

THE INFLUENCE OF SUPPLY CHAIN NETWORKS, FLEXIBILITY AND INTEGRATION ON THE PERFORMANCE OF SMALL AND MEDIUM ENTERPRISES IN THE SOUTHERN GAUTENG, SOUTH AFRICA

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—Abstract —

Competitive challenges in the modern business environment have resulted in the need for organisations to integrate business processes strategically across other business units within the supply chain network. The study examines the influence of supply chain network, flexibility and integration on the SMEs business performance in the Southern Gauteng region. A quantitative research survey was conducted among 401 SMEs owners/managers. SPSS 22.0 was used to analyse the data. AMOS 22.0 was used to perform confirmatory factor analysis. Structural path modelling (SEM) was conducted to assess the proposed model fit and to test the statistically significant relationship of the hypothesis. The research study results revealed that supply chain network, flexibility and integration positively influence SMEs business performance. This study contributes new knowledge to the existing literature by providing a research framework that can enhance SMEs performance and also provide practical recommendations based on the research findings for SMEs and for future research. Furthermore, as one of the first studies addressing the influence of supply chain network, flexibility and integration on the performance of SMEs in the Southern Gauteng region, in South, it has generated new insights and outlines strategic reasons for SME owners and managers to improve on their business relationships across the value chain.

Key Words: *Supply chain, networks, flexibility, integration, performance*

JEL Classification: L1

1. INTRODUCTION

Supply chain has become a source of competitive advantage within organisations especially for its role it plays in creating customer value and business growth (Martinsen & Bjorklund, 2012). As a management activity, supply chain has the propensity to enhance operational, market and financial performance of an organisation (Narasimhan & Talluri, 2009). Supply chain is a link that connects independent organisations together for creating value in products or services to satisfy the customer's needs. Hence, a careful integration of supply chain and supply chain flexibility can improve small and medium enterprises' (SMEs) performance, create value, and generate capital into a business. However this can only happen with careful implementation of supply chain networks and flexibility among SMEs as firms no longer compete as independent entities, but rather as integral parts of supply chain links, and the ultimate success (performance) of a firm depends on its managerial ability to integrate and coordinate its supply chain strategy (Hartmann & Grahl, 2012). A successful integration of supply chain strategy can improve a firm's supply chain performance by reducing costs, increasing efficiency and providing better service to customers (Martinsen & Bjorklund, 2012). However, the management of supply chain strategy is a complex task which requires a clear understanding of the influence of supply chain networks, their flexibility and integration (Golicic & Davis, 2012).

SMEs are the major focus of this study. Within the South African economy, the small and medium enterprise sector is a subset of the small, medium and micro enterprises (SMMEs), and it is referred to as a separate, legal and distinct owner-managed entity (KNC & Associate, 2002:3). The definition provided by South Africa's National Small Business Amendment Act (26 of 2003) is used to describe SMEs in South Africa and defines an SME as a small enterprise, which constitutes fewer than 50 employees, with an annual turnover of between R2 million and R25 million; and a medium enterprise as a business with between 50 and 200 employees, with an annual turnover of between R4 million and R50 million. In South Africa, SMEs constitute 95 per cent of the total business of both in the formal and informal sectors (Soontiens, 2002). SMEs, therefore, are an important segment and driver of economic growth in South Africa and as a result, government, co-operate bodies, and institutions are placing emphasis on innovative SMEs research and development (Oke, Burke & Myers, 2007; Nielsen & Thomsen, 2009). Therefore, the purpose of the study is to determine the influence of supply chain networks, flexibility and supply chain integration on the performance of SMEs in Southern Gauteng, South Africa.

2. THEORETICAL REVIEW, HYPOTHESIS AND RESEARCH FRAMEWORK

2.1 Supply chain networks and SMEs performance

Supply chain networks involve the collection and extraction of information about competitors, competitive environment and competitive strategies, with the aim of winning and maintaining competitive advantages of enterprises (Zha & Chen, 2009). Researchers have indicated that supply chain networks can enable SMEs to be more competitive and increase performance to customers as well as improving their organisational performance (Harland, Caldwell, Powell & Zheng, 2007; Bayraktar, Demirbag, Koh, Tatoglu & Zaim, 2009; Chin, Hamid, Rasli & Baharun, 2012). SMEs can gain strategic business skills through communication exchange among organisations within the supply chain network, which may further enable SMEs leverage limited resources and skills efficiently and effectively (Rabinovich, Knemeyer & Mayer, 2007; Barnes & Liao, 2012). The results emanating from supply chain network directly influence SMEs performance, for example, increased revenue growth, reduce time to market, lower cost and improved customer satisfaction (Hakansson & Ford, 2002). Therefore, supply chain networks enable SMEs reach the maximum level of competitive advantage and performance. This study, therefore, proposes that:

H1: *Supply chain networks have a significant positive influence on SMEs performance.*

2.2 Supply chain networks – flexibility and integration

Supply chain flexibility is defined as an attribute of a system's technology or organisation's ability to cope with uncertainty, and to adapt or respond to changes (Tachizawa & Gimenez, 2010). Supply chain flexibility is also required to face its environmental needs and expectations without incurring excessive costs, time, organisational disruptions and performance losses (Sanchez & Perez, 2005; Gong, 2008; Gosling, Purvis & Naim, 2009). Quick responses to customer's orders are the reason for the implementation of supply chain networks in competitive environments and as a result, organisations seek to enhance supply chain flexibility through their business strategy (Zhang, Vonderembse & Su Lim, 2003; Choy, Chow, Tan, Chan, Mok & Wang, 2008).

In the emerging global markets with technological networks, both researchers and practitioners of supply chain network believe that gaining competitive advantage is no longer achieved through a single organisation working in isolation but

through a network of inter-organisational relationships (Hammervoll, 2011; Albino, Dangelico & Pontrandolfo, 2012; Li, Ragu-nathan, Ragu-nathan & Rao, 2012; Wu, Chuang & Hsu, 2014). While this may be true, the backbone connecting and aligning all the logistical activities within the functional areas of SMEs and across the entire supply chain network in ensuring that objectives and set goals are achieved is the most difficult part of any business strategy process (Chen, Preston & Xia, 2012). Enhancing flexibility within a supply chain network requires a well-organised and planned integrated strategy of all functional activities so that the whole process of supplying and delivering to customers is efficient and effective (Kim, 2009; Flynn, Huo, & Zhao, 2010). A plan to implement supply network relationship into the business strategy can also mean a plan to implement flexible strategies that are well integrated to keep up with competitors (Droge, Vickery & Jacobs, 2012; Williams, Roh, Tokar & Swink, 2013). Therefore, it is hypothesised that:

H2: *Supply chain networks have a significant positive influence on SMEs supply chain integration.*

H3: *Supply chain flexibility has a significant positive influence on SMEs supply chain integration.*

2.3 Supply chain flexibility and SMEs performance

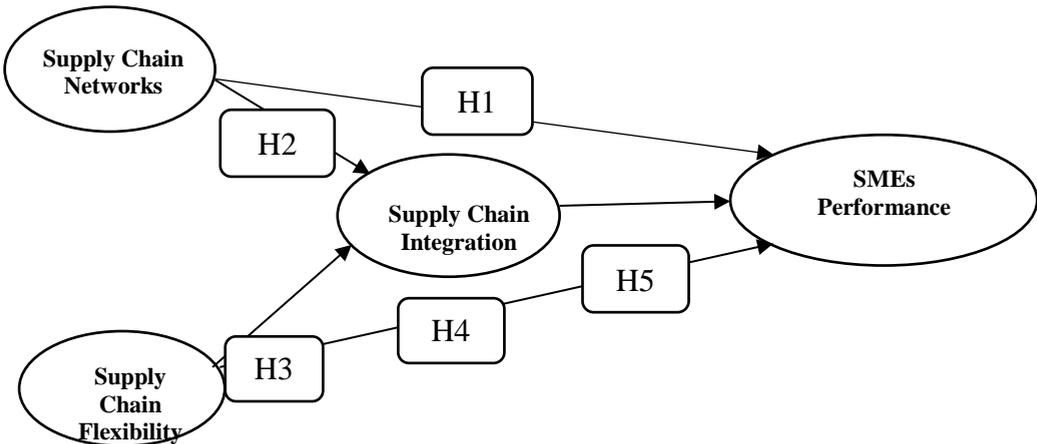
Different strategic processes to achieving business performance have been researched on, for example, setting goals and objective, managerial structure as well as culture and procedural strategies which has a direct influence on SMEs performance (Garengo, Biazzo & Bititci, 2005; Li, et al. 2006; Braunscheidel & Suresh, 2009; Wu et al. 2014). However, a rigid or a strict vision and objectives that restrict the SMEs to operate in one direction may have a negative effect on the performance of SMEs as the set business objectives may provide inflexibility when flexibility may be needed. In today's business competitive environment, flexibility is needed to respond to market uncertainty, changing customer requirements and expectations without incurring excessive costs, time, organisational disruptions and performance losses (Sanchez & Perez, 2005; Shang & Marlow, 2005). Supply chain flexibility aids SMEs use of limited resources efficiently and effectively, cope with the emerging technological challenges as well as global business competitive challenges (Zhang et al. 2003; Tachizawa & Gimenez, 2010). The study, therefore, hypothesises that:

H4: *Supply chain flexibility has a significant positive influence on SMEs performance.*

H5: *Supply chain integration has a significant positive influence on SME performance.*

The proposed conceptual framework showing the hypothesised relationship between the research variables is presented in Figure 1.

Figure 1: Conceptual framework showing the hypothesised causal relationships



3. RESEACH METHODOLOGY

3.1 Sampling and data collection

The study is located within a quantitative research paradigm. A questionnaire was constructed to test the influence of supply chain networks, flexibility and integration on supply chain performance among SMEs. The study was undertaken in the Southern Gauteng region, specifically in Vereeniging, Vanderbijlpark and Meyerton. Out of the 500 SMEs that were randomly selected for the study, a total of 401 questionnaires were completed and used for data analysis.

3.2 Measuring instrument

The questionnaire was divided into four sections, namely supply chain networks, supply chain flexibility, supply chain integration, and supply chain performance. The research scales were adopted mainly based on previous works. Minor adaptations were made in order to fit the research context and purpose. Supply chain networks measuring items were adapted from Kenny and Fahy (2011). Flexibility measuring items were adapted from Merschmann and Thonemann (2011), while integration measuring items were adopted from Narasimhan and

Kim (2002). Lastly, the overall supply chain performance measuring items were adopted from Green, Whitten and Inman (2012). All the measurement items were measured on a seven-point Likert scales to express the degree of agreement, with one being strongly disagree, to seven being strongly agree.

4. ANALYSIS OF RESULTS

Confirmatory factor analysis (CFA) was conducted using maximum likelihood (ML) extraction using the Analysis of Product Moment Structures (AMOS) 23.0 programme to check whether the model satisfactory fits the data. ML was used in the study as this method is tolerant to violations of the assumptions of non-normality (Olsson, Foss, Troye & Howell, 2000). The following goodness-of-fit measures were considered as a guide to an acceptable model fit: chi-square/degree of freedom (< 3.0), goodness of fit (GFI) > 0.90 , incremental fit index (IFI) > 0.90 , Tucker- Lewis index (TLI) > 0.90 , comparative fit index (CFI) > 0.90 , and standard root mean square error of approximation (RMSEA) < 0.08 (Hu & Bentler, 1999). These results are reported under Table 2 which shows a satisfactory fit of the data to the measurement model.

4.1 SMEs Profile

The majority of the SMEs have been in business between 5-7 years ($n=132$; 32.9%) and some have been in operation for 11 years and more ($n=113$; 28.2%). The profile also indicated that the majority of the SMEs have annual sales between R1 million to R5 million ($n=145$; 36.2%) and also have physical assets worth less than R4 million ($n=166$; 41.4%). The distribution of the number of employees in the participating SMEs indicated that more than half of the SMEs employ fewer than 50 employees ($n=216$; 53.9%) followed by those SMEs who employ between 50-99 employees ($n=131$; 32.7%). The SMEs participants were managers ($n=213$; 53.1%) and owners ($n=188$; 46.9%) respectively.

4.2 Reliability

Table 2 provides the results of the reliability analysis. The internal consistency (reliability) of the measuring items was assessed using the Cronbach's alpha coefficient which ranged from 0.742 to 0.945. These values indicate satisfactory internal consistency of α value > 0.7 (Johnson & Christensen, 2012). Further, the composite reliability values are greater than the recommended value of 0.7 (Kern, 2011), which ranged from 0.835 to 0.942.

4.3 Validity

4.3.1 Convergent validity

Convergent validity was assessed to check if the four factors; supply chain networks, flexibility, supply chain integration and SMEs performance loaded highly on their respective factors. According to Vinzi, Chin, Henseler and Wang (2010), the recommended factor loadings for convergent validity should be above 0.5. As indicated in Table 2, the factor loadings are all above the recommended value ranging from 0.617 to 0.904. This indicates acceptable individual item convergent in the validity of all scale items. Further, convergent validity was also examined using the composite reliability (CR) value for each construct, which should be greater than 0.7 (Kern, 2011). In Table 2, the composite reliability estimate exceeds 0.7 providing adequate evidence of convergent validity.

Table 2: Results of the reliability and item statistics

Research constructs		Descriptive statistics		Cronbach's test	AVE	CR	Factor loading	Maximum SV
		Mean	Std. deviation	Item-total α Value				
Supply chain network	I _{SCN-1}	5.10	1.390	0.581	0.895	0.591	0.895	0.232
	I _{SCN-2}	4.98	1.316	0.746				
	I _{SCN-3}	5.08	1.287	0.779				
	I _{SCN-4}	5.07	1.325	0.789				
	I _{SCN-5}	5.02	1.362	0.726				
	I _{SCN-6}	4.86	1.533	0.713				
	I _{SCN-7}	5.12	1.464	0.653				
Supply chain flexibility	I _{SCF-4}	5.55	1.106	0.755	0.872	0.560	0.835	0.349
	I _{SCF-5}	5.61	1.140	0.710				
	I _{SCF-6}	5.78	1.103	0.632				
	I _{SCF-8}	5.76	1.220	0.605				
Internal integration across the supply chain	I _{IAS-1}	5.09	1.272	0.655	0.909	0.538	0.902	0.349
	I _{IAS-2}	5.11	1.152	0.702				
	I _{IAS-3}	5.14	1.166	0.760				
	I _{IAS-4}	5.38	1.209	0.692				
	I _{IAS-5}	5.28	1.223	0.723				
	I _{IAS-6}	5.20	1.268	0.774				
	I _{IAS-7}	5.22	1.180	0.718				
	I _{IAS-8}	5.27	1.245	0.624				
SMEs performance	I _{SBP-1}	5.46	1.193	0.739	0.945	0.700	0.942	0.288
	I _{SBP-2}	5.48	1.035	0.823				
	I _{SBP-3}	5.53	1.046	0.837				
	I _{SBP-4}	5.57	1.035	0.854				

Research constructs	Descriptive statistics		Cronbach's test		AVE	CR	Factor loading	Maximum SV
	Mean	Std. deviation	Item-total	α Value				
I _{SBP-5}	5.52	1.072	0.848				0.904	
I _{SBP-6}	5.62	1.027	0.824				0.854	
I _{SBP-7}	5.65	1.045	0.805				0.813	

SCN= Supply Chain Network; SCF= Supply Chain Flexibility; IAS= Integration across Supply Chain; SBP= Small Business performance; C.R.: Composite Reliability; AVE: Average Variance Reliability; MSV: Maximum Shared Variance; Scores: 1=Strongly Disagree; 2=Disagree; 3=Slightly Disagree; 4=Neutral; 5=Slightly Agree; 6= Agree; 7=Strongly agree. Measurement CFA model fits criteria: CMIN/DF= 2.690; NFI=0.906, TLI=0.929, CFI=0.938, IFI=0.939, RMSEA=0.065.

4.3.2 Discriminant validity

Component correlation matrix was the first method used to check the discriminant validity of the research constructs. This was done by assessing whether the component correlation matrix among the construct was less than 1.0. In Table 3, the inter-correlation values for all paired latent variables are less than 1.0 and which indicate the existence of discriminant validity. Correlation value of SBP and IAS is 0.373, SCN and IAS is 0.420, SCN and SBP is 0.278, SCF and IAS is 0.492, SCF and SBP is 0.402, and SCF and SCN is 0.395 provides evidence of discriminant validity as the research constructs were not highly correlated (>0.80) (Khosrow-Pour, 2006). Further, the square roots of average variance extracted (AVE) and maximum shared variance value (MSV) was used to determine discriminant validity of the research constructs. According to Bearden, Netemeyer and Haws (2011), all construct average variance extracted estimations should be larger than the maximum shared variance (MSV). In Table 2, all the corresponding average variance extracted (AVE) are higher or above the maximum shared variance (MSV) for all the research constructs, hence providing further evidence of discriminant validity.

Table 3: Correlation between constructs

COMPONENT	1 IAS	2 SBP	3 SCN	4 SCF
1 IAS	1.000	.373	.420	.492
2 SBP	.373	1.000	.278	.402
3 SCN	.420	.278	1.000	.395
4 SCF	.492	.402	.395	1.000

SCN=Supply Chain network; SCF=Supply Chain Flexibility IAS=Integration across Supply Chain; SBP=SMEs Performance or Small Business Performance.

4.4 Hypotheses testing results

It was hypothesised that there is a positive relationship between the research construct measuring supply chain networks, flexibility, supply chain integration and SMEs performance. Table 4 shows the causal paths and hypotheses. The critical ratio (C.R.–values) are all above 1.96 indicating statistical significant at the level of 5 percent (Lei & Wu, 2007). Further, the model fit indices showed a good fit of the structural model to the data. The model fit indices are reported under table 4.

Table 4: Results of structural equation model analysis

Causal Path	Hypothesis	Path Regression Coefficients	S.E.	C.R.	p-value	Significance Level
SBP <--- SCN	H1 (+)	.156	.051	3.085**	.002	Accepted at p<0.05
IAS <--- SCN	H2 (+)	.253	.049	5.219*	***	Accepted at p<0.001
IAS <--- SCF	H3 (+)	.479	.065	7.408*	***	Accepted at p<0.001
SBP <--- SCF	H4 (+)	.456	.074	6.140*	***	Accepted at p<0.001
SBP <--- IAS	H5(+)	.150	.071	2.102**	.036	Accepted at p<0.05

Structural equation model fits criteria: CMIN/DF= 2.451; NFI=0.917, RFI=0.901, TLI=0.939, CFI=0.949, IFI=0.949, RMSEA=0.060. *significant at p<0.001 ** significant at p<0.05.

5. DISCUSSION

The first hypothesis (**H₁**) posited that supply chain networks have a significantly positive influence on SMEs performance. This hypothesis was supported with a direct effect (path coefficient = 0.156, t-value = 3.085, p < 0.05). The majority of the participating SMEs in this study believe that supply chain networks can enhance their competitive capability to survive through efficient use of business resources and effective implementation of innovative ideas. The majority of the SMEs also attest to the fact that supply chain network serves as an opportunity to gain access into market in the industry and market in another industry. Nevertheless, supply chain network capabilities and skills are still a challenge for most of the SMEs. This was theoretically supported by Thakkar, Kanda, & Deshmukh (2008), Antonio, Richard and Tang (2009), stating that indeed supply networking may be challenging for SMEs because of the capabilities and skills that are needed when developing relationships, as well as the fear of information

revolution, increasing global competition, which creates more demanding customers.

The second hypothesis (**H2**) posited that supply chain networks have a significantly positive influence on SMEs supply chain integration. The hypothesis was supported (path coefficient = .253, t-value = 5.219, $p < 0.001$). Although, supply chain network improves the performance efficiency of the SMEs, supply chain network also involves formulating and implementing integrated logistics-related strategies in order to manage product delivery effectively to customers within the organisation as well as across the supply chain. A high level of supply chain integration allow SMEs to differentiate themselves from competitors. This was affirmed by (Flynn *et al.* 2010:59, Kim 2009:328), stating that a well-organised and planned integrated strategy positively influences the operational activities involved in supplying and delivering products and services to customers throughout the supply chain.

The third hypothesis (**H3**) posited that supply chain flexibility has a significantly positive influence on SMEs supply chain integration. The hypothesis is supported (path coefficient = 0.479, t-value = 7.408, $p < 0.001$). The participated SMEs agreed that the relationship between flexibility and integration is important. This indicates that those SMEs who are able to implement supply chain flexibility and supply chain integration internally and across the supply chain has the propensity to compete better and respond faster than their rivals. This was supported by Wong, Boon-itt and Wong (2011), whose study affirmed that SMEs supply chain flexibility requires integrated information systems that connect all members within the supply chain for it to improve cost-efficiency, profit, healthy collaborative relationships, customer satisfaction, and superior supply chain performance.

The fourth hypothesis (**H4**) posited that supply chain flexibility has a significantly positive influence on SMEs performance. The hypothesis is supported (path coefficient = 0.456, t-value = 6.140, $p < 0.001$). This relationship revealed that supply chain flexibility is an important competitive strategy among SMEs due to reliable delivery of products and services, improved customer service level as well as agile responsiveness to changing customer demands and needs that arise. However, supply chain flexibility acceptance is rated higher than supply chain network, which also stipulates competitive challenges among SMEs. This is also supported by Thakkar *et al.* (2008:122) whose study affirm that supply

networking practices among SMEs are not strong compared to the larger organisations.

The fifth hypothesis (**H5**) posited that supply chain integration has a significantly positive influence on SMEs performance. The hypothesis is supported (path coefficient = 0.150, t-value = 6.140, $p < 0.001$). In this study, supply chain integration was the heart of the relationship model between supply chain network, flexibility and SMEs performance but also a dependent variable. This suggested that SMEs strategic goals and objectives should embrace the emerging strategic developmental changes resulting from supply chain network and its flexibility to achieve high levels of competitive performance. Narasimhan and Kim (2002) concurs that though strategic integration plays a big role in enhancing business performance, supply networking and flexibility are the strategic forces that trigger SMEs motives to improve on their internal integration mechanisms and thereby resulting in higher levels of business performance.

6. RECOMMENDATIONS

The research findings indicated that the ongoing supply chain network relationship among SMEs may be less effective if not strategically integrated to enhance performance. This suggests that SMEs existing networking relationships should be developed through a strategic intervention approach leading to further enhancement and strengthening of SMEs collaborative network skills. This will also strengthen SMEs integration strategy between customers and suppliers, and may also attract SMEs to embrace the importance of supply chain network. The intervention approach may begin by developing groups of supply chain networking SMEs within the sub-region of Southern Gauteng where important information on effective business management strategy challenges are shared and thereby aid a better understanding and implementation of supply chain network and business performance. Awarding competition programmes for SMEs networking ability would play a strategic role in boosting SMEs supply chain networks integration and also promote SMEs collaborative relationship with larger organisations. This will lead to cost reduction in operation costs and risk, improve SMEs product quality, enhance smooth product and service flow and improved SMEs business strategy techniques.

7. LIMITATIONS AND IMPLICATIONS FOR FUTURE RESEARCH

In this study SMEs were the focus of research. Further study on the research topic could be extended to larger organisations. The study was undertaken in the

Southern Gauteng region of South Africa, but does not fully represent all the regions where SMEs in South Africa are located. Consequently, the study findings cannot be generalised to all SMEs. Furthermore, because the study relied on quantitative method of data collection, the data collected through a questionnaire may have been affected by the participated SMEs state of business relationships at the time of filling the questionnaire. In this case, qualitative or longitudinal method of data collection is recommended for any further research on supply chain network, flexibility and integration influences on SMEs performance. This will help to reflect on changing competition benefits, performance and challenges of SMEs supply network, flexibility and integration strategy over time. Furthermore, data triangulation incorporating both qualitative and quantitative method of research is also recommended in order to gain more insight into the research topic.

8. CONCLUSION

For SMEs to compete successfully within the rival environment, they need to understand and implement the right business strategies. This study revealed that positive significant relationships exist between supply chain networks, supply chain flexibility, supply chain integration and SMEs performance, which further confirm the proposed research conceptual framework for SMEs business performance. This study also suggests to both SMEs owners and government or policy makers in South Africa the importance of supply chain network relationship for SMEs business performance and economic growth. The research model, however, provides some insights and directions for SMEs supply chain performance researchers.

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