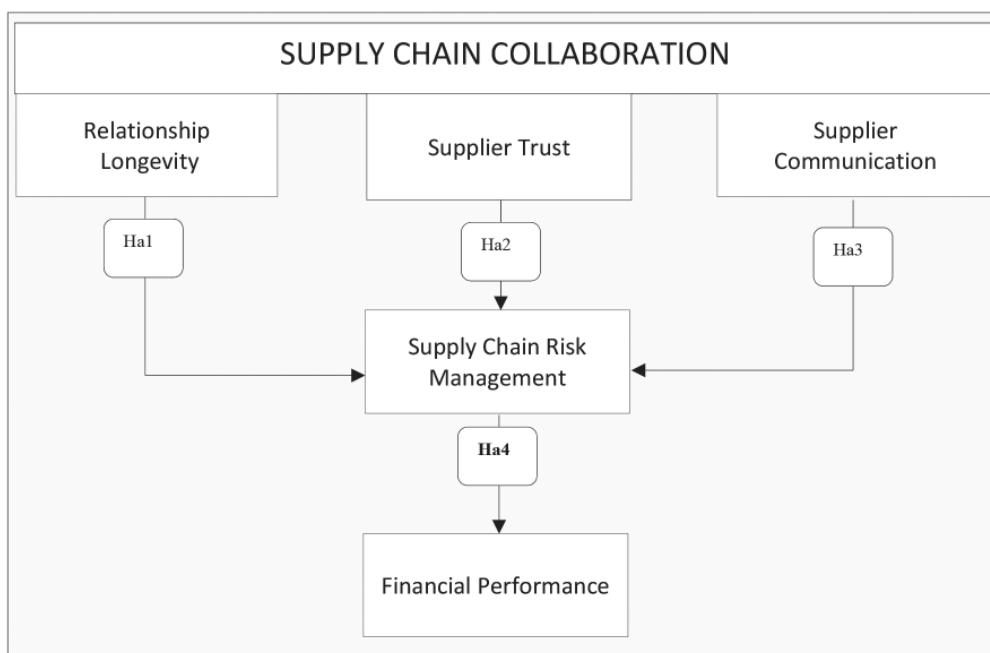


Figure 1: Conceptual Framework for the connection between Supply Chain Collaboration, Supply Chain Risk Management and Financial Performance

Figure 1 suggests that when supply chain partners collaborate in long-term relationships, with long lasting relationships that are characterised by trust and communication as building blocks, exposure to supply chain risk is minimised which ultimately translates into improved financial performance.

Supplier trust

Trust among supply chain partners is a critical component of SCRM (Bala & Kumar 2011; Bianchi & Saleh, 2010). Although the benefits of trust in SCC are evident,

Colquitt and Rodell (2011) note that nurturing and sustaining collaborative trust remains a challenge. This view is supported by Fawcett et al. (2012) who note that relatively few companies have built adequate trust with supply chain members. In a supply chain characterised by the deficit of trust, it is difficult to nurture and sustain collaborative relationships (Richey, Roath, Whipple & Fawcett 2010; Wallenburg, Cahill, Knemeyer & Goldsby 2011). In the absence of trust, partners often take deliberate efforts to block the efficient distribution of information (Miocevic 2016). In addition, Tam and Tan (2015) conclude that in a supply chain devoid of trust, predatory behaviour is rife which results in power asymmetries and exploitation of weak partners by their powerful counterparts. However, despite the challenges associated with establishing trust, the role of trust in reducing risk in the supply chain is widely acknowledged (Liu 2012). Based on the foregoing discussion, it is hypothesised that:

Ho₁: There is no relationship between supplier trust and SCRM.

Ha₁: There is a positive relationship between supplier trust and SCRM.

Supplier communication

Although communication offers a number of advantages to supply chain partners, information is not easily shared within the supply chain (Müller & Gaudig 2011). For instance, a report by Cai, Jun and Yang (2010) suggests that supply chain partners are reluctant to share pertinent information due to the possibility of information abuse. Similarly, Yang and Maxwell (2011) note that information may constitute a significant constraint if partners cannot monitor how such information is used. According to Bala and Kumar (2011), the extent of collaborative trust determines the extent of information sharing. However, Wieland and Wallenburg (2013) opine that if communication is managed effectively, it has the potential to enhance supply chain agility, resilience and reduction in operating risks. Conversely, Hung, Ho, Jou and Tai (2011) argue that the distortion of information exposes supply chain partners to significant risks. The foregoing discussion points to the need for a counter balance between communication and risk management. Thus, it is hypothesised that:

Ho₂: There is no relationship between supplier communication and SCRM.

Ha₂: There is a positive relationship between supplier communication and SCRM.

Relationship longevity

There is consensus among researchers and supply chain practitioners that long-term collaborative relationships have the potential to enhance the efficiency of the supply chain (Hingley et al. 2015; Pauraj, Chen & Lado 2012). However, in order to derive relational competencies, collaborative relationships should be nurtured and must be sustainable (Nyaga et al. 2010). Commitment and trust are more likely to be embedded when supply chain partners commit to work together in the long-term (Dyer & Singh 1998; Mehrjerdi 2009). Additionally, Blackhurst, Dunn and Craighead (2011) underscore that long-term collaborative relationships reduce uncertainty and risks within the supply chain. This leads to the following hypotheses:

Ho₃: There is no relationship between relationship longevity and SCRM.

Ha₃: There is a positive relationship between relationship longevity and SCRM.

Supply chain risk management and financial performance

Poor management of supply chain risks has serious implications for organisational performance. For instance, Lavastre et al. (2012) highlight that poor management of supply chain risks results in uncertainty, cost pressures and unpredictable demand. The following hypotheses are therefore put forward;

Ho₄: There is no relationship between SCRM and financial performance.

Ha₄: There is a positive relationship between SCRM and financial performance.

Research methodology and design

The study commenced with an extensive literature review on the research constructs. Thereafter, a quantitative approach which involves the use of statistical, mathematical, and/or computational techniques to investigate observable phenomena (Mann 2003), was adopted to conduct the investigation. The quantitative approach was appropriate for this research since the study intended to test relationships between different constructs. A cross sectional survey design, in which information is captured to make inferences about a population of interest at a specific point in time (Sedgwick 2014) was selected in the collection of primary data. This type of design was suitable for this study because of its low cost implications and its ability to either prove or disprove hypotheses.

Research sample

Respondents consisted of either owners or managers of SMEs based in the southern part of the Gauteng Province of South Africa. The geographic scope of the study included Heidelberg, Meyerton, Sasolburg, Vanderbijlpark, Vereeniging and surrounding areas. This region was preferred because of its easy accessibility to the researchers and the availability of many SMEs, which are the majority types of business enterprises in the area. To ensure that only those people that are relevant to the study were selected, a non-probability purposive sampling technique was used. Despite its non-probability nature, purposive sampling is also applicable to quantitative research (Teddlie & Yu 2007). To be selected as part of this study, one had to meet a predetermined criterion, which was to be either an owner or manager of an established SME which had been operating for more than five years. To determine the sample size, the approach suggested by Comrey and Lee (1992) which stipulates that 100 = fair, 200 = good, 500 = very good, and >1000 = excellent, was followed.

After administration of the survey, questionnaires from 243 SMEs were used in the final data analysis. Approximately 37 percent of the participating SMEs employed between 51 and 100 people. An estimated 43 percent of these SMEs operated in the retail sector while almost 22 percent were in the manufacturing sector. The majority of the SMEs (52%) had been in existence for periods ranging between six and ten years. Furthermore, most of the SME owner/managers (53%) were aged between 36 and 55 years. Approximately 81 percent of the SME owner/managers were male and at least 42 percent had a tertiary educational qualification.

Data collection procedures and measurement scales

A self-response survey using a structured questionnaire was conducted for the collection of primary data. The surveys were conducted between March and April 2015. Three students studying for a Bachelor of Technology degree in Logistics at a University of Technology based in Southern Gauteng were recruited and trained as research assistants for the collection of data.

Measurement scales were operationalised using previous studies. The measures for relationship longevity were adapted from the work of Aziz and Noor (2013). Measures for supplier trust were adapted from Ketkar, Kock, Parente and Verville (2012). Supplier communication measures were adapted from the work of Vickery, Droge, Stank, Goldsby and Markland (2004) and Hoegl and Wagner (2005). Measures for SCRM were adapted from Tang (2006). Financial performance was measured subjectively using questions adapted from Narver and Slater (1990), Avlonitis and Gounaris (1997), as well as Santos and Brito (2012). Response options

were configured on five-point Likert scales which ranged from strongly disagree to strongly agree for the relationship longevity, supplier trust, supplier communication and SCRM scales. However, the Likert scale for the financial performance scale was anchored by 1= much worse than industry average and 5= much better than industry average. A list of measurement scales used in this study is included in Appendix A.

Data analysis

Demographic details of respondents were analysed using the Statistical Packages for the Social Sciences (SPSS version 23.0). Hypotheses were tested using a structural equation modelling (SEM) approach using the Analysis of Moment Structures (AMOS 23) statistical software.

Reliability and validity

Structural Equation Modeling (SEM) was adopted for both measure validation as well as testing the structural model. The first part of the procedure included conducting a confirmatory factor analysis (CFA) to ascertain the psychometric properties of the measurement scales. Reliability was measured using three indicators, namely the Cronbach alpha coefficient, Composite Reliability and Average Variance Extracted (AVE). A minimum value of 0.7 is expected to endorse the reliability of any scale for the Cronbach alpha as well as the composite reliability (Eisinga, Te Grotenhuis & Pelzer 2013). For the AVE, a minimum value of 0.5 is acceptable for confirmation of reliability (Bagozzi & Yi 2012). In addition, measurement scales were tested for four types of validity, namely face validity, content validity, convergent validity and discriminant validity. Face validity was ascertained by requesting three experts in supply chain management to review the questionnaire. Content validity was ascertained through pre-testing the questionnaire with a convenience sample of 30 respondents, as prescribed by Grim (2010). Convergent validity was measured by checking if the factor loadings were above 0.5 (Gefen, Straub & Boudreau 2000). Discriminant validity was determined by checking whether the Average Shared Variance (ASV) was lower than the AVE for all constructs under consideration in the study (Hair, Black, Babin & Anderson 2010). The results of these tests are provided in Table 1.

Table 1: Accuracy analysis statistics

Research constructs		Descriptive statistics		Reliability tests		CR	AVE	Item loadings	Highest SV
		Mean	SD	Itemtotal	α Value				
Relation-ship Longevity (RL)	RL-1	3.62	1.67	0.566	0.732	0.757	0.534	0.616 ^c	0.174
	RL-2			0.612				0.724 ^c	
	RL-3			0.615				0.820 ^c	
	RL-4			0.519				0.855 ^c	
Supplier Trust (ST)	ST-1	3.74	1.53	0.547	0.777	0.845	0.576	0.635 ^c	0.450
	ST-2			0.535				0.575 ^c	
	ST-3			0.544				0.831 ^c	
	ST-4			0.681				0.712 ^c	
	ST-5			0.616				0.773 ^c	
Supplier Communication(SC)	SC-1	3.51	1.29	0.545	0.802	0.710	0.512	0.893 ^c	0.387
	SC-2			0.672				0.588 ^c	
	SC-3			0.534				0.754 ^c	
	SC-4			0.654				0.513 ^c	
	SC-5			0.517				0.501 ^c	
Supply Chain Risk Management (SCRM)	SCRM-1	4.03	1.44	0.552	0.824	0.734	0.502	0.655 ^c	0.419
	SCRM-2			0.737				0.566 ^c	
	SCRM-3			0.651				0.672 ^c	
	SCRM-4			0.513				0.816 ^c	
	SCRM-5			0.624				0.619 ^c	
Financial Performance	FP-1	3.26	1.31	0.568	0.861	0.755	0.523	0.813 ^c	0.233
	FP-2			0.545				0.847 ^c	
	FP-3			0.561				0.833 ^c	
	FP-4			0.742				0.715 ^c	
	FP-5			0.592				0.883 ^c	
	FP-6			0.634				0.864 ^c	

* Scale: 1 – Strongly Disagree; 4 – Neutral; 5– Strongly Agree
C.R: Composite Reliability; AVE: Average Variance Extracted; S.V.: Shared Variance
^a significance level $p < 0.05$; ^b significance level $p < 0.01$; ^c significance level $p < 0.001$

As reported in Table 1, measurement scales satisfied all recommended thresholds. In terms of reliability, Cronbach alpha and composite reliability values were beyond the recommended 0.7 value while AVE values were higher than the minimum threshold of 0.5. This confirms that all measurement scales as used in this study were reliable. With respect to face validity, the reviewers made some recommendations for improving the questions used and technical issues. Feedback from the pretest was used to eradicate inconsistencies in such areas as interpretation of questions, ambiguity of some words, sensitivity of questions as well as other concerns associated with the administration of the questionnaires. All factor loadings were

above the recommended minimum threshold of 0.5, which confirms the adequacy of convergent validity in this study. Furthermore, the HSV was lower than the AVE for all constructs, which attests to the sufficiency of discriminant validity in this study. Therefore, all measurement scales as used in this study were deemed to be both reliable and valid.

Model fit analysis

As prescribed by Fornel and Larcker (1981) it is necessary to conduct a model fit analysis for both the CFA model as well as for the structural model. The resulting model fit indices are used to establish whether the model is acceptable. The model fit indices used in this study are recommended by a number of authoritative scholars (Browne & Cudeck 1989; Byrne 1994; Hu & Bentler 1995; Kline, 1998; Ullman 2001; Schumacker & Lomax 2004) in the use of SEM. The results of the model fit analysis for both CFA and SEM are provided in Table 2.

Table 2: Model fit analysis

FIT INDEX	Thresholds	Results for CFA	Results for SEM
Chi-Square/ d. f.	≤3	2.245	2.313
CFI (Comparative Fit Index)	≥ 0.9	0.910	0.927
RMSEA (Root Mean Square Error of Approximation)	≤0.08	0.032	0.025
NFI (Normed Fit Index)	≥ 0.9	0.956	0.916
TLI (Tucker Lewis Index)	≥ 0.9	0.983	0.922
IFI (Incremental Fit index)	≥0.9	0.951	0.934
GFI (Goodness of Fit)	≥0.9	0.919	0.920
AGFI (Adjusted Goodness of Fit)	≥0.9	0.936	0.965

Table 2 confirms that for the CFA model, a ratio of chi-square value to degree-of-freedom of 2.245, as well as CFI, RMSEA, NFI, TLI, IFI, GFI and AGFI of 0.910, 0.032, 0.956, 0.983, 0.951, 0.919 and 0.936 were achieved. All of these data fulfilled the approved parameters, which demonstrates the existence of an acceptable fit between the CFA model and the sample data. Prior to testing the proposed hypotheses there was a need to conduct model fit analysis for the structural model. The resulting figures indicated that the ratio of chi-square over degree-of-freedom was 2.313. This value is less than the specified upper boundary of less than 3.0 and,

so confirms the model fit. Moreover, CFI, RMSEA, NFI, TLI, IFI, GFI and AGFI values were 0.927, 0.025, 0.916, 0.922, 0.934, 0.920 and 0.965, which satisfies the approved limits. Thus, the proposed conceptual model converged meaningfully and credibly portrays the structure of the empirical data collected from the sample of SMEs in Gauteng Province, South Africa.

Results of hypotheses tests

Hypotheses were tested using the SEM procedure, to test whether specific paths are significant. The results are provided in Table 3.

Table 3: Results of structural equation model analysis

Proposed Relationships	Null Hypothesis	Alternative Hypothesis	Path Coefficient	Significance P	Decision
RL→SCRM	Ho ₁	Ha ₁	0.021	0.453	Accept null hypothesis
ST → SCRM	Ho ₂	Ha ₂	0.542	0.007	Reject null hypothesis
SC → SCRM	Ho ₃	Ha ₃	0.473	0.034	Reject null hypothesis
SCRM → Financial Performance	Ho ₄	Ha ₄	0.640	0.002	Reject null hypothesis
Note: RL=Relationship longevity; ST= Supplier trust; SC= Supplier communication; SCRM=Supply chain risk management; FP=financial performance $p < 0.05$.					

Statistical evidence provided in Table 3 shows that three out of four null hypotheses were rejected, implying that the proposed associations between the involved constructs were valid. These individual results for each set of hypotheses tests are discussed in greater detail in the next section.

Discussion of results

The aim of this study was to investigate the connection between SCC, SCRM and financial performance within SMEs. To achieve this aim, the study considered the influence of three SCC elements, namely relationship longevity, supplier trust and supplier communication on SCRM, and the influence of the latter on financial performance. In the ensuing discourse, the association between each set of constructs is discussed in terms of the results of the null hypothesis.

The first null hypothesis (Ho₁) was accepted since relationship longevity had an almost negligible and statistically insignificant impact ($r=.021$; $p=.453$) on SCRM. By implication, within SMEs, an increase in relationship longevity exerts a

minimum impact on SCRM or does not predict it. Likewise, the existence of a long lasting relationship between an SME and its suppliers does not necessarily point to the entrenchment of more robust risk management activities within the supply chain by that SME. The current study contradicts previous results (Zomorodi & Fayezi 2010; Loader 2011; Ntayi 2011) that concluded that better lasting relationships lead to enhanced risk management within supply chains. Furthermore, as stated previously, the standpoint in literature on SCM lists improved risk management as one of the paybacks of relationship longevity between supply chain partners (Dwyer, Schurr & Oh 1987; Bensaou 1999; Hoyt & Huq 2000; Duffy 2008).

The results of the present study are surprising, since they deviate from traditionally established patterns. Conceivably, it could be that with South Africa being an emerging market, the dominance of arms lengths (transactional) relationships between trading partners remains an enduring practice. This perspective finds support from Avittathur and Jayaram (2016) who suggest that the tendency to be conservative and to rely on transactional relationships is higher where markets have not yet developed, as businesses seek to hedge themselves from the possibility of business failure. More so, considering that the organisational life span for most SMEs in South Africa is less than five years (Bureau for Economic Research 2016), it is natural to expect buyer-supplier relationships to last for even shorter periods. Relationship longevity is therefore almost an imaginary concept for SMEs in such contexts, given the ever-threatening possibility of business failure in the market.

The second null hypothesis (H_{02}) was rejected since there was a strong positive and statistically significant association ($r=.542$; $p=.007$) between supplier trust and SCRM. This result demonstrates that risk management is likely to improve as buyer supplier trust increases within SME supply chains. Likewise, it is logical to presuppose that SMEs that have established trust with their suppliers also exercise meaningful SCRM practices. In other words, supplier trust amongst SMEs predicts SCRM. Consistent with these results, a number of studies (Ismail & Alina 2010; McDowell, Harris & Gibson 2010; Ismail, Omar & Wei 2015; Mafini, Pooe & Loury-Okoumba 2016) concluded that SME buyer supplier trust has a stimulus effect on risk management activities amongst SMEs operating in various supply chains. Ha, Park and Cho (2011) further stress that buyer-supplier trust has a significant impact on collaboration in information sharing and the sharing of both benefits and risk, which leads to higher supply chain performance. Such sharing of supply chain risk is important to SMEs in South Africa as it shields them from a plethora of threats such as the volatility of the South African rand, an unpredictable socio-political environment, global competitive forces and an unstable industrial relations climate, which relentlessly dominate the South African economic landscape. Thus, the view

that the cultivation of trust between buyers and suppliers may be part of the solution to shield SMEs from these risks is valid.

The third null hypothesis (H_{03}) was rejected on the basis that there existed a moderately positive and statistically significant ($r=.473$; $p=.034$) association between supplier communication and SCRM. This result validates that risk management by SMEs in any particular supply chain is bound to improve whenever communications between these SMEs and their suppliers intensify. The result also makes it rational to assume the existence of effective SCRM initiatives and systems wherever considerable communications exist between SMEs and their supply chain partners. Stated in other words, supplier communication predicts SCRM in SMEs. For supplier communication to be convincing in improving SCRM, there is a need for both the buying and supplying entities to be allowed to articulate their positions without being judged, interrupted or disrespected (Cai et al. 2010). In view of this, supply chain partners have to communicate in order to coordinate the follow of products from suppliers to buyers without interruption. Issues such as contractual obligations and prices, technological adaptations, delivery schedules, market dynamics and other strategic issues have to be discussed until buying and supplying partners develop a common understanding (Oosterhuis 2009). Without this common understanding, no mutual cooperation is likely to occur between the partners, leading to conflict between them.

The fourth null hypothesis (H_{04}) was rejected, based on the existence of a strong positive and statistically significant ($r=.640$; $p=.002$) association between SCRM and financial performance. This result illustrates that the financial performance of SMEs is likely to increase when they strengthen their risk management activities within the supply chain. Based on the results of this study, the perspective that SMEs which have effective risk management systems in place within their supply chains also have superior financial performance is deemed rational. Stated in other words, SCRM predicts financial performance in SMEs. Risk management systems may include forecasting, optimisation, stock management, multi-sourcing arrangements and risk assessments and audits, amongst others (Wieland & Wallenburg 2013). However, since each supply chain is very complex, most of these systems may not be adequate in dealing with supply chain risks, and should be combined with other approaches. An important approach that is usually combined with SCRM is supply chain resilience, which is meant to ensure that a supply chain is able to recover from a risk in the event that the systems in place could not deal with that risk (Durach, Wieland & Machuca 2015). SMEs could therefore benefit immensely by applying the correct risk management systems to their complex scenarios in order to counter effectively the threats presented by each supply chain risk.

A notable result in this study is that supplier trust ($r=.542$) emerged as the strongest predictor of SCRM as compared to relationship longevity ($r=.021$) and supplier communications ($r=.473$). It may be that amongst the three predictor constructs, it is trust that fosters the greatest benefits for SMEs, hence it emerged as the most important predictor of SCRM. For instance, it is only when trust exists between supply chain partners that their relationship can last (Vieira et al. 2013), which places relationship longevity as a possible outcome of supplier trust. Similarly, effective supplier trust can result in increased environmental communications between all stakeholders, including communication with suppliers (Chopra & Meindl 2010). This likewise places supplier communication as a possible outcome of supplier trust. However, the fact that these constructs were placed at the same predictive position in this study only sustains the supremacy of the value that supplier trust adds to risk management activities within SME supply chains. This value comes through various benefits, all which in different ways, facilitate better risk management within supply chains. Examples of these benefits include improved supplier performance, reduced costs, greater transparency in the supply chain and increased sales (Laequuddin et al. 2012; Oh & Rhee 2010). Other benefits include improved efficiency, extra stability in demand, mitigation of pricing volatilities and continuous improvement (Li, Zhao & Qu 2012). Thus, in the context of this study, the greatest impact on SCRM in SMEs originates from supplier trust rather than from relationship longevity and supplier communication.

Limitations and future research possibilities

Several limitations of the current study are hereby acknowledged. The first limitation relates to the rather modest sample size of 243 SMEs that were based in one province (Gauteng) of South Africa. Due to this limitation, not all the research results and implications of this study are universally applicable. In view of this, similar studies could be conducted using enlarged samples drawn from other regions of the country to generate more encompassing results. The second limitation is the dependence on self-report measures of the constructs under consideration. This enhanced the study's susceptibility to self-reporting bias, which is the tendency to under-report behaviours deemed inappropriate by researchers, and the tendency to over-report behaviors viewed as appropriate (Donaldson & Grant-Vallone 2002). The study is also limited in that only three SCC elements were used. Future studies could be conducted using other SCC sub-elements such as *inter alia*, integration, supplier development and technology adoption. Future research could also be conducted using specific industries in order to narrow the results to specific SME segments.

Conclusions, theoretical and managerial implications

The study makes it clear that to remain competitive, SMEs have to prioritise SCC activities to manage and strengthen their risk management activities and improve financial performance. With respect to this study, these activities include two dimensions, namely supplier trust and supplier communication, both of which predict SCRM. However, one dimension, relationship longevity, does not seem to contribute in any meaningful way to risk management within SME supply chains. At the same time, improvements in risk management within SMEs predict their financial performance. The study therefore concludes that SCC positively contributes to SCRM, which in turn, contributes positively to the financial performance of SMEs.

Despite the acknowledged limitations, the study still contributes important theoretical and managerial implications. Theoretically, the study provides current insights on the interplay between SCC, SCRM and financial performance from the context of an emerging market located in Africa, south of the Sahara. This contribution is important, given that SCM in this region is still developing. In doing so, future research endeavours have been provided with yet another additional source of reference, especially where the constructs used in this study are concerned. Overall, the study provides SMEs with information to use in achieving improved risk management and superior financial performance through collaborative activities with suppliers.

Several recommendations are put forward to improve SCC, SCRM and financial performance in SMEs. Partnering with suppliers in analysing costs, managing quality, adopting new technologies and improving business processes could improve trust and relationship longevity (Eckerd & Hill 2012). Supply chain relationships could also be improved by making early payments as a way of demonstrating that suppliers are a priority (Wilding, Wagner, Ashby, Leat & Hudson-Smith 2012). Supplier training should be provided to suppliers to enable them to understand the specific needs of the buying SMEs (Mettler & Rohner 2009). It is further important for SMEs to become more transparent by ensuring that their quarterly and annual reports are available to strategic suppliers (Carr & Kaynak 2007). Monthly supplier newsletters can be created, which contain information that suppliers can use to improve their supply efforts (Marshall 2015). The selection of appropriate communication media is also important, as it determines the overall effectiveness of buyer-supplier interactions (Li, Ye & Sheu 2014). If special attention is paid to these areas, it is likely that collaboration and risk management efforts will lead to better financial performance in SME supply chains.

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Appendix 1

Measurement Scales Used in the Study

Relationship Longevity

Our business expects its relationship with key suppliers to last a long time.

Suppliers see our relationship as a long-term alliance.

We view our suppliers as an extension of our business.

We work with key suppliers to improve their performance in the long run.

Likert Scale: 1= strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Supplier Trust

When making important decisions, our suppliers are concerned about our welfare.

Our suppliers have often provided us with information that has later proven to be true.

Though situations change, we believe that our partners will be ready and willing to offer us assistance and support.

Our major suppliers are good at keeping their promises.

Whenever our suppliers give us advice on our business operations, we know that they are sharing their best judgement.

Likert Scale: 1= strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Supplier Communication

There is intense communication between our business and its suppliers.

There is frequent communication between our business and its suppliers.

A variety of media is used in the communication between our business and its partners.

Information shared between our business and its suppliers is reliable.

Likert Scale: 1= strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Supply Chain Risk Management

Our business uses inventory optimisation to manage risk.

Our business uses alternative sourcing arrangements to manage risk.

Insurance arrangements are in place as a contingency measure for risk.

Risk assessments and audits are regularly conducted to manage risk.

Regular awareness campaigns and training programs are used to manage risk.

Likert Scale: 1= strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Financial Performance

Value of annual profits

Ability to meet financial obligations

Capacity to make regular financial investments

The value of assets versus the value of liabilities

Ability to make more profit than other similar business (relative profit)

Company savings

Likert Scale: 1= much worse than industry average; 2= worse than industry average; 3=neutral; 4=better than industry average; 5=much better than industry average
