E-PROCUREMENT, SUPPLIER INTEGRATION AND SUPPLY CHAIN PERFORMANCE IN SMALL AND MEDIUM ENTERPRISES IN GAUTENG PROVINCE

by

Jeremiah Madzimure

Student number: 216073618

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PROMOTER: Prof. M. Dhurup

CO-PROMOTER: Prof. C. Mafini

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DEDICATION

This project is dedicated to:

Edith Mugabe Madzimure, my late mother, whose encouragement and dedication to strive for the best in life has taken me to this destination. She is my hero and there are no words to express my gratitude to my humble late mother who always tolerated and encouraged me to become a successful man. Her wise words will live with me until we meet again.

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed……

Date……

STATEMENT 1

This dissertation is being submitted in fulfilment of the requirements for the degree of Doctor Technologiae: Business.

STATEMENT 2

The dissertation is the result of my own independent work/ investigation, except otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is appended.

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I hereby give consent for my dissertation, if accepted, to be available for photocopying and for interlibrary loans and for the title and summary to be made available to outside organisations.

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ABSTRACT

The purpose of this study was to investigate the relationship between e-procurement, supplier integration and supply chain performance in Small and Medium Enterprises (SMEs) in the Gauteng Province of South Africa. Most studies on e-procurement, supplier integration and supply chain performance have focused on large companies. Current knowledge involving SMEs and e-procurement is still limited. This study, therefore, was conducted to fill this gap. With rapid changes in technology and globalisation of markets, firms, especially SMEs, need support to adapt to technology and make use of e-procurement functions to compete with larger firms.

The paradigm used in this study was post-positivism. A quantitative research approach was adopted in this study. The target population for this study consists of all owners and managers who are currently employed in SMEs in the Gauteng Province, South Africa.

To measure the study constructs, the survey material was designed in the form of a structured questionnaire. Participants were asked to complete three test instruments, namely, an e-procurement questionnaire, supplier integration questionnaire and supply chain performance questionnaire as well as their profile and SME profile. A total number of 350 questionnaires was distributed to the identified sample of SME owners and managers of which 294 responded and finally 283 questionnaires were usable and used for data analysis.

The confirmatory factor analysis (CFA) was performed to establish scale accuracy. All measures conformed to acceptable model fit and composite reliability (CR) and revealed that the scales used in this study are reliable. The reliability results confirmed that all constructs reached the generally agreed upon minimum scale range for Cronbach's alpha of 0.70. Finally, the structural model was tested; four out of seven hypotheses were supported. Validity in this study was achieved through face, content, convergent and discriminant validities.

The principal finding of this study reveals that e-design has a positive and significant linear relationship with supplier integration. In addition, the results showed that e-sourcing has a positive and insignificant linear relationship with supplier integration. The insignificant relationship could be indicative of the fact that enterprises are not fully utilising the e-procurement systems in selecting their suppliers to effectively improve their collaboration with supply chain member firms. The findings further reveal that e-negotiation has a positive and significant linear relationship with supplier integration. The study's empirical findings also indicate that e-evaluation has a negative and insignificant relationship with supplier integration. Further, e-informing was also found to have a negative relationship with supplier integration. The study

additionally revealed that supplier integration has a positive and significant linear relationship with tangible supply chain performance. Lastly, the SEM findings show that supplier integration has a positive and significant relationship with the intangible supply chain performance.

After reviewing the results, the conclusion was drawn that theoretically, this research has contributed to literature by providing additional information on supply chain management, e-procurement, supplier integration and supply chain performance. The results presented provide useful information about the relationship between e-procurement, supplier integration and supply chain performance in SMEs, with implications for supplier firms and other relevant stakeholders. These results contribute to the expanding body of knowledge on supply chain aspects. The current study added practical value by developing an integrative model which might be used by SME practitioners in South Africa. The study recommends that the collaborating firm owners and managers consider increasing the levels of supplier collaboration by having regular meetings, training workshops or courses and conferences to improve their supply chain performance. Furthermore, it is recommended that SME owners and managers must effectively implement e-design systems to increase the chance of integrating with their suppliers, thereby increasing the chance of improving performance as well as cutting supply chain costs. Areas for further research and limitations for this study have also been highlighted.

Key-words: E-procurement, supplier integration, supply chain performance, SMEs, South Africa.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

3PL	3rd Party Logistics
4PL	4th Party Logistics
AGFI	Adjusted goodness-of- fit statistic
AMOS	Analysis of moment structures
ANOVA	Analysis of variance
AVE	Average value extracted
B2B	Business to Business
B2C	Business to Consumer
BU	Business Unit
CA	Cronbach's Alpha
CFA	Confirmatory factor analysis
CFI	Comparative-fit-index
CPFR	Collaborative Planning Forecasting and Replenishment
CR	Composite reliability
CRM	Customer Relationship Management
CSCMP	Council of Supply Chain Management Professionals
df	Degrees of freedom
E- BUSINESS	Electronic Business
EAI	Enterprise Application Integration
E-DESIGN	Electronic Design
EDI	Electronic Data Interchange
E-EVALUATION	Electronic Evaluation
EFT	Electronic Funds Transfer
E-INFORMING	Electronic Informing
E-MRO	Electronic Maintenance, Repair and Operations
E-NEGOTIATION	Electronic Negotiation

E-PROCUREMENT	Electronic Procurement
ERP	Enterprise Resource Planning
ESI	Early Supplier Involvement
E-SOURCING	Electronic Sourcing
GFI	Goodness-of-fit index
H	Hypothesis
HR	Human Resources
IDD	Integrated Demand Planning
IFI	Incremental fit index
IT	Information Technology
ITC	Information Technology and Communications
ITL	Institute of Transport and Logistics
JIT	Just in Time
KMO	Kaiser-Meyer-Olkin
KPI	Key Performance Indicator
LT	Lead Time
MM	Materials Management
MSA	Measure of sampling adequacy
n	Sample size
N	Target population size
NFI	Normed-fit index
OD	Organisational Design
OGC	Office of Government Commerce
P	Path coefficient
PDM	Physical Distribution Management
POS	Point of Sale
R & D	Research and Development

RFID	Radio Frequency Identification
RMSEA	Root mean square error of approximation
RSC	Retail Supply Chain
SA	South Africa
SC	Supply Chain
SCC	Supply Chain Council
SCI	Supply Chain Integration
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SCP	Supply Chain Performance
SEM	Structural equation modelling
SI	Supplier Integration
SMEs	Small and Medium Enterprises
SMREs	Small and Medium Retail Enterprises
SPSS	Statistical package for social sciences
SRM	Supplier Relationship Management
TLI	Tucker-Lewis index
US	United States
VMI	Vendor-Managed Inventory
WIP	Work-in-Progress
χ^2	Chi-square value

CHAPTER 1
INTRODUCTION AND PROBLEM ORIENTATION

1.1 INTRODUCTION

With the effect of globalisation, e-procurement and supply chain integration have become paramount to the success of procurement and supply chain management especially to Small and Medium Enterprises (SMEs) in a developing country context such as South Africa. It has been commonly accepted that information infrastructures such as e-procurement functions have become increasingly connected and embedded with other infrastructures such as supply chain integration to iniate the growth of SMEs (Vaast & Walsham 2017:547). In line with this notion, the usage of various e-procurement functions as well as integration with suppliers timeously may result in positive supply chain performance of a firm and is also considered as an innovation strategy action (Mishra & Agarwal 2010:249).

This thesis focuses on the relationship between e-procurement, supplier integration and supply chain performance in SMEs. This chapter provides the background and motivation for the study. The problem statement is discussed, and the objectives are specified including the hypotheses. The theoretical and conceptual framework is highlighted. The paradigm perspective of the research is given. Thereafter, the context and the setting in which the research took place and the research approach used, is described.

1.2 BACKGROUND TO THE STUDY AND MOTIVATION

In South Africa, Small and Medium Enterprises (SMEs) play a critical role in the country's economy. SMEs contribute to approximately 50 percent of the country's Gross Domestic Product (GDP) and up to 60 percent of the overall employment in South Africa (Abor & Quartey 2010:225). SMEs play a crucial role in creating employment in an economy (Doern 2009:279). Over the past decade, many SMEs have shifted to the use of the Internet in business in the quest for efficiency and effectiveness (Makien, Kahkonen & Lintukangas 2011:61; Basheka, Oluka & Mugurisi 2011:535; Fernandes & Vieira 2015:588). SMEs are also important driver of the economy (Ahmad & Alaskari 2014:477). Moreover, SMEs play a very important role in supply chain management (SCM) as they may serve as producers, distributors, retailers as well as customers (Maiga 2016:2). Therefore, it is not surprising that SMEs are the backbone of most economies in the world, including South Africa.

With rapid changes in technology and globalisation of markets, firms, especially SMEs, need support to adapt to technology and make use of e-procurement functions to compete with larger firms. SMEs undertake efforts to compete on multiple fronts, which include implementation of e-procurement and supplier integration to improve supply chain performance (Maiga 2016:1). The five forms of e-procurement, namely: e-sourcing, e-design, e-informing, e-negotiation and e-evaluation have emerged as important elements of e-procurement in the supply chain management field. E-procurement is increasingly recognised as an effective tool to reduce purchasing costs and streamline processes. To continually succeed in the market, especially SMEs, the e-procurement concept has become vital, as competition is no longer among firms but among supply chains as well. The other benefits of e-procurement to a firm include reducing order cycle times (Tatsis, Mena, Van Wassenhove & Whicker 2006:68; Gunesekaran & Ngai 2008:159; Liu, Sun, Wang & Zhao 2011:53); expanding supplier bases (Moon 2005:61); reducing paper work (Gunesekaran & Ngai 2008:170); eliminating order errors (Zheng, Bakker, Knight, Gilhespy, Havard & Walker 2006:290; Mettler & Rohner 2009:25); productivity and/or service improvement (Gunasekaran, McGaughey, Ngai & Rai 2009:161); improving effectiveness of purchasing process (Panayioutou, Gayilas & Tatsiopoulos 2004:100) and reduction of purchase department size and number of functional areas involved in the purchasing process (Ronchi, Brun, Golini & Fan 2010:132).

This study focused on SME retail owners and managers since it is a major contributor to technical innovation and new product developments (Ou 2016:89). Moreover, the retail and wholesale sector contribute a third to the national GDP (Dennis & Piatti 2015:31; Sibindi & Aren 2015:201). It therefore warrants that small retail businesses are essential for the growth of the South African economy (Schmidt, Mason, Bruwer & Aspeling 2017:20) and this in turn create the need to conduct a study in this very important sector of the economy.

Apart from discussing the background of the study, this chapter also deliberates on the theoretical framework, the problem statement, research objectives, and formulation of hypotheses, research methodology, ethical considerations and chapter classification.

1.3 THEORETICAL FRAMEWORK

The research theory, e-procurement, SMEs in South Africa, supplier integration and supply chain performance are briefly discussed in this section.

1.3.1 Research theory

The theoretical rationale underpinning this study is the Configuration Theory (Miller 1986:233). According to Sinha, Kingshuk, Van de Ven and Andrew (2005:389), the Configuration Theory

allows for detailed examination of the dimension of supply chain integration and performance. This theory is appropriate because it can handle complicated organisational phenomena from a holistic perspective. The configuration approach involves dominant gestalts or configurations of observable characteristics or behaviours that may lead to an outcome (Ward, Bickford & Leong 1996:599). The Configuration Theory indicates the need to consider organisational arrangements, that is, configurations, to obtain high performance. Therefore, this study considers the combination of e-procurement elements and supplier integration as the configuration of organisational resources to obtain better organisational performance.

1.3.2 E-procurement

One of the developments in contemporary supply chain management is e-procurement (Chirchir, Ngeno & Chepkwony 2015:26). E-procurement refers to an information technology (IT) based business model that facilitates the necessary processes conducted between business parties in a procurement transaction (Smart 2010:423; Tai 2011:5398). Similarly, McCue and Roma (2012:58) define e-procurement as the use of information technology to facilitate business-to-business purchase transactions for materials and services. It is clear from these two definitions that e-procurement is not merely a system for making purchases online but a *link between customer and supplier.*

E-procurement activities include: enterprise resource planning (ERP); e-maintenance, repair and operations (E-MRO); e-sourcing; e-tendering; e-reverse auctioning; e-informing and e-market-places (Smuts, 2008:38). According to McCue and Roma (2012:62), tools such as e-notice, e-auction, e-catalogue, e-dossier, e-submission and e-signatures are components of e-procurement. In this study, e-sourcing, e-design, e-informing, e-negotiation and e-evaluation and supplier integration are considered as the processes through which e-procurement contributes to supply chain performance. For this study, e-design refers to the "setting of purchasing requirements on an electronic procurement system" (Chang, Tsai & Hsu 2013:35). E-procurement if maintained properly will allow the company to establish and maintain competitive advantages and reduce staff time and paperwork (Tai 2011:5397).

1.3.3 Small and Medium Enterprises in South Africa

The National Small Business Act No. 26 of South Africa 1996, as amended in 2003, defines an Small and Medium Enterprise (SME) as "a separate and distinct entity including co-operative enterprises and non-governmental organisations managed by one owner or more, including its branches or subsidiaries if any, is predominantly carried out in any sector or subsector of the

economy mentioned in the schedule of size standards and can be classified as an SME by satisfying the criteria mentioned in the schedule of size standards". According to the National Small Business Act No. 26 of South Africa 1996, as amended in 2003, in the Government Gazette (Republic of South Africa 2003:8), a small enterprise in South Africa is one that employs 50 people or less and has a total turnover of up to R19m, with a total asset value of R3m. A medium enterprise employs from 50 up to 200 people and has a total turnover of R39m with a total asset value of R6m. This study focused on Small and Medium Enterprises (SMEs).

1.3.4 Supplier integration

Supplier integration refers to the process of interaction and collaboration between the firm and its suppliers to ensure effective flow of supplies (Flynn, Hou & Zhao 2010:58; Zhao, Huo, Selen & Yeung 2011:372). Zhao, Huo, Flynn and Yeung (2008:371) state that many organisations across the globe are creating co-operative, mutually beneficial partnerships with supply chain partners, due to increasing global competition (Zhao, Huo, Flynn & Yeung 2008:371). These authors further state that companies need to implement supply chain integration to meet the new challenges of the global competitive environment.

SMEs constantly face the problem of on-time delivery (Zhao, Feng & Wang 2015:166). Through integration with suppliers, SMEs share order and inventory information with suppliers. Furthermore, supplier integration which includes proper communication, sharing information and working together with suppliers, can reduce upstream complexity (Zhao *et al*. 2015:167-168). The benefits of supplier integration are that it enhances responsiveness, flexibility and time-saving. Supplier integration also plays a role in reducing transaction costs through the reduction of uncertainties and reducing of production costs (Flynn, Hou & Zhao 2010:58). Therefore, supplier integration has a positive impact on operational performance (Yu, Chavez, Feng & Wiengarten 2014:683). In supplier integration, opportunistic behaviours are greatly reduced under shared visions and co-operative goals (Wong, Tjosvold & Yu 2005:782; Prajogo, Oke & Olhanger 2015:102).

1.3.5 Supply chain performance

Supply chain performance is defined as the performance of various processes included within the firm's supply chain function (Srinivasan, Mukherjee & Gaur 2011:268). One of the key aspects of successful supply chain performance is co-operation and mutual decision making between trading partners (Botta-Genoulaz, Campagne, Llerena & Pellegrin 2010:834; George, Williams & Henthrone 2011:231). Companies try to improve their industrial performance in terms of cost,

delays, adaptability, variety and traceability. Collaboration practices and information exchanges between partners become essential within any supply chain, as they contribute to performance (Sakka & Botta-Genoulaz 2009:1). An effective performance measurement is essential for supply chain performance because it provides the basis to understand the system as well as information about the results of system efforts to supply chain partners (Bhagwat & Sharma 2007:54; Chen, Yang & Li 2007:524). Overall, supply chain performance is recognised as an important factor for improving competitive advantage (Amaratunga & Baldry 2002: 218; Das, Narasimhan & Talluri 2006:203; Chang *et al.* 2013:35).

1.4 PROBLEM STATEMENT

Most studies on e-procurement, supplier integration and supply chain performance have focused on large companies (Chang *et al.* 2013:38). Current knowledge involving SMEs and e-procurement as well as supplier integration in developing countries such as South Africa is still limited, which creates a need for further research to occupy this research gap (Boehmke & Hazen 2017:163). Furthermore, the South African (SA) government is increasingly adopting and encouraging e-procurement in SMEs. This is in line with the objectives of the National Development Plan (NDP) vision 2030, which include innovation, employment creation and the adoption of technology as mechanisms for the economic development of the country (Zarenda 2013:5). The South African government is eager to develop and streamline SME operations since SMEs make an important contribution to the economy. The relationship between e-procurement, supplier integration and supply chain performance in SMEs in South Africa has not been fully investigated (Zheng, Bakker, Knight, Gilhespy, Harland & Walker 2016:290). Many SMEs have been investing in IT infrastructure over the past few years to automate and streamline their internal business processes. Although these enterprises have been successful in maintaining inventories, their ordering systems and customer management still lack the ability to leverage the real power of inter-connectivity and integration with their suppliers to improve their supply chain performance (Zhao *et al.* 2011:368).

Although there are studies dedicated to SMEs and e-procurement in countries like the USA, Ireland, Finland, Australia and Malaysia (Fatoki 2014:27), literature does not provide any structured research about this subject in the context of South Africa, more specifically in the Gauteng region.

SMEs in developing countries face countless challenges ranging from technology, globalisation, liberalisation, poor networking amongst the important players in the market and stiff competition from established firms (Gumboh & Gichira 2015:225). These challenges inhibit collaboration

among supply chain partners and consequently affect SME performance. The lack of appropriate technology has been cited as impediment to SME collaboration, innovation and growth. Therefore, the most persistent challenge to greater supplier integration is lack of adequate information systems. Insufficient information system support is a barrier since collaboration is essentially information based. Therefore, in the current climate of global supply chain competition, supplier integration is regarded as a prerequisite for winning performance (Njagi & Ogutu 2014:191).

Although e-procurement and supply chain performance has been studied in specific industries such as health, hospitality, manufacturing, service and technology-based industries (Njagi & Ogutu 2014:191), research focusing on SMEs retail sector is minimal (Zhao, Feng & Wang 2015:166). Such gaps are addressed through research. This study intended to bridge these gaps by investigating the relationship between e-procurement and supplier integration and supply chain performance in SMEs in the Gauteng Province.

The past decade (2008-2018) has seen a growing interest in the strategic importance of integrating suppliers as well as implementing e-procurement. Whilst there have been studies conducted to provide more insight into these areas (e-procurement and supply chain performance), there remains a need for more understanding of the notion and practice between these constructs as increasing competition puts pressure on firms. Furthermore, the empirical investigation of the impact of these antecedents on SME performance has received little attention (Georgise, Thoben & Seifert 2014: 1; Pooe & Mahlangu 2017:238).

1.5 OBJECTIVES OF THE STUDY

In this study, the objectives are classified into the following categories, namely: the primary objective, theoretical objectives and empirical objectives.

1.5.1 Primary objective

The main objective of this study is to investigate the relationship between e-procurement, supplier integration and supply chain performance in Small and Medium Enterprises (SMEs) in the Gauteng Province of South Africa.

1.5.2 Theoretical objectives

To achieve the primary objective, the following theoretical objectives were formulated for the study:

To review the literature on supply chain management and how it relates to SMEs;

To review the literature on e-procurement elements such as e-sourcing, e-design, e-informing, e-negotiation and e-evaluation and the nature of the relationships of these variables to supply chain performance;

To conduct a literature study on supplier integration toward supply chain performance;

To conduct a literature synthesis on supply chain performance.

1.5.3 Empirical objectives

The study addresses the following empirical objectives:

To determine the influence of e-design on supplier integration in the SME sector;

To determine the influence of e-sourcing on supplier integration in the SME sector;

To determine the influence of e-negotiation on supplier integration in the SME sector;

To establish the influence of e-evaluation on supplier integration in the SME sector;

To determine the influence of e-informing on supplier integration in the SME sector;

To assess the influence of supplier integration on tangible supply chain performance in the SME sector;

To assess the influence of supplier integration on intangible supply chain performance in the SME sector;

To develop a framework for the design and implementation of e-procurement, supplier integration and supply chain performance-related initiatives in the SME sector.

1.6 THE CONCEPTUAL FRAMEWORK

The conceptual framework is provided in Figure 1.1. This highlights the proposed linkage between the constructs under investigation in this study.

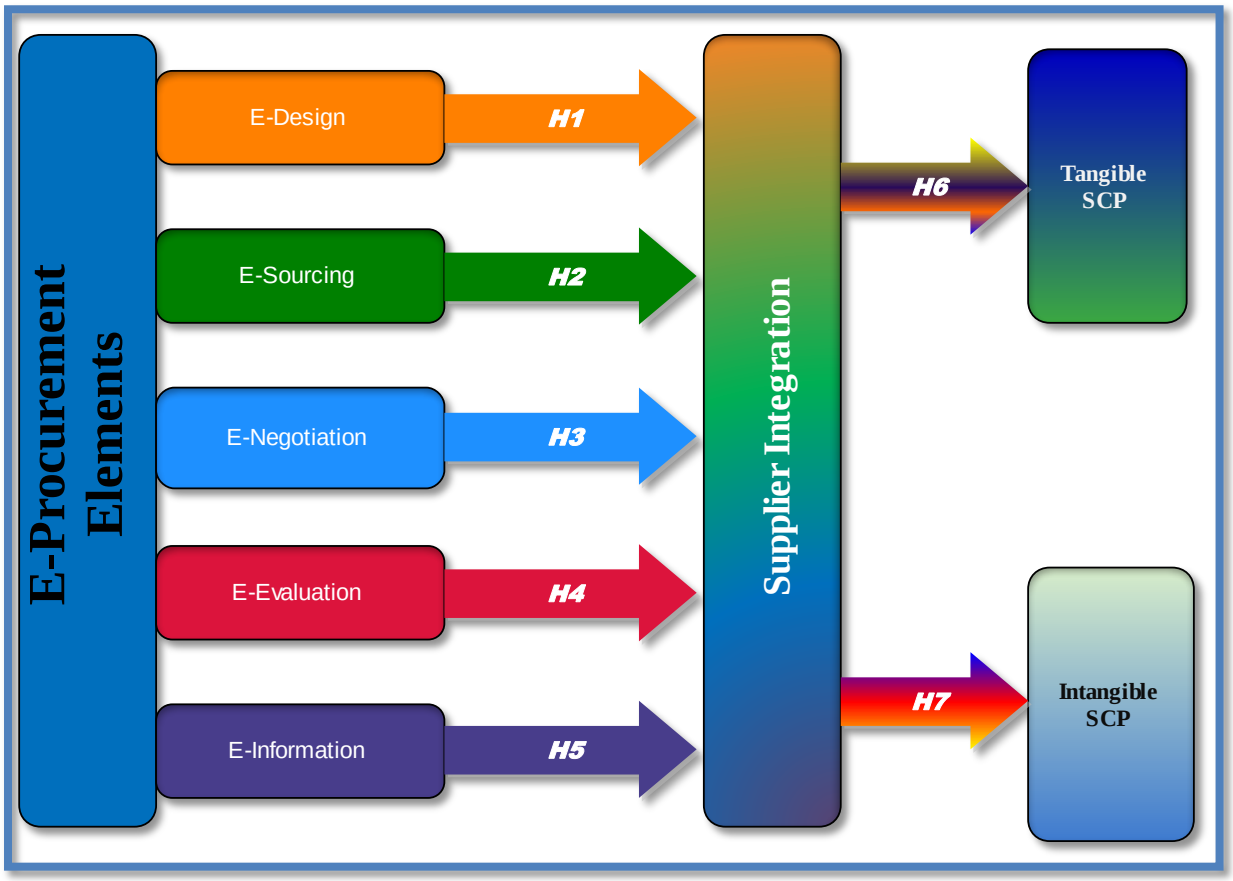


Figure 1.1: Conceptual framework

1.7 HYPOTHESES

Based on the conceptualised research framework, the following seven hypotheses were developed:

H1: E-design positively influences supplier integration in the SME sector.

H2: E-sourcing positively influences supplier integration in the SME sector.

H3: E-negotiation positively influences supplier integration in the SME sector.

H4: E-evaluation positively influences supplier integration in the SME sector.

H5: E-informing positively influences supplier integration in the SME sector.

H6: Supplier integration positively influences tangible supply chain performance in the SME sector.

H7: Supplier integration positively influences intangible supply chain performance in the SME sector.

1.8 RESEARCH METHODOLOGY AND DESIGN

1.8.1 Research design

The appropriate paradigm for this study was post-positivism. Post-positivism reports experience, in this case, the surveys as data. It also advocates methodological pluralism and assumes that the method to be used in a study should be selected based on the research question being addressed (Wildemuth 1993:450). Since a post-positivist paradigm was selected, a quantitative research approach was adopted in this study. According to Borrego, Douglas and Amelink (2009:54), a study of the relationship of cause and effect among constructs is well suited to a quantitative research strategy. As this study assessed the relationships between e-procurement, supplier integration and+ supply chain performance, it was appropriate to use a quantitative approach. A cross-sectional survey design was adopted in this study to determine the opinions of owners and managers in SMEs. A cross-sectional survey design is one which involves a descriptive study of a situation at one specific point in time. It offers advantages such as allowing researchers to collect a large amount of information quickly and usually a cross-sectional study is inexpensive, hence making it fit for this study.

1.8.2 Sampling design

Sampling design refers to a provision of a plan for a quantitative description of trends, attitudes or opinions of a population by studying a sample of that population (Creswell 2013:435). The sampling design for this study consisted of the target population, sampling frame, sample size and sampling approach and technique.

1.8.3 Target population

Schindler (2010:8) defined target population as an entire group of items that allows data to be sourced and investigated. Neumann (2006:224) defined target population as the specific pool of subjects that the researcher is interested in studying. The target population in this study consisted of all retail owners and managers of SMEs in Gauteng Province, South Africa. The retail owners and managers were chosen mainly because the study assume that they could provide information the researcher was looking for. Apart from that, the researcher also thought that these people have experience working with suppliers and in e-procurement sections.

1.8.4 Sampling frame

The sampling frame refers to a set of elements from which a researcher can select a sample of the target population (Kumar 2011:163). The sampling frame for this study was unavailable since there was no single list of SMEs in the Gauteng Province. This study mainly focuses on retail owners and managers, operating within SMEs in Gauteng. Since no established database could be found, the business telephone directory was used as a starting point to come up with a list of SMEs in Gauteng. Telephone calls were made to establish whether these businesses were still in existence, if they qualified to be SME business enterprises in terms of the definition and whether they would grant permission to conduct the study in their organisations.

1.8.5 Sample size

The sample size for this study was based on the historical evidence approach. Studies by Pearcy, Parker and Giunipero (2008:628); Flynn *et al.* (2010:62); Danese and Romano (2011:223); Ombat (2015:708) and Chirchir *et al.* (2015:31) were considered in determining the sample size. These studies used sample sizes ranging from 97 to 617. Therefore, the sample size for this study was set at n=350. More details and/or justification on the determination of the sample size are provided in Chapter 5, Section 5.6.2.2.

1.8.6 Sampling approach and techniques

Robinson, Skarmeas and Spyropoulou (2006:595) define sampling as the process of selecting a few elements from the targeted population. Sampling is necessary in research because in most cases, it is difficult to investigate the whole population. In view of this, sampling is used in the search for typicality and is linked to external validity or generalisability (Kumar 2011: 165). In other words, in research, samples are used to draw conclusions about populations from which they are drawn. A non- probability sampling technique in the form of the convenience sampling technique was used. The convenience sampling technique was used because there was no sampling frame. Additionally, use of this technique offers several advantages such as cost-effectiveness and the fact that it is very easy to carry out with few rules governing how samples should be collected, which was important to this study.

1.8.7 Measurement instrument

Data was collected through a survey questionnaire. The questionnaire used in this study consists of four sections. All measurement scales were measured using five-point Likert-type scales,

anchored by 1= strongly disagree and 5=strongly agree. All questions were closed-ended. Further details about the measurement instrument (questionnaire) are provided in Chapter 5, Section 5.7.

1.8.8 Data collection method and procedure

Questionnaires were distributed by the researcher, who was assisted by three trained field workers. A period of three months (May, June and July 2017) was set aside for administering and collecting the data.

1.9 STATISTICAL ANALYSIS

Data were analysed using descriptive and inferential statistics. The respondents' biographic information and the composition of the sample were analysed using descriptive statistics in the form of frequencies and charts. The other constructs were analysed using the Statistical Package for Social Sciences (SPSS version 24.0) for Windows and the Analysis of Moment Structures (AMOS version 24.0).

1.9.1 Confirmatory factor analysis (CFA)

Confirmatory factor analysis (CFA) was conducted using the Analysis of Moment Structures (AMOS), version 24.0 to assess psychometric properties of the measurement scales. Three parameters, namely reliability, validity and model fit were considered.

1.9.1.1 Reliability

Reliability measures the quality of the research instrument used, in this case, the research questionnaire (Sarantakos 2005:88). Reliability in this study was ascertained using Cronbach's Alpha Coefficient, the Average Variance Extracted (AVE) and Composite Reliability (CR). For the Cronbach's Alpha Coefficient and the CR, the recommended values should be greater than or equal to 0.70 for each scale (Babbie 2013:49). According to Fraering and Minor (2006:284), the minimum acceptable value for the AVE for each scale is 0.50. Accordingly, these thresholds were applied in this study. A pilot study was also conducted to ascertain the reliability of the measurement instrument. According to Sarantakos (2005:256), a pilot study is a small-scale replica and a rehearsal of the main study. Further details regarding the reliability analysis are provided in Chapter 6.

1.9.1.2 Validity

Validity refers to the degree to which evidence supports any inferences a researcher makes, based on the data (McKinney 2011:6). In this study, four validities, namely face, content, convergent and discriminant validities were measured. To ensure face validity, the research study used several experts in supply chain management to judge the questions independently. To ascertain content validity, a pilot study was conducted with a conveniently selected sample of 42 respondents, as recommended by Wade and Love (2006:135). To ascertain convergent validity, the factor loadings for each item were checked. Most of the values were over 0.50 with few very close to 0.5 and were accepted. Discriminant validity was ascertained by assessing whether correlations between constructs are positive (Litwin 2005:135). Further details regarding validity are reported on in Chapter 6.

1.9.1.3 Model fit

Model fit refers to the extent to which a hypothesised model is consistent with the data (Pallant 2007:195). In this study, model fit was ascertained by using the following indices: Chi-square/degrees of freedom, Comparative fit index (CFI), Incremental fit index (IFI), Tucker-Lewis index (TLI) and Root Mean Square Error of Approximation (RMSEA). The acceptable thresholds should be equal to or higher than 0.90 for Chi-square/degrees of freedom, CFI, IFI, TLI and RMSEA values should be equal to or less than 0.08 (Lysons & Farrington 2012:586).

1.9.2 Structural equation modelling (SEM)

Path modelling (Structural Equation Modelling) was used to estimate the relationships among the constructs. SEM was conducted to test the validity of the proposed model and the hypotheses, by using the AMOS 24.0 statistical software programme. The purpose of structural equation modelling is that it aims to obtain estimates of the parameters of the model, that is, the factor loadings, the variances and the co-variances of the factors as well as the residual error variances of the observed variables. The other purpose is to assess the fit of the model, that is, to assess whether the model itself provides a good fit to the data (Hox & Bechger 2007:356). The measurement of model fit was done using the following indices: Chi-square/degrees of freedom, CFI, IFI, TLI and RMSEA, using the same thresholds to those applied in the CFA.

1.10 ETHICAL CONSIDERATIONS

Research ethics refer to the principles of conduct governing an individual or group and concern for what is right or wrong, good or bad (Lysons & Farrington 2012:655). In this study, three

research ethics principles were considered, namely informed consent, confidentiality and anonymity as well as permission to conduct the study.

1.10.1 Ensuring participants have given formal consent

Informed consent means the researcher must emphasise the importance of accurately informing participants about the nature of the study and the respondent must provide a written or verbal consent to participate in the research study (Babbie 2013:39). Participants were not forced to participate. Participants were also told that participation may be terminated at any given time with no adverse consequences should they wish not to continue with the study (completing the questionnaire). All respondents signed a formal consent form before completing the questionnaire.

1.10.2 Ensuring confidentiality and anonymity

Information provided by participants or respondents was treated with utmost confidentiality and anonymity. The names of respondents did not appear on the questionnaire or data since anonymity was promised to all respondents. The informed consent forms were kept apart from the questionnaires collected to avoid linking the data (Sarantakos 2005:21). The data was securely stored by the researcher and no one else has access to the data.

1.11 CHAPTER CLASSIFICATION

CHAPTER 1: Introduction and problem orientation

This chapter deals with the introduction and general context of the study. It includes, amongst others, the background of the study, problem statement, primary objectives, theoretical and empirical objectives, conceptual framework, research methodology, data analysis and ethical considerations.

CHAPTER 2: Supply chain management

This chapter provides the overview of literature focusing on supply chain management in the SMEs within South Africa and beyond.

CHAPTER 3: E-procurement

This chapter deals with literature related to e-procurement. In particular, the various e-procurement elements under consideration in this study, namely: e-sourcing, e-design, e-information, e-negotiation and e-evaluation are discussed.

CHAPTER 4: Supplier integration and supply chain performance

This chapter provides an in-depth description of supplier integration and supply chain performance.

CHAPTER 5: Research methodology

This chapter covers the research design and methodology. It provides details of the quantitative methodology used in the study. This chapter also outlines the sampling design, the population and sample, data collection process, data collection tool (questionnaire) and ethical considerations. A subsection on data analysis and analysis of the psychometric properties of the instrument form part of this chapter.

CHAPTER 6: Data presentation, interpretation and analysis

This chapter presents the results and findings of the study, presenting tables of computed statistics and graphs depicting results. The chapter also provides an analysis and interpretation of the findings. All the analyses and interpretations are made in relation to the research objectives, hypotheses as well as the literature reviewed in Chapters 2, 3 and 4.

CHAPTER 7: Summary, conclusions and recommendations

Based on the results, findings and discussion presented in Chapter 6, this chapter provides a conclusion in relation to the stated research objectives, focusing on the relationship between e-procurement, supplier integration and supply chain performance in SMEs. This chapter also provides recommendations based on the literature reviewed, the primary as well as secondary data gathered throughout the study. Limitations of this research and suggestions for future research are also highlighted in this chapter.

1.12 SUMMARY OF THE CHAPTER

This chapter serves as a road map for the entire study. The definition of SMEs within the South African context was defined, the nature of the study constructs, namely, e-procurement, supplier integration and supply chain performance have been highlighted. The conceptual framework indicating the causal relationships between study constructs, research hypotheses, study objectives, target population, the significance of the study and methodology were provided. Lastly, the classification of chapters was outlined.

The next chapter discusses the concept of supply chain management.

CHAPTER 2
SUPPLY CHAIN MANAGEMENT

2.1 INTRODUCTION

Chapter 1 provided a brief overview of the background, problem statement, objectives of the study as well as the conceptual framework and the research process, with reference to e-procurement, supply chain management, supplier integration and supply chain performance as the main concepts for this study. In this chapter, a comprehensive literature study on various aspects pertaining to supply chain management is undertaken. The focus of this chapter is on the conceptualisation of supply chain management. This chapter discusses the supply chain management definitions, functions and roles in business. The objectives and the importance of the supply chain are discussed. Different types of supply chains are also deliberated upon. The retail supply chain and the supply chain operations reference (SCOR) model are elaborated on. In addition, the drivers and benefits of supply chain management are also highlighted. Finally, the supply chain characteristics and supply chain requirements conclude this chapter. The next section conceptualises supply chain management.

2.2 CONCEPTUALISATION OF SUPPLY CHAIN MANAGEMENT

Supply Chain Management (SCM) has become one of the primary key success factors to deal with increasing complexity of the current business envirnonment (Manuj & Sahin 2011:511; Serdarasan 2013:533). The world in which we live can best be described as ever-changing. With a burgeoning population and changing needs, businesses have been strained as never before. Present day consumers are more aware of their value expectations than ever (Ross 2011:94). Supply Chain Management (SCM) is often leveraged as a mechanism for obtaining and sustaining competitive advantage in a constantly changing marketplace (Taljaard 2005:527; Branch 2009:211; Stentoft 2017:113). Therefore, organisations have become more demand-driven and customer focused. Thus, technology is critical in SCM because it provides rapidly accessible information to all supply chain partners.

SCM evolved in the 1980s and ushered in a new era of business competition (Cannella, Dominguez & Framinan 2017:123; Modrak & Soltysova 2017:341). This was a direct result of great economic changes at the time for the global economy and an increasingly uncertain business environment (Sanders 2012:115). The other reasons for the SCM existence were because of

industrial relationships that became increasingly complex over the last decades (Kurbel 2013: 221). One other factor driving the growth of SCM has been the massive change in the capability and availability of information technology (Chopra & Meindl 2016:2). These technologies provided rapidly accessible information to all parties. New technologies have also played a key role in the aforementioned evolution of supply chains (Cozmiuc & Petrisor 2018:1). Another significant factor was greater customer affluence and sophistication, resulting in greater customer demand for a wide choice of quality goods and services (Sanders 2012:178). The Internet and other technologies such as EDI accelerated this change by empowering customers. Therefore, advances in information technology, transportation methods and greater customer empowerment created a rise in SCM. Furthermore, the SCM concept has been stimulated by integrated logistics.

Many companies are implementing SCM to increase profit and customer satisfaction (Hugos 2011:2). According to Wisner, Tan and Leong (2012:217) and Sanders (2012:3), to understand SCM, one must begin with a discussion of the supply chain. Many researchers have attempted to define supply chain and supply chain management scholarly. There is no universally agreed definition of supply chain and supply chain management. Therefore, definitions from different scholars are explored below.

Sanders (2012:3) and Banyai, Banyai and Illes (2017:1) define a supply chain as the network of all entities involved in producing and delivering a finished product to the final customer. This includes, amongst others, manufacturing, producing, storing goods in warehouses, order entry and tracking, distribution and delivery to the final customer. According to Lysons and Farrington (2006:92) and Li (2014:99), a supply chain refers to the network and linkages of many organisations working together to improve the flows of material and information from the supplier to the end user. This definition is also agreed upon by Monczka, Handfield, Guinipero and Patterson (2016:13) who define a supply chain as a set of organisations associated with flows of products, services, finances and information down to the final consumer. Therefore, from these definitions above, a supply chain consists of key flows:

Physical flow of materials;

Information flow that informs the supply chain; and

Resources (especially finance, people and equipment) which help the supply chain to operate effectively. Furthermore, not all resources in the supply chain are tangible, for example, a good quality intercompany relationship is often cited as a highly important ingredient of effective supply chains.

According to Li (2014:3) and Christopher and Ryals (2014:29), a supply chain has four stages, namely: the supply network, the internal supply chain, distribution systems and the end users. Davis (1993:36) and Sanders (2012:6) acknowledge that there are two critical flows in any supply chain. Firstly, the material flow, which refers to the flow of physical goods from suppliers through the distribution centres to stores. Secondly, information flow means the flow of demand data from end customer back to purchasing and to suppliers, and supply data from suppliers to the retailer, so that material flow can be accurately planned and controlled. Sales information is shared on a real-time basis, which leads to less uncertainty and less safety stock (Hines 1994:16; Sanders 2012:7). The sharing of real-time information serves to compress or shorten the supply chain from a time stand-point. The result of this more timely and accurate information is a reduction in the amount of inventory carried throughout the supply chain (Christopher 2011:83). Thus, the greatest opportunities for meeting demand in the market-place with a maximum of dependability and a minimum of inventory come from implementing integration between material and information flow across the supply chain. These flows are depicted in Figure 2.1.

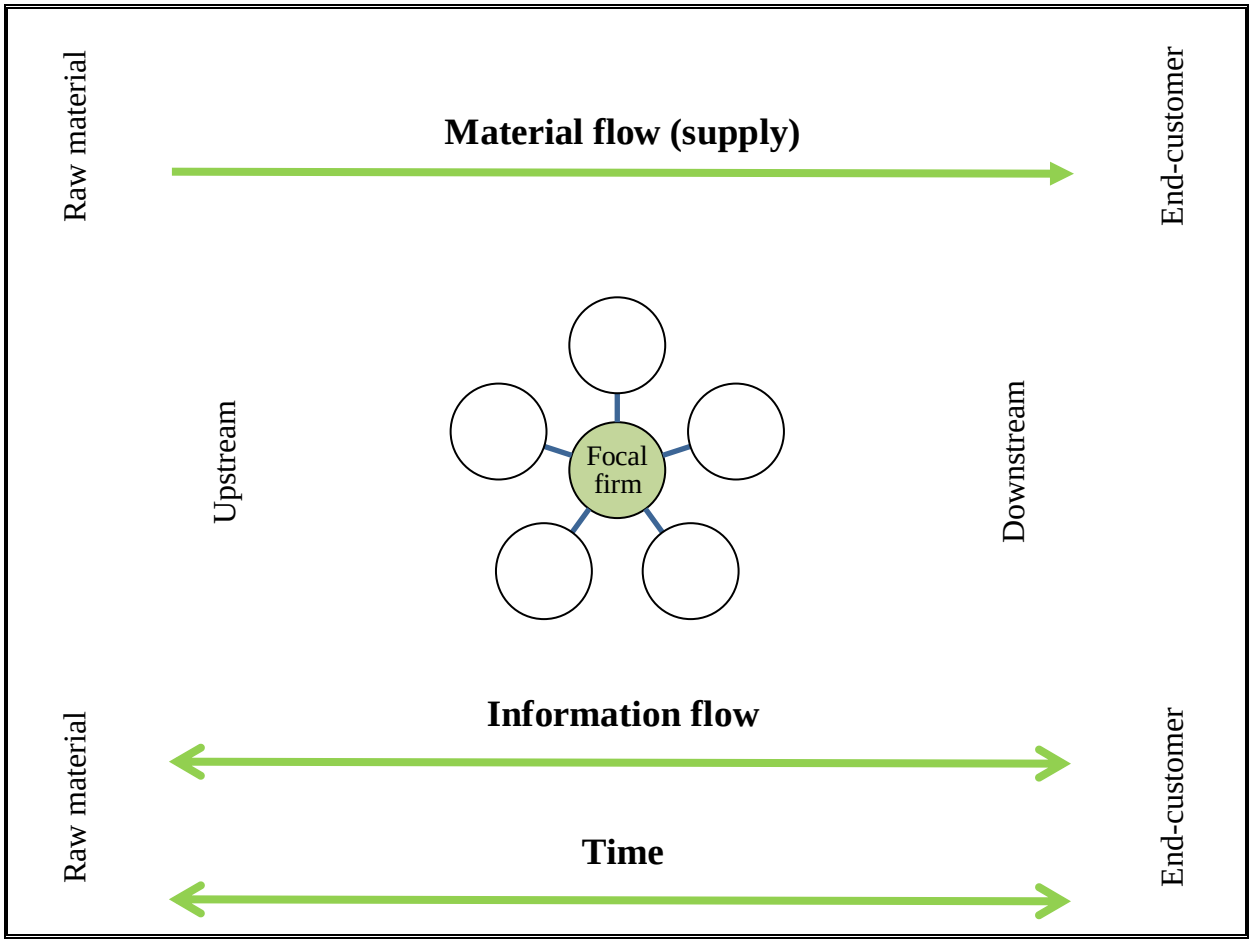


Figure 2.1: The supply chain network

Source: **Harrison & Van Hoek (2014:3)**

The flows represented in Figure 2.1 begin with suppliers who supply and transport raw materials and components to producers or manufacturers. Manufacturers transform these materials into finished products that are then shipped to either manufacturer's own distribution centres or to wholesalers. Next, the products are shipped to retailers who sell the product to the final consumers. Therefore, the key to successful SCM is the management of these flows through the chain.

According to Lysons and Farrington (2012:87-88), a supply chain can be divided into two parts: materials management (MM) and physical distribution management (PDM). MM is concerned with the flow of materials to and from production or manufacturing and is defined as the organisation and control of all aspects of inventory embracing procurement, warehousing, work-in-progress (WIP) and distribution of finished goods. Lysons and Farrington (2012:87) define MM as concerned with the input phase of moving bought-out items such as raw materials and components from suppliers to production. PDM refers to the flow of goods from the receipt of an order until the goods are delivered to the customer (CSCMP 2013:45). PDM relates to the output phase of moving finished goods from production departments to finished goods stores and then through appropriate channels of distribution to the ultimate customer. The main activities associated with PDM are inventory control, warehousing and storage, materials handling, protective packaging and containerisation, and transportation (Lysons & Farrington 2006:88). A typical supply chain is shown in Figure 2.2.

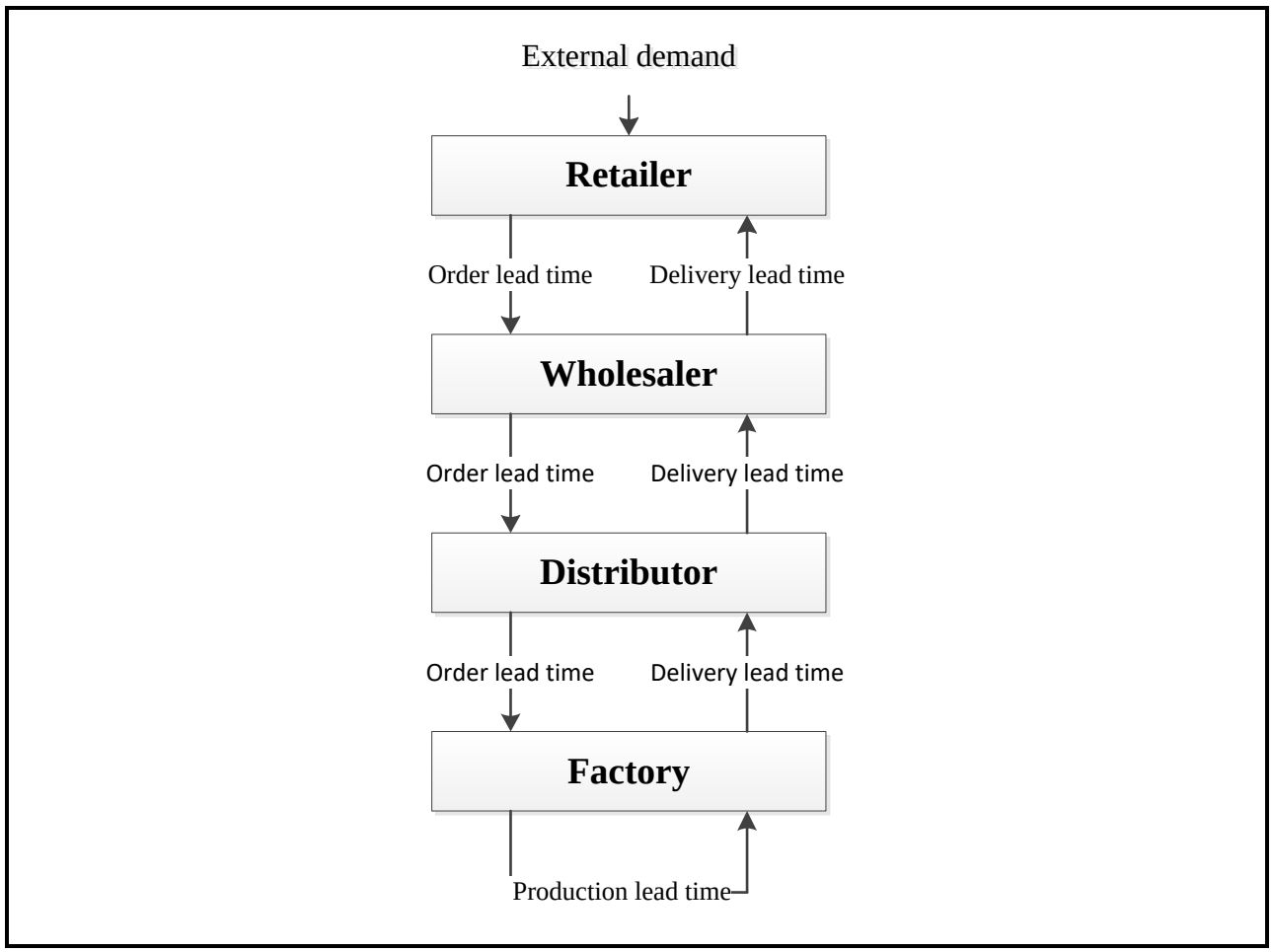


Figure 2.2: A simple supply chain

Source: Simchi-Levi *et al*. (2012: 154)

From Figure 2.2, it can be established that the supply chain is an integrated process involving many partners and spans the entire production cycle of a good or service. Furthermore, the aim of a supply chain is to keep materials flowing from source to the end customer.

There is lack of consensus regarding the definition of SCM (Fawcett & Waller 2013:183; Zinn & Goldsby 2014:23). Analogously, SCM refers to the coordination or integration of many goods and services-related activities among supply chain participants to improve operating efficiencies, quality and customer service among the collaborating organisations. Supply chain participants involve manufacturers, suppliers, customers and external bodies (Wisner *et al.* 2012:8). Sanders (2012:3) also defines supply chain management as the design and management of the flow of products, information and funds throughout the supply chain. It involves the coordination of all the activities of a supply chain.

Monczka *et al.* (2016:13) define supply chain management as proactively managing the two-way movement and coordination of various flows from raw material to the end user. In other words,

SCM requires the coordination of activities and flows that extend across boundaries. Supply chain management is the management, across and within a network of upstream and downstream organisations, of both relationships and flows of material, information and resources. The purposes of SCM are to create value, enhance efficiency, and satisfy customers (Mangan, Lalwani, Butcher & Javadpour 2012:11). Therefore, SCM does not necessarily imply any ownership or control of supply chain partners. It is thus that SCM integrates supply and demand management within and across companies.

The most important part of this definition is its emphasis on the inter-organisational element of SCM. True SCM focuses on interactions and collaborations with suppliers and customers to ensure that the end customers' requirements are satisfied adequately (Drake 2012:3). The supply chain management framework is illustrated in Figure 2.3.

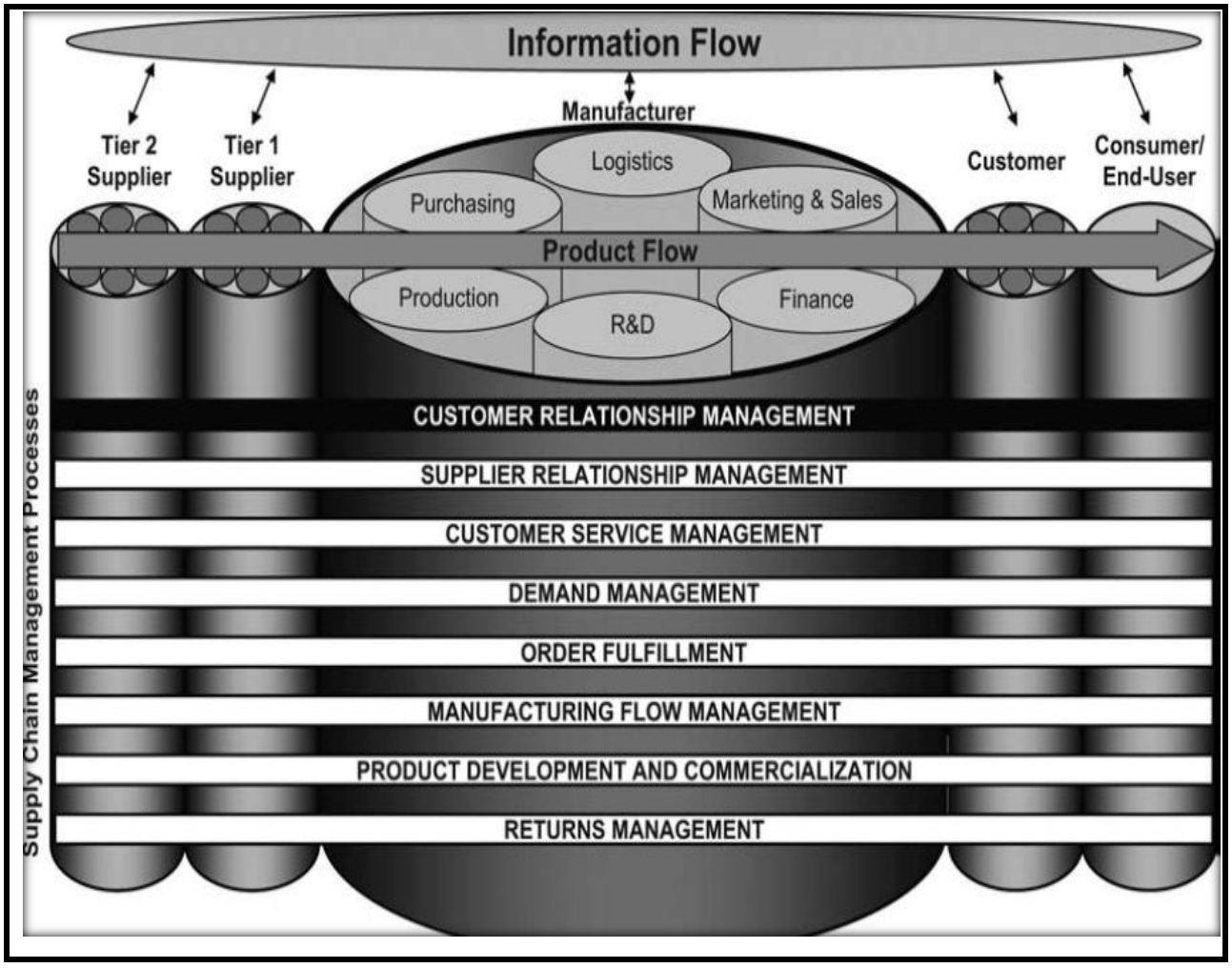


Figure 2.3: Supply chain management framework

Source: Lambert (2010:5)

Each of the above eight processes is briefly described below:

- **Customer relationship management (CRM)** is concerned with learning about customers' needs and behaviour and the integration of sales, marketing and service strategies. This process provides the structure for how relationships with customers are developed and maintained (Lambert 2010:17). In this process they do customer segmentation. The management group customers according to their value. The goal is to increase customer loyalty by providing customized products and services appropriate to a particularvalue proposition. According to Li *et al*. (2006:109), customer relationship management constitutes the entire range of practices that are used for the purpose of building and managing a firm's long-term relationships with its customers, managing the complaints of customers as well as improving customer satisfaction. The major processes of customer relationship management include marketing, sell, order management and call/service centre (Chopra & Meindl 2010:473). As an important element of supply chain management practices, a firm's close relations with its customers enables and encourages long term relationships that can lead to collaborations as well as the sharing of strategic information between the firm and its customers. More so, a firm's close relations with its customers can allow a firm to differentiate its products from those of its competitors, sustain customer loyalty and rapidly extend the value it provides to its customers (Salazar 2012:4).

- **Supplier relationship management (SRM)** is concerned with how an enterprise interacts with its suppliers and therefore is the mirror image of CRM. This process provides the structure for how relationships with suppliers are developed and maintained (Lambert 2010:18). The supplier relationship management processes include design collaboration, sourcing, negotiating, buying and supply collaboration (Chopra & Meindl 2010:478). (Lambert 2010:18) further acknowledges that in this process, long term relationships akey for success as they aid competitive advantage and improves performance of the firm and supply chain as a whole.

- **Customer service management (CSM)** is concerned with providing internal and external customers with high-quality goods and services, at the lowest cost, with shortest times and maximum responsiveness and flexibility to their needs (CSCMP 2013:56). This SCM process represents the face of the firm. It is the first point of contact for administering product and service agreements. Customer service management assist customers with information such as product applications, product availability as well as promised shipping dates (Lambert 2010:20). Therefore, this process is aimed at solving problems before they

affect the customers and may be a competitive advantage for the firm and supply chain as a whole.

- **Demand management** is concerned with balancing the requirements of internal and external customers with supply chain capabilities (APICS 2017:67). This supply chain management process encompasses demand forecasting, synchronising supply and demand, increasing flexibility and reducing variability (Salazar 2012:1). Thus, a good demand management system effectively coordinates marketing requirements and production plans as well as making use of point-of-sale and key customer data to reduce uncertainty (Lambert 2010:23).

- **Order fulfilment** is concerned with the fulfilment of customers' orders efficiently and effectively and at the minimum total cost (Lambert 2010:26). This supply chain management process is concerned with filling orders, design a network and enable a firm to meet customer requests. The logistics functions ususallly perform this work but it needs to be coordinated and implemented across functions.

- **Manufacturing flow management** is concerned with all the processes and activities required to transform inputs and a variety of resources into finished goods and services. The manufacturing process produces and supplies products to the distribution channels based on past forecasts. Manufacturing processes must be flexible to respond to market changes and must accommodate mass customisation. Orders are processes operating on a JIT basis in minimum lot sizes. Also, changes in the manufacturing flow process lead to shorter cycle times, meaning improved responsiveness and efficiency in meeting customer demand (Lambert 2010:25). Therefore, this process aims to make a wide variety of products in a timely manner at a lowest possible cost (Lambert 2010:23).

- **Product development and commercialisation** is concerned with all the processes and activities involved in the development and marketing of new or existing products (Swanson, Goel, Francisco & Stock 2018:100). Customers and suppliers must be integrated into the product development process to reduce time to market. As product life shortens, the appropriate products must be developed and successfully launched with ever shorter time-schedules to remain competitive. According to Liu (2009:285), managers of the product development and commercialisation process must:

  - coordinate with customer relationship management to identify customer-articulated needs;
  - select materials and suppliers in conjunction with procurement; and

- develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

  Therefore, this supply chain management process provides the structure for working with customers and suppliers to develop products and bring them to market. Effective implementation of this process will enable management to coordinate the efficient flow of new products across the supply chain (Lambert 2010:35). This process will also enable firms to develop the right products with shorter life cycles to remain competitive in the market.

- **Returns management** is concerned with the activities related to reverse logistics, returns, 'gatekeeeping" and return avoidance. Return avoidance involves finding ways to minimize the number of return requests. Avoidance could also entail changing promotional programs that load the pipeline when there is no realistic chance that the product shipped or transported will be sold (Lambert 2010:51). This is in the form of returned products that are unacceptable to customers for a variety of reasons, such as damaged or obsolete goods (Sanders 2012:7). As a result, effective returns management is of paramount importance to SCM as it contributes to a sustainable competitive advantage. Therefore, this process is crucial because it can reduce costs and increase revenues by eliminating performance failures that cause unwanted returns.

Therefore, for supply chain management to work effectively and efficiently, the supply chain management processes discussed above are of paramount importance to an organisation.

The SCM activities can be grouped into strategic, tactical and operational levels (Wisner *et al.* 2012:102) and are discussed as follows:

Strategic:

Information technology infrastructure to support supply chain operations;

Where-to-make and what-to -make-or-buy decisions; and

Aligning overall organisational strategy with supply strategy.

Tactical:

Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise;

Milestone payments; and

Focus on customer demand.

Operational:

Demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers;

Inbound operations, including transportation from suppliers and receiving inventory; and

Production operations, including the consumption of all fulfilment activities, warehousing and transportation to customers.

Supply chain management is a dynamic and ever-changing process that requires coordination amongst members of the supply chain. SCM activities include the following:

- **Coordination:** SCM involves coordinating the movement of goods and services through the supply chain, from suppliers to manufacturers to distributors to final customers; it also includes movement of goods back up the supply chain as products may be returned. Coordination also involves the movement of funds through the supply chain as products are purchased and sold. This includes various financial arrangements and terms of purchase between buyers and suppliers (Sanders 2012:7).

- **Information sharing:** SCM requires sharing relevant information among members of the supply chain. This includes sharing demand and sales forecasts, P-O-S data, promotional campaigns planned and inventory levels. Sharing this information enables the entire supply chain to work in unison (Sanders 2012:6).

- **Collaboration:** SCM requires collaboration between supply chain members so that they jointly plan, operate and execute business decisions as one entity. This is important for decisions that range from product design and process improvement to implementing business initiatives or following a business strategy. For example, this may include collaborating on ways to cut costs or improve quality standards throughout the entire supply chain (Sanders 2012:7).

In this section, it emerges that the SCM activities can be grouped into strategic, tactical and operational levels. Also, what emerges largely is that there is no consensus on the definition of SCM. Therefore, for this study, the definitions provided by Mangan *et al.* (2012:11) and Wisner *et al.* (2012:8) are adopted to define the concept of supply chain management. They serve as pertinent definitions because they contain critical concepts such as coordination or integration,

supply chain participants/organisations and flow of material, information and resources. The next section discusses retail supply chains.

2.3 RETAIL SUPPLY CHAINS

Sparks (2010:4) acknowledges that retailers are now dominant partners in most supply systems and have used their positions to re-engineer operations and partnerships with suppliers and logistics service providers. No longer are retailers the passive recipients of manufacturer allocations, but instead are the active channel controllers organising supply in anticipation of, and in reaction to customer demand. Roberts (2010:6) points to the changing capability, technology, and expectations of retail supply chains and the extension of these demands on those involved in satisfying retail needs.

SME retailers play an important role in supporting the needs of the local population in terms of products, services and retail formats. Furthermore, South Africa's retail and wholesale sector is a significant component of the country's economy, a major employer, which provides jobs for an estimated 20% (3.1 million citizens) of the national worksforce (Steyn 2013:432; Statistics South Africa 2015).

Table 2.1 illustrates a typical retail supply chain.

Table 2.1: The retail supply chain

Sourcing	Inbound logistics	Transport	Customer central service
• Goods receiving/ Warehousing • Inbound transportation • Incoming quality control • Inventory management • Import documentation/ Clearance (in case of import)	• Outbound transport • Good issue • Warehousing at store • Packaging • Export documentation (if applicable) • Transit inventory management	• Manufacturing outsourcing • Private label development • Source identification • Source selection • Contract management • Vendor development • Vendor rating	• Category planning • Merchandise forecasting and balancing • Assortment planning • Store clustering • Private label and product development • Pricing • Deciding location of store and warehouses • Deciding logistics outsourcing service providers • Finalising procurements/contracts • Deciding supply chain KPIs

Source: Ray (2012:8)

Table 2.1 also explains the different functions of a retail supply chain. The importance of the supply chain is discussed in the next section.

2.4 THE IMPORTANCE OF THE SUPPLY CHAIN

An efficient and effective supply chain can provide a sustainable competitive advantage that will secure a firm's position in the global market (Drake 2012:1). The objective of every supply chain is to maximise the overall value generated. The value that a supply chain generates is the difference between what the final product is worth to the customer and the effort of the supply chain in filling the customer's request (Chopra & Meindl 2016:6). This value is also known as supply chain surplus. Supply chain surplus is the difference between the value of the product to the final customer and the costs the supply chain incurs in fulfilling the customer request (Chopra & Meindl 2016:15) as illustrated by the following equation:

Supply Chain Surplus = Customer Value – Supply Chain Cost

The paramount goal of SCM is to deliver the best customer service through coordinated management of materials, finances and information which flow across a network of suppliers as well as internal and external customers (Sharma 2012:1). The primary objective of a supply chain comprises creating superior mutual value for the customer in terms of the product and service delivered at a time and place in response to customer needs and demand (Sharma 2012:9). The other secondary objectives of a supply chain include:

Profitability- the revenue must exceed the expenses or the costs of the supply chain.

Reliability- a supply chain aims to provide time and place specific delivery with a superior level in fulfilling the order.

Flexibility/ability – a good supply chain should be flexible enough to absorb fluctuations in demand without any extra costs.

Responsiveness- refers to how much time it takes to meet the customers' needs, particularly when the design and volume need to undergo a change.

Turnover rate- it is important that a high turnover rate of assets is used in the supply chain. Fast turnover reduces the risk of obsolescence, increases productivity and thus profitability.

Communication and coordination- a supply chain objective is to produce good communication, and information sharing ability and competence across all channel partners (Sharma 2012:10).

There are major trends that have emerged to make SCM a critical success factor (Shah 2009:10). These are:

Shift in power structure in the chain- in almost every industry, the entities closer to customers are becoming more powerful. In general, manufacturers are forced to respond quickly to the customers' demands, because of changes in the power structure within the chain.

The globalisation of manufacturing- over the past decade, tariff levels have come down significantly. Many companies are restructuring their production facilities to be on par with global standards (Shah 2009:10; Narasimhan 2018:157).

The next section discusses the drivers and enablers of supply chain management.

2.5 DRIVERS AND ENABLERS OF SUPPLY CHAIN MANAGEMENT

2.5.1 Drivers of supply chain management

Figure 2.4 illustrates the five major supply chain drivers.

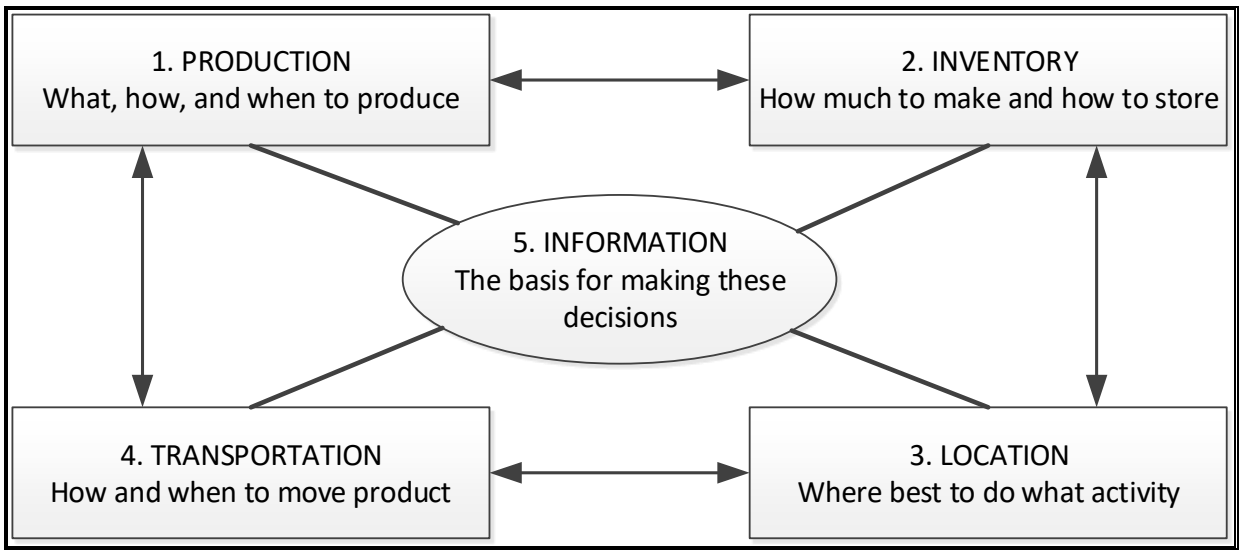


Figure 2.4: The major supply chain drivers

Source: **Sanders (2012: 76)**

The main driver of modern SCM is information and technology and the essence of modern SCM is inter-organisational collaboration (Li 2014: 8). According to Hugos (2011:10-17), there are five drivers of SCM: production, inventory, location, transportation and information. These are illustrated in Figure 2.4 above.

2.5.2 The four enablers of supply chain management

Monczka, Handfield, Guinpero and Patterson (2016:20-24) identify four key enablers of supply chain management. According to the authors, these enablers provide the foundational support needed to develop progressive strategies and approaches to supply chain management. The key enablers are Human Resources (HR), Organisational Design (OD), Information Technology (IT) and Measurement and are discussed below.

2.5.2.1 Human resources (HR)

Employees form the heart and soul of any organisation and the attainment of operational excellence often boils down to the quality of HR. Monczka *et al.* (2016:20) point out that the skills set required of today's purchasing manager is very different from a few years ago. According to Gunasekaran, Patel and McGaughey (2004:76), the top five knowledge areas for purchasers are (1) supplier relationship management; (2) total cost analysis; (3) purchasing strategies; (4) supplier analysis; and (5) competitive market analysis. Therefore, having properly qualified and skilled workers in the aforementioned areas is important.

2.5.2.2 Organisational design (OD)

Monczka *et al.* (2016:22) describe OD as the process of assessing and selecting the structure and formal system of communication, the division of labour, co-ordination, control, authority and responsibility required to achieve organisational goals and objectives including the supply chain objectives.

2.5.2.3 Information technology (IT)

The 21st century has seen rapid growth in the development of IT software and supply chain support software (Handfield *et al.* 2011:20). Technology has allowed for enhanced collaboration between supply chain partners. Monczka *et al.* (2016:23) describe two primary supply chain applications that enhance collaboration and involve purchasing. These applications are supply chain planning and supply chain execution. On the one hand, planning software helps improve forecast accuracy, optimise production scheduling, reduce working capital costs, shorten cycle times and improve customer service. Execution software helps obtain materials and manage physical flows from suppliers through downstream distribution to ensure that customers receive the right products at the right location, time and cost (Swanson et al. 2018: 102).

Thus, technology allows supply chain partners to collaborate in real time. This level of collaboration assists in creating a more agile purchasing organisation through its ability to respond to changes in the internal and external environments. Visibility within the supply chain is also improved since orders can be "tracked" with greater accuracy and ease, which improves the order fulfilment rate and the lead times.

2.5.2.4 Measurement

The fourth enabler of supply chain management is the measurement system in place. There are, however, many obstacles between measurement and improved performance (Handfield *et al.* 2011:22). The authors list the following obstacles:

"Too many measurement metrics;

The debate over the correct metrics;

Constantly changing metrics; and

Old data".

Therefore, measurement is important since it helps to support fact-based decision making. Without proper measurement, the accuracy of decision making may be compromised. Also, measurement

and the proper metrics are a good way to communicate and ensure that the expected performance is achieved. As Monczka *et al*. (2016:23-24) point out, suppliers tend to perform better once they know that their performance is being evaluated. The measurement process also helps determine if new initiatives are producing the desired results.

Overall, these enablers become barriers to SCM if they are not in place. Each of these enablers has its own set of attributes as noted in the paragraphs above. Figure 2.5 illustrates the four enablers of SCM:

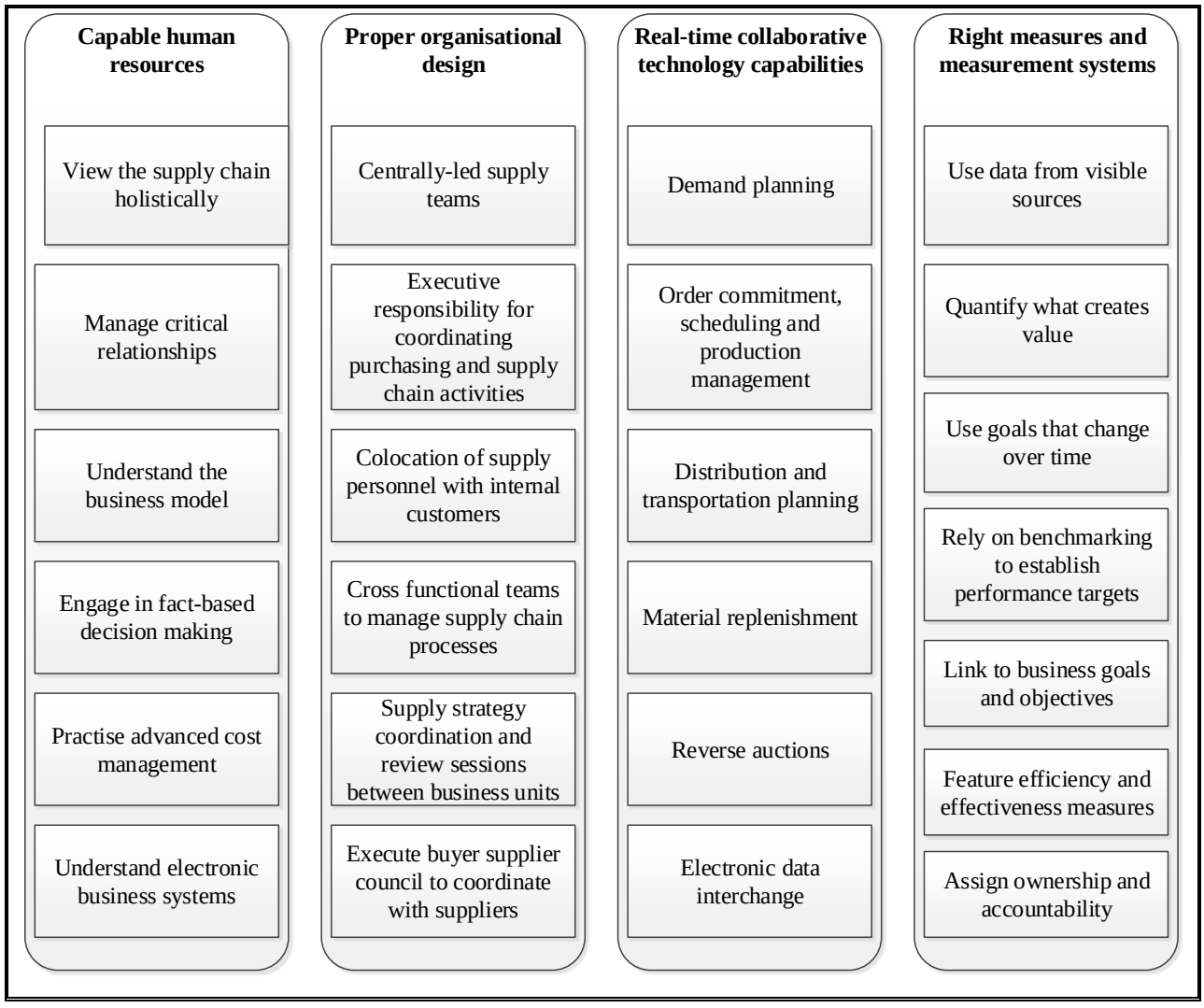


Figure 2.5: The four enablers of supply chain management

Source: **Marien (2000:302); Handfield *et al.* (2016:21)**

It is recognised that excellence in the above areas does not just happen – a commitment to the four enablers of SCM permits firms to reap benefits. These enablers provide the support that makes the development of progressive strategies and approaches possible. The four enablers model shows that firms have certain guiding philosophies and business requirements that are the foundation of

all supply chain activities. These guiding philosophies and requirements may relate to areas such as globalisation, customer responsiveness or supply chain integration (Monczka *et al.* 2008:20).

Today's organisation faces many trends that impact the way supply chains are designed and managed (Sanders 2012:20). These trends are a result of a fast-changing global and technologically-connected economy that creates unique challenges companies must address (Fiss 2007:1187; Sridharan & Simatupang 2009:18; Walters 2009:16). These trends are elucidated on below:

- **Globalisation:**

The concept of the "global marketplace" has changed the meaning of how and where business is conducted, for all enterprises and for individual customers. Changes in information technology, transportation, and government policies made the concept of a global economy an important reality (Stock & Boyer 2009:695). Globalisation has replaced the so-called "cold war" and World War II era as the dominant driving force of world economies (Furter 2005:5). Through globalisation, companies have benefited from a larger choice of products. Consumers have also benefited from greater product choice, higher quality and lower cost (Sanders 2012:20).

- **Outsourcing:**

This refers to hiring a third party to perform a set of tasks for a fee (Stock & Boyer 2009:691). To be able to focus on core competencies (sometimes called "distinctive competencies"), many companies outsource other activities to those that can do them better (Sanders 2012:29). This has helped companies be more efficient by focusing on what they do best (Van Der Klauw 2009:27). The concept of outsourcing nowadays has been taken to a new level because of the convergence of technologies (Jain & Banyouncef 2007:148).

- **Technology:**

An important driver of SCM is technology (Walters 2007:225). Technological advances have enabled companies to produce products faster, with better quality, at a lower cost (Bowersox, Closs and Cooper 2007:4). Advancements in IT have had the greatest impact on SCM. In fact, IT can be viewed as an enabler of SCM as without it coordination between supply chain members would not be possible (Van Der Klauw 2009:17). IT has made information sharing along the supply chain possible (Smuts 2008:33; Sridharan & Simatupang 2009:255).

- **Postponement:**

This is when a company seeks standardised parts and components, and produces specific product elements at each market (Sanders 2012:23). Completion of the final product is postponed till local

demands are known with greater certainty (Sridharan & Simatupang 2009:255). Therefore, postponement is an important strategy for companies to reach diverse geographic areas while still providing customisation.

- **The lean supply chain:**

The lean philosophy has focused on the elimination of waste and has helped companies to become more competitive (Sanders 2012: 23). The lean supply chain is defined as the set of all organisations directly taken by upstream and downstream flows of products, services, finances and information that collaboratively work to reduce cost and waste (Sanders 2012:24). As such, a lean supply chain requires all supply chain organisations to work together with an effort to cut costs. It also requires a coordinated effort among partners to eliminate waste across the entire supply chain by analysing processes and identifying areas for improvement.

- **Managing supply chain disruption:**

Supply chain disruptions are a significant corporate crisis and can be very costly (Furter 2005:28). Managing supply chain risks is challenging because disruptions can occur for a wide variety of reasons. This includes transportation delay, industrial plant fires, work slowdowns or stoppages and natural disasters. Companies are continuing to look for ways to guard their supply chain against disruptions. Some strategies include having access to backup suppliers, building excess capacity into the system, screening and monitoring suppliers for supply chain risks, requiring suppliers of critical items to develop detailed disruption plans and including the expected costs of disruption in the total of sourcing (Sadler 2007:47; Jain & Bauyouncef 2007:148).

- **Supply chain security:**

Supply chain security is the study of supply chain security and maintaining product integrity as goods are moved across the globe between borders (Sanders 2012:24). Today's strict security initiatives make supply chain relationships much more complex, and the study of ways to protect security while maintaining efficiency is now a key issue (West & Lafferty 2007:317). Theft and product tampering are major security concerns. Therefore, supply chain security looks at different ways to protect the product, from using electronic seals to prevent tampering, to using RFID and GPS technologies to track product location.

- **Sustainability and the green supply chain:**

The population of the world continues to grow, creating shortages of many resources (Sanders 2012:25). This means designing processes to use environmentally friendly inputs and create outputs that can be recycled and that do not contaminate (Walters 2007:79). Sources of supply and

movement of goods are huge factors in ensuring sustainability, for example, Starbucks selects and manages their growers to ensure the integrity of their environment (Walters 2009:8). Other aspects of the supply chain are also important to satisfaction, such as packaging and transportation to reduce environmental impacts. Changes such as reducing the amount of cardboard or filler by designing "smart packages" can save companies money.

- **Innovation:**

Innovations are increasingly becoming a critical capability across the globe (Sanders 2012:25). This includes designing new products that satisfy customer demands and designing new cost-cutting production processes (Shah 2009:23). Innovative products need greater protection from copying and tampering and security measures become critical (Rian & Walters 2009:14). As competitive pressures increase, continuing to find ways to manage supply chains will remain an important issue. This therefore means that companies need to come up with new ideas and can produce and deliver products faster than their competitors.

- **The financial supply chain:**

In today's downturned global economy, companies are under greater financial pressures than ever before to cut costs (Miguel & Brito 2011:31). The result has been a push to redesign entire supply chains and search for less costly sources of supply (Stock & Boyer 2009:701). This includes strategies such as global sourcing and product outsourcing, trying to achieve labour cost advantages by pushing operations offshore, and outsourcing non-core activities (Walters 2009:2). As companies send operations offshore, however, there are significant financial implications. This includes masked hidden costs, such as managing more expensive plants and equipment in emerging countries (Bowersox, Closs & Cooper 2007:5). Global operations can wreak havoc on the financial supply chain as the longer chain has a higher amount of tied-up working capital.

To sum up, the following drivers seem to be very important for successful supply chain management: production, inventory, location, transportation and information. It emerges that the following enablers are critical to an organisation: Human Resources (HR), Organisational Design (OD), Information Technology (IT) and Measurement. The researcher noted that these enablers become barriers to SCM if they are not in place. The goals of supply chain management are elaborated on in the next section.

2.6 ROLE AND OBJECTIVES/ GOALS OF SUPPLY CHAIN MANAGEMENT

The focus in SCM is on system optimisation. "Tools that can assist in systems or supply chain improvements are benchmarking current performance in a particular inventory network,

understanding the sources of uncertainty and the impact on upstream and downstream nodes in the supply chain, working to control uncertainty and planning for changes in policies and procedures that might lead to cost reductions or performance improvements" (Davis 1993:36). SCM has an important role to play in moving goods more quickly to their destination. Faster product availability is key to increasing sales (Zalgris 2000:3).

According to Leenders *et al*. (2006:29-32), the other goals of SCM include:

Standardise, where possible, items bought, and the processes used to procure them - standardisation refers to the process of agreeing on a common specification or process. Specifications and processes may be standardised across an organisation. Supply chain management process standardisation can result in shortened cycle time, lower transaction costs, and greater opportunities to share knowledge across functional and organisational boundaries.

Purchase required items at the lowest total cost of ownership - supply's responsibility is to obtain the needed goods and services at the lowest total cost of ownership, which necessitates consideration of other factors such as quality levels, after-sales service, warranty costs, inventory and spare parts requirements - that in the long term might have a greater cost impact on the organisation than the original purchase price.

Lysons and Farrington (2012:95) further state the objectives of supply chain management as follows:

The integration of both internal and external competencies;

The building of alliances, relationships and trust throughout the supply system;

The reduction of costs and improvement of profit margins;

The maximisation of return on assets (net income after expenses/interest);

The facilitation of innovation and the synchronisation of supply chain processes; and

The optimisation of the delivery of products, services, information and finance both upstream and downstream and across internal and external boundaries.

The different types or approaches to supply chain management are discussed in the next subsection.

2.7 APPROACHES TO SUPPLY CHAIN MANAGEMENT

Li (2014:13) explains the two approaches to supply chain, that is, efficient supply chains and responsive supply chains.

2.7.1 Responsive supply chains

Responsive supply chains are primarily concerned with minimising delivery cycle time, as in agile supply chains (Lysons & Farrington 2012:94).

2.7.2 Efficient supply chains

Efficient supply chains are mainly concerned with reducing the cost of operations, as in lean productions (Lysons & Farrington 2006:94). Table 2.2 shows the comparison between a responsive supply chain and an efficient supply chain:

Table 2.2: Responsive supply chain and efficient supply chain

	Efficient supply chain	**Responsive supply chain**
Demand	Constant, based on forecasting	Fluctuates, based on customer orders
Product life cycle	Long	Short
Product variety	Low	High
Contribution margin	Low	High
Order fulfilment lead time	Allowed longer fulfilment lead time	Short
Supplier	Long – term	According to product life cycle
Production	Make-to-stock	Assemble-to-order; make to order
Capacity cushion	Low	High
Inventory	Finished goods inventory	Parts, components, subassembly
Supply selection	Low cost, consistent quality and on-time delivery.	Flexibility, fast delivery, high performance design quality.

Source: Li (2014:14)

2.8 PUSH AND PULL PROCESSES

2.8.1 Push processes

This type of supply chain is more suited to mass production. The manufacturer bases demand forecasts on orders received from the retailer's warehouse. Such a strategy means that the firm will take much longer to respond to changes in the market-place. This longer response time will

result in the inability to respond to changes in demand and inventory obsolescence as demand declines for certain products (Simchi-Levi *et al.* 2012:188-189). The push-based system depends on demand received from the nearest downstream partner and not the end customer. In other words, a manufacturer will receive demand information from the retailer's warehouse. This situation leads to a bullwhip effect. This is due to the variability of orders received from the retailer's warehouses being much larger than the variability of customer demand (Simchi-Levi *et al.* 2012:189). The increase in variability leads to:

excessive inventory due to the need for more safety stock;

greater variation in production batches;

poor service levels; and

product obsolescence.

Generally, in a push-based supply chain, one often finds increased transportation costs, high inventory levels and high manufacturing costs.

2.8.2 Pull processes

A pull-based system is enabled by information sharing and information flow between partners in the supply chain. Firms typically favour, where possible, pull-based systems due to:

their ability to decrease lead times through the ability to better anticipate incoming orders from retailers;

decreased inventory at the retailers since inventory levels at these facilities increase with lead times;

a decrease made in the variability due to lead time reduction; and

the lower inventory levels due to decreased variability (Sadler 2007:228).

Pull-based systems have the advantages of being adaptable, reducing inventory levels and reducing supply chain costs. Conversely, pull-based systems are difficult to implement when lead times are long, to the extent that it is not practical to react to demand information. Also, with pull-based systems, it is difficult to take advantage of economies of scale since systems are planned. Table 2.3 shows the characteristics of both the push and pull-based supply chain.

Table 2.3: Characteristics of the push and pull portions of the supply chain

Portion	Push	Pull
Objective	Minimise cost	Maximise service level
Complexity	High	Low
Focus	Resource allocation	Responsiveness
Lead time	Long	Short
Processes	Supply chain planning	Order fulfilment

Source: Simchi-Levi *et al*. (2012:194)

The shortcomings of both push and pull-based systems have led firms to search for a strategy that takes advantages of both systems. The result is the hybrid push-pull system, which is explained below.

2.8.3 Push-pull processes

In recent years, there has been a move towards more hybrid systems such as the push-pull approach, which incorporates elements of both the approaches. The push/pull approach is important in designing the supply chain. Demand uncertainty and variations are treated differently in these two systems (Li 2014:19-20). In a push-pull strategy, the initial stages are operated in a push-based manner while the remaining stages employ a pull-based strategy. The interface between the push and pull based stages is known as the push-pull boundary or decoupling point (Simchi-Levi *et al.* 2012:190). In a retail context, the decoupling point or push-pull boundary is normally established by determining the point of the last strategic stock. Normally, in the retail set-up, this is the warehouse. This is illustrated in Figure 2.6, which shows the decoupling point considering the supply chain timeline:

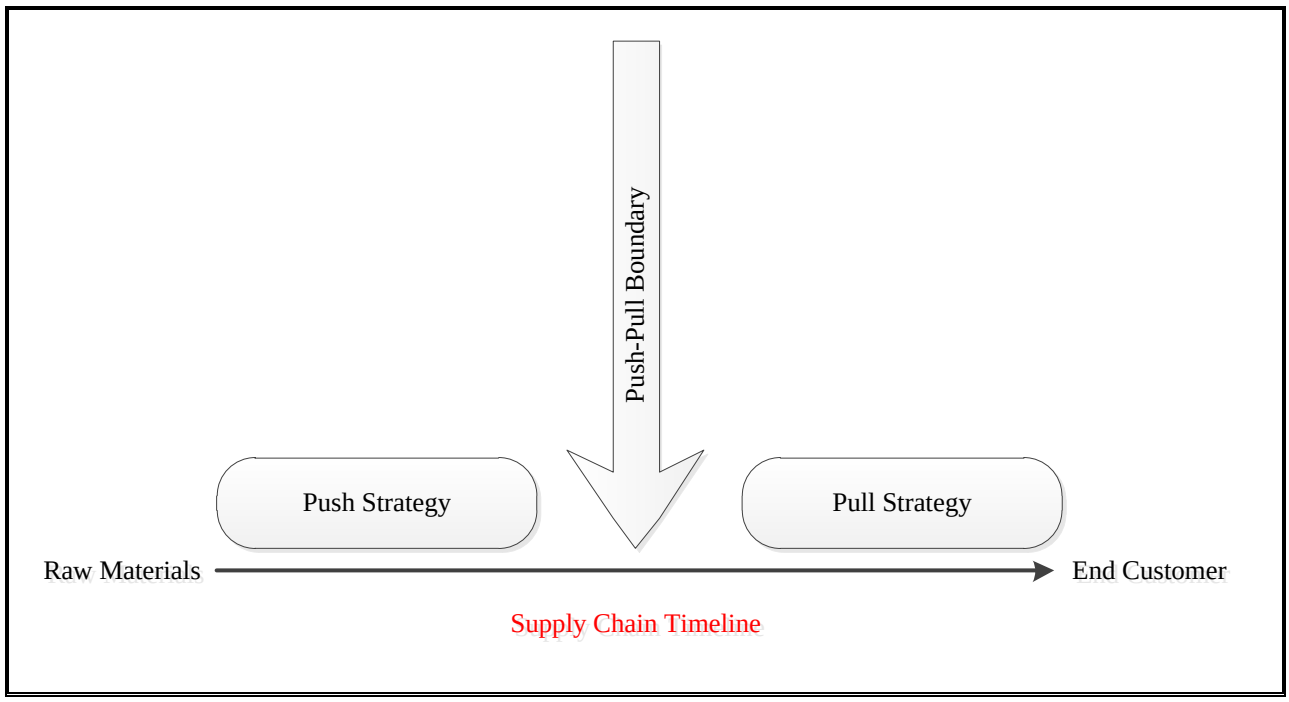


Figure 2.6: The push-pull supply chains

Source: **Simchi-Levi (2012:190)**

According to Simchi-Levi *et al.* (2012:190-191), understanding this approach begins with a consideration of the supply chain timeline, which is defined as the time that elapses between the procurement of raw material and the delivery of the order to the customer. The push-pull boundary is located somewhere along this timeline.

2.9 SUPPLY CHAINS ACCORDING TO DEGREE OF COMPLEXITY

According to Lysons and Farrington (2012:93), the supply chain can also be classified according to the degree of complexity, namely: direct supply chain, extended supply chain and ultimate supply chain. An example of a direct supply chain is shown in Figure 2.7.

2.9.1 Direct supply chain

Figure 2.7: Direct supply chains

Source: Lysons and Farrington (2012:93)

A direct supply chain, as shown above, consists of company or supplier and a customer involved in the upstream and/or downstream flow of products, services and information.

2.9.2 Extended supply chain

An extended supply chain, as shown in Figure 2.8, includes suppliers of the immediate supplier and customers of the immediate customer.

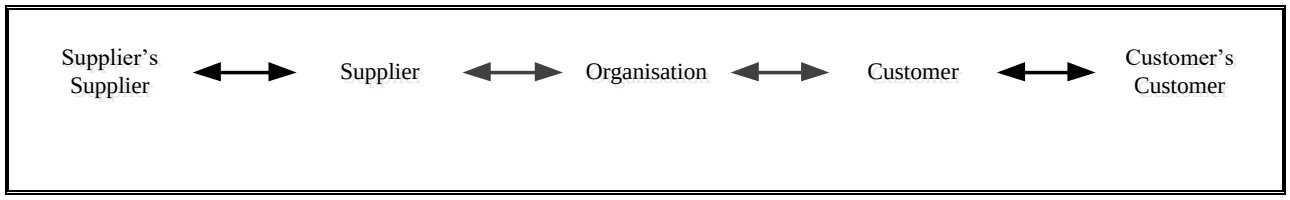


Figure 2.8: Extended supply chains

Source: Lysons and Farrington (2012:93)

2.9.3 Ultimate supply chain

An ultimate supply chain, (Figure 2.9), includes all the organisations involved in all the upstream and downstream flows of products, services, finances and information from the ultimate supplier to the ultimate customer.

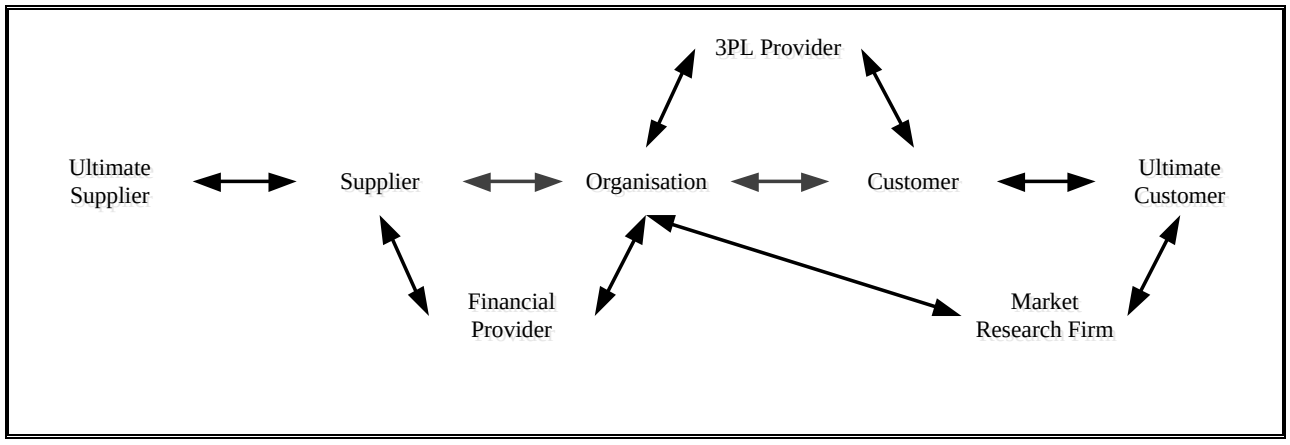


Figure 2.9: Ultimate supply chains

Source: Lysons and Farrington (2012:93)

2.10 SUPPLY CHAINS ACCORDING TO CUSTOMER- SUPPLIER RELATIONSHIPS

According to Lysons and Farrington (2012:93), supply chains can be grouped according to customer-supplier relationships and these include concentrated chains, batch manufacture, retail and distribution chains and service chains.

2.10.1 Concentrated chains

These are found in businesses such as the automotive industry that have few customers, customers with demanding requirements and EDI systems or a requirement for JIT deliveries.

2.10.2 Batch manufacture

Batch manufacture has many customers, complicated relationships webs - an undertaking with which an enterprise is in contact, may at different times, be a customer, supplier, competitor or ally.

2.10.3 Retail and distribution chains

Retail and distribution chains have many customers but relatively few suppliers, customised methods, such as vendor-managed inventory (VMI) of facilitating dealings with suppliers.

2.10.4 Service chains

Service chains implement the mission statements of organisations such as hospitals, libraries and banks with the delivery of services, books, information and financial services (Lysons & Farrington 2012:93). The SCOR model is explained in the next section.

2.11 THE SUPPLY CHAIN OPERATIONS REFERENCE (SCOR) MODEL

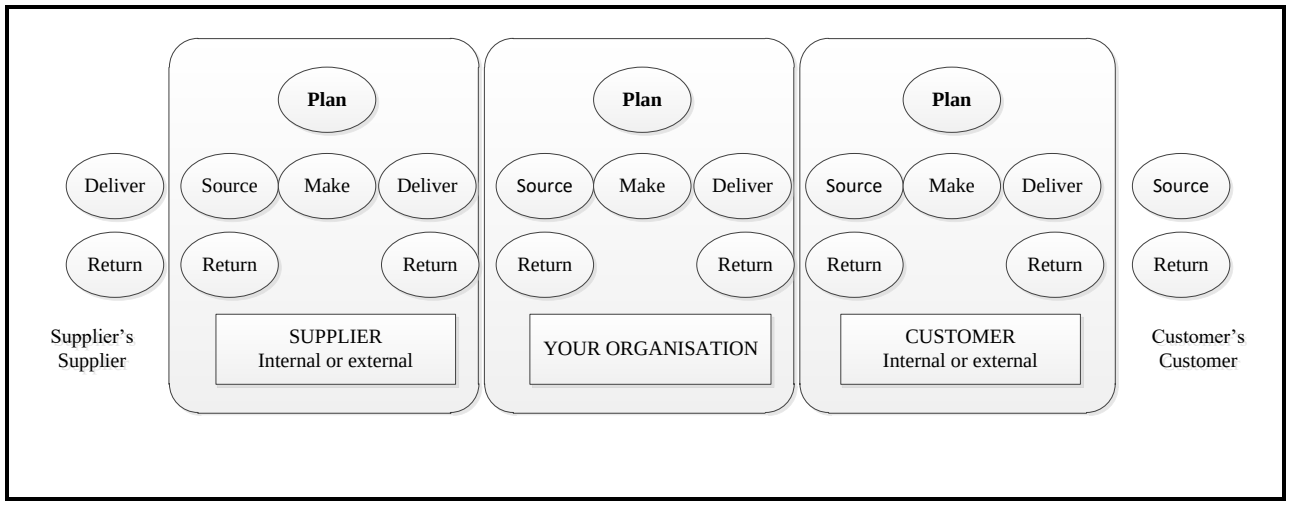


Figure 2.10: Supply Chain Operations Reference (SCOR) model

Source: Drake (2012:3)

The Supply Chain Council (SCC), an international non-profit organisation, has developed its Supply Chain Operations Reference (SCOR) process reference model to align a firm's supply chain performance metrics with its overall strategic goals (Drake 2012:3). The model provides a standardised description of the processes, relationships and metrics that define supply chain management. It is helpful to consider the SCOR model's highest-level processes when describing SCM. According to the SCOR model, supply chain management covers five broad areas:

Plan: all supply chains must undertake a significant amount of planning because so many of their operations are performed in different locations. It takes a great deal of planning to synchronise these actions and this synchronisation is important because the activities are cross-functional and interrelated.

Source: after the initial plans have been established, the firm starts to acquire resources from its suppliers, for example machinery, technology and capacity.

Make: once the resources have been acquired the firm performs its primary transformation activity to turn resource inputs into outputs that can ultimately satisfy downstream demands (customers).

Deliver: after the resources are transformed from inputs to outputs, they must be moved to the next phase of distribution. The delivery of services requires that the firm manage its customer requirements and ensure that the customer is satisfied with the service received.

Return: these include defects, shipment errors, buyback arrangements, customer service policies or end life disposal. These return flows can be very costly for the companies that have not

developed appropriate processes to handle them and they can turn into a revenue source and competitive advantage for companies that proactively plan for them (Drake 2012:4-5).

Therefore, implicit in the SCOR model's description of supply chain processes are the linkages of these processes with those of the firm's supply chain partners. For example, a manufacturer's sourcing process is invariably dependant on its suppliers' delivery. The benefits of supply chain management are stated in the next section.

2.12 BENEFITS OF SUPPLY CHAIN MANAGEMENT

According to Sharma (2012:25), the benefits of supply chain management include:

reducing working capital deployment (inventories, warehousing and financial costs);

re-engineering, simplification and optimisation of processes across different components and stages at different levels;

optimisation of workforce across various orders/clients at different levels and locations;

reduction in time to market through disintermediation and better logistics;

reduction in processing and administrative lead times at all stages;

capturing and tracking of feedback from all supply chain partners at each stage and better collaboration based on the feedback;

bringing about accurate inventory forecasting and planning;

streamlining incoming material flow and synchronising it with production at the plant level, particularly in a lean environment;

ensuring a certain in-process/work-in-progress (WIP) material and finished goods;

tracing and tracking order information, its fulfilment status and maintaining a certain promised service delivery level; and

improved satisfaction levels of internal and external customers.

Additionally, the OGC (2006:9-10), cited more benefits of SCM which include the following:

Better risk allocation: in an increasingly complex delivery landscape, allows the authority to assess how risk can be allocated across the supply chain and how they can be managed most effectively.

Better-defined requirements through early supply chain involvement in the shaping of the business need: for example, this could be through market sounding. Involvement of the SC at an early stage can be vital in establishing the right requirements and the approach to meeting them.

SCM can contribute to improved long-term sustainability and better capacity management of supply markets through the availability of a more competitive supply base. In the next section, the supply chain characteristics and requirements are elaborated on.

2.13 SUPPLY CHAIN CHARACTERISTICS AND REQUIREMENTS

This section describes the supply chain characteristics and supply chain requirements.

2.13.1 Supply chain characteristics

Sanders (2012:18-19) notes the three key characteristics of a competitive supply chain: responsiveness, reliability and relationship management.

- **Responsiveness:** refers to the ability to respond to customers' requirements in ever-shorter time frames. Today customers want shorter lead times, greater flexibility and greater product choice. This means that the supplier and manufacturer should be able to meet the precise demands of the customer in a shorter amount of time than ever before.

- **Reliability:** uncertainty is a fact of life for most businesses. In fact, uncertainty is the main reason why companies carry safety stock inventories – to guard against uncertainty – which then results in higher costs. The best way to reduce uncertainty is by increasing reliability through the redesign of processes that impact performance. One factor that greatly improves reliability in supply chains is improved visibility (Drake 2012:112).

- **Relationship management**: an important characteristic of competitive supply is their focus on relationship building and collaboration, rather than on arms-length adversarial relationships that had been dominant in the past. Such practices improve quality, product innovation and design while reducing cost and improving overall responsiveness.

2.13.2 Supply chain requirements

Four essential supply chain requirements are connectivity, integration, visibility and responsiveness. Connectivity is the ability to exchange information with external supply chain partners in a timely, responsible and usable format that facilitates inter-organisational collaboration. Integration is the process of combining or coordinating separate functions, processors or producers and enabling them to interact in a seamless manner. Responsiveness is the ability to react quickly to customer's needs or specifications by delivering a product of the right quality, at the right time, in the right place, at the lowest possible cost. Visibility is the ability to access or view pertinent data or information as it relates to logistics and the supply chain

(Wilkingson & Birmingham 2003:39; Lysons & Farrington 2012:99). Therefore, for a supply chain to function well, the four requirements are of paramount importance.

It emerges that the three key characteristics of a competitive supply chain are responsiveness, reliability and relationship management. The four essential supply chain requirements are connectivity, integration, visibility and responsiveness and were described above.

2.14 APPLICATION OF THE CONFIGURATION THEORY TO SUPPLY CHAIN MANAGEMENT

In order to explain supply chain management in South African SMEs, this study was grounded in the Configuration Theory. The Configuration Theory has received recognition as a relevant framework in explaining supply chain management concepts (Samson 2011:1299). The Configuration Theory displaced the Contingency Theory as the dominant perspective in the 1980s. This perspective is characterised by its holistic view of organisations, which are conceived as "composed of tightly interdependent and mutually supportive elements such that the importance of each element can be best understood by referring to the whole configuration" (Miller & Friesen 1984:1). Thus, the Configuration Theory has its roots in the Contingency Theory and the Configuration Theory is a significant break with the past (Meyer, Tsui & Hinings 1993:1178).

Configuration Theory is used to denote any multidimensional castellation of conceptually distinct characteristics that commonly occur together (Fiss, Marx & Cambre 2013:1). In other words, the Configuration Theory approach can describe multi-way complex relationships in a holistic way. The early research in configuration theory on supply chain management was first conducted by Fisher in 1997. It was based on the type of product and demand predictability. Fisher (1997:105) classifies these products into two, namely: functional products and innovative products. The study concluded that functional products have predictable demand whereas innovative products have unpredictable demand. The study also further explained that physically efficient supply chain configuration is the most appropriate for functional products and a supply chain configuration focusing on a market-responsive-process is most suitable for innovative products.

The application of the Configuration Theory to supply chain management will lead to a better understanding of the relations between numerous elements of supply chain management. The knowledge of the different configurations spans a field of possible solutions for supply chain management in the sense of equifinality, which means that a functional outcome can be realised via different ways (Gresov & Drazin 1997:405). This knowledge will therefore help a supply chain

manager/SME owner to set the details in his organisation either by copying or by promoting innovations thus improving the supply chain performance.

Khandwalla (1973:481) also pointed out that, not only the optimisation of isolated elements, but also the harmony among these elements have a deep impact on performance. The author argued that a better fit between the elements of a system will lead to a higher performance. The Configuration Theory also aspires to provide predictive insight with respect to which firm configurations will be successful under what sets of circumstances (Weele 2010:1054). The Configuration Theory was applicable to this study because it treats a set of elements, that is, configuration, as a single predictor. All elements of a configuration together simultaneously explain the outcome of interest in the study, the supply chain performance. Therefore, it can effectively explain complementary, synergetic effects of elements to produce an outcome (Fiss 2007: 1193; El Sawy, Malhotra, Park & Pavlou 2010: 836).

2.15 CONCLUSION

The primary purpose of this chapter was to provide an overview of supply chain management concepts. This chapter aimed to indicate how an effective supply chain management process adds value to an organisation. It also sought to initiate the understanding of some core concepts of supply chain management.

Definitions and concepts of supply chain and supply chain management in business were highlighted in this chapter. Discussions on the role and objectives of supply chain and supply chain management were elaborated on. The different types or approaches to supply chains were dealt with. The SCOR model was also examined. The drivers and benefits of supply chain management were also discussed.

Over and above, this chapter explains the basic concepts of supply chain management and shows that supply chains in some form are required to deliver best value to the customer at minimum cost and effort. What emerges most in this chapter is that supply chain management constitutes a critical knowledge and tool for managers as it will assist them in delivering products and services on time, on budget and at an acceptable level of quality.

The next chapter discusses e-procurement functions which include e-sourcing, e-design, e-informing, e-negotiation and e-evaluation and benefits associated with them in SMEs.

CHAPTER 3
THE NATURE OF E-PROCUREMENT

3.1 INTRODUCTION

Chapter 2 provided definitions of a supply chain and supply chain management and reviewied literature on the role, benefits, drivers and approaches to supply chain management. Supply chain requirements and principles including the SCOR model were also discussed. The current chapter focuses on literature encompassing the nature of e-procurement. The chapter conceptualises e-procurement and discusses its functions. These functions include e-sourcing, e-design, e-informing, e-negotiation and e-evaluation and are discussed under each separate section. The different types of e-procurement systems and the benefits of e-procurement are also explored in this chapter. Finally, the chapter elaborates on various e-procurement system types. The application of the Configuration Theory to this chapter is discussed in the next section.

3.2 THE CONFIGURATION THEORY

The Configuration Theory is broadly defined as "any multi-dimensional constellation of conceptually distinct characteristics that commonly occur together" (Meyer, Tsui & Hinnings 1993:1175). In other words, the Configuration Theory suggests that organisations are best understood as clusters of interconnected structures and practices, rather than modular or loosely coupled entities whose components can be understood in isolation. Because of its multidimensional nature, the Configuration Theory is particularly relevant to e-procurement because it captures its functions and how they improve supplier integration. This is in conjunction with the purpose of the study, which is designed at exploring how the effective implementation of e-procurement functions can result in improved supplier integration, subsequently leading to improved supply chain performance. As such, the theory is relevant to the current study as it aims to examine the effects of e-procurement functions, such as e-informing, e-design, e-evaluation, e-negotiation and e-sourcing on supplier integration. The next section discusses the conceptualisation of e-procurement in terms of e-business and e-commerce.

3.3 CONCEPTUALISATION OF E-PROCUREMENT

One of the most important developments in supply chain management all over the world in modern times is e-procurement (Chirchir *et al.* 2015:26). The introduction of information technology has radically changed the traditional way of operating in business (Chaffey 2006:35; Chang & Wong

2012:262). The Internet has provided opportunities for electronic procurement to explore in this new era (Baily, Farmer, Crocker, Jessop & Jones 2008:393). The Internet has enabled companies to manage supply chains more effectively and efficiently. It has become an open market for electronic business transactions (Sharma 2012:247). Therefore, the Internet makes electronic procurement simple, fast and saves a lot of paperwork.

E-procurement is part of e-commerce (Chu, Leung, Hui, & Cheung 2007:154). E-commerce makes use of advanced technology to assist business transactions of information flow and funds flow. Further, e-commerce involves business to business (B2B) transactions, business to customer (B2C) transactions and customer to customer (C2C) transactions. E-commerce is conducted through a variety of electronic means such as Electronic Data Interchange (EDI), Electronic Funds Transfer (EFT), bar codes and faxes (Li 2007:6). According to Chang and Wong (2012: 262), the Internet and e-commerce are drastically changing the way purchasing is done.

On the other hand, Wu (2007:576) defines e-procurement as "the use of information technologies to facilitate business-to-business transactions for materials and services". E-procurement is a specific set of instruments, technologies and organisational solutions supporting public procurement processes, particularly considering the possibility to manage tendering procedures and auctions online (Gardenal 2015:3).

E-procurement is regarded as a subset of supply chain management and is defined by Hugo and Badenhorst-Weiss (2011:163) as follows:

> *"E-procurement is the process by which goods and services are sourced electronically or more specifically, online. This process goes beyond simply ordering goods and services online since it also includes the flow of information between buyers and suppliers and the transaction processes typical of purchasing transactions. E-procurement moves the current manual transaction-based environment to an online environment, which enables the realisation of efficiencies in terms of time, the accuracy of information and audit trails."*

Though there is no clear agreed upon definition of e-procurement, the consensus is that e-procurement uses IT to process transactions of goods and services (Choudhury & Hartzel 2008:45).

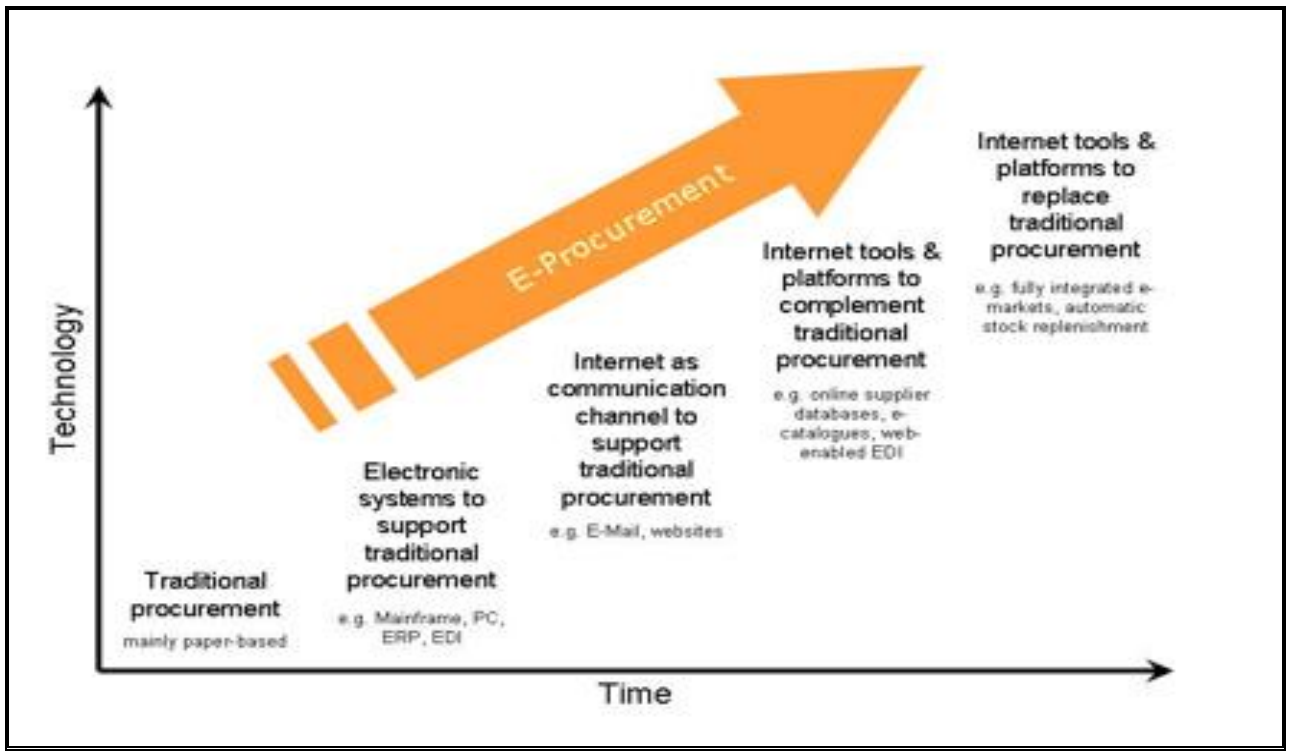


Figure 3.1: The evolution of e-procurement

Source: Chang and Wong (2012:268)

The historical context of e-procurement is demonstrated in Figure 3.1. E-procurement has evolved through many stages. Stage one is traditional procurement which was mainly paper-based. The second stage is the introduction of electronic systems to support traditional procurement, for example, main-frames, and personal computers were introduced. The third stage is the Internet phase as a communication channel to support traditional procurement. Examples include emails and websites. The fourth stage brought about the Internet tools and platforms to complement traditional procurement. Examples include online supplier databases and e-catalogues. The last stage sees traditional procurement being replaced by Internet tools and platforms which include fully integrated e-markets and automatic stock replenishment.

For the purpose of this study, the definition of e-procurement can be defined as the business-to-business purchase and sale of supplies over the Internet (Baily *et al.* 2008:394; Chopra & Meindl 2013:564).

This section discussed the conceptualisation of e-procurement. It emerged that e-procurement is one of the most important developments in supply chain management in modern times. E-procurement involves the use of technology in facilitating transactions between buyers and suppliers. There is no single universal definition for e-procurement. E-procurement has evolved through four stages which are traditional procurement, electronic systems to support traditional

procurement, Internet as a communication channel and Internet tools and platforms finally replacing traditional procurement. The next section discusses the five e-procurement functions which are the main constructs for this study.

3.4 E-PROCUREMENT FUNCTIONS

This section analyses literature on e-procurement functions. As mentioned by Hugos (2011:116) these functions include e-sourcing, e-design, e-informing, e-negotiation and e-evaluation. The purpose of these functions is to streamline the procurement process and make it more efficient.

3.4.1 E-sourcing

E-sourcing refers to the process of finding new potential suppliers using Information Communication Technologies (ICT) with the aim of decreasing search costs. In other words, it refers "to the identification of new suppliers for a specific category of purchasing requirements using Internet technology" (Lysons & Farrington 2012:373; Ombat 2015:703). It simply uses a web-based platform to support all steps in the sourcing process, including expenditure analysis, demand aggregation, requirements definition, supplier discovery, negotiations (RFI, RFP and RFQ), that is, (request for indent/proposal/quotation), reverse auctions, bid evaluation and contract management.

E-sourcing is the tool that drives supply chain management. As the world market for goods and services becomes a key competitive advantage, e-sourcing is redefining the way companies manage their supply chains (Chaffey 2002:341). Buyers and sellers located on different continents can meet electronically. Thus, e-sourcing may also lead to higher transactional accuracy and cost reductions for the entire supply chain (Benton 2014:161).

E-sourcing is also defined by Lysons and Farrington (2012:373) as using the Internet to make decisions and form strategies regarding how and where services or products are obtained. Therefore, e-sourcing allows research, design and purchasing personnel to find parts, components and sub-assemblies for prototypes and subsequent production models.

According to Corina (2011:65), the main benefit of e-sourcing is "increased decision-making flexibility and lower prices". Sharma (2012:249) proposed more benefits of e-sourcing to include:

integrated process automation;

saves time through seamless information transfer;

improves productivity with template reuse, such as product templates, RFQ templates and documents;

enables full transparency when monitoring or reporting;

creates collaboration between key stakeholders and team members;

ensures unified measurement of Key Performance Indicators (KPIs) and follow up on sourcing goals on equal terms; and

increases savings by strong functionality with scenario building possibilities, enabling more informed and constructive decisions.

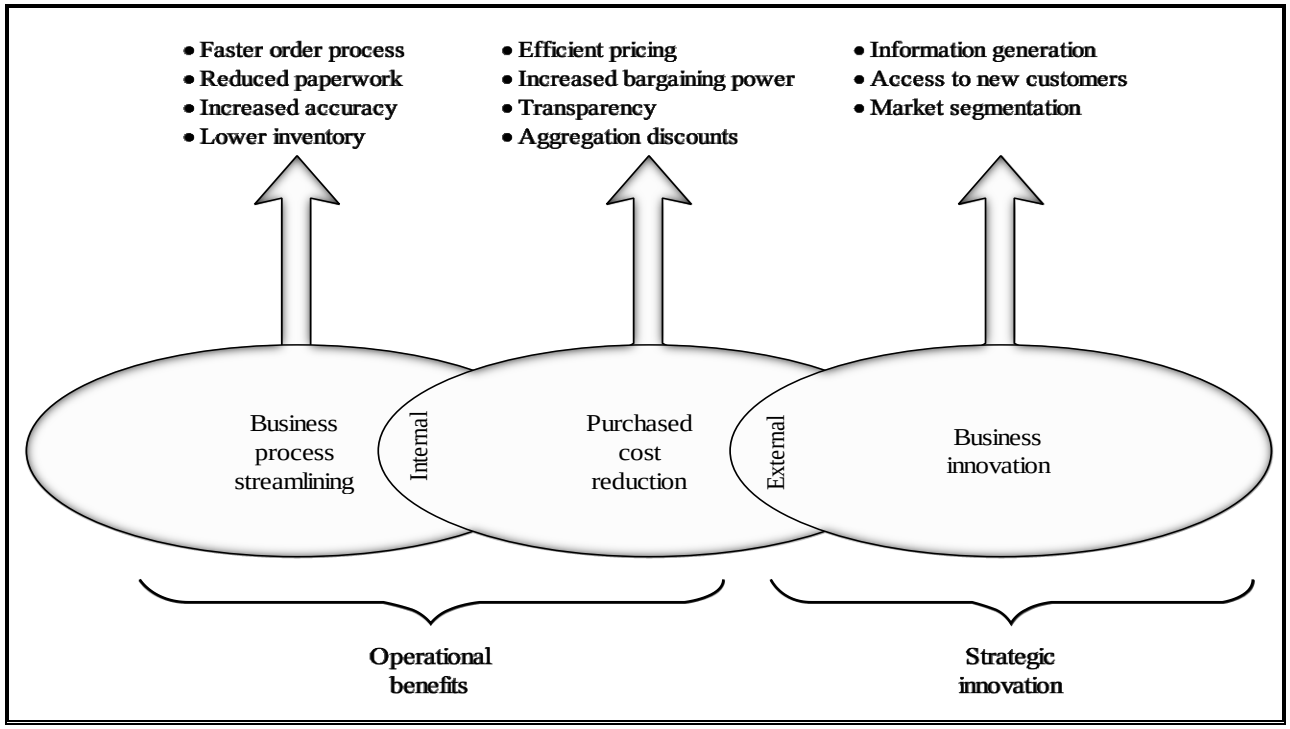


Figure 3.2: Benefits of e-sources

Source: Benton (2014:161)

Figure 3.2 shows that e-sourcing creates value by reducing total cost of ownership; streamlining the purchasing process and business innovation.

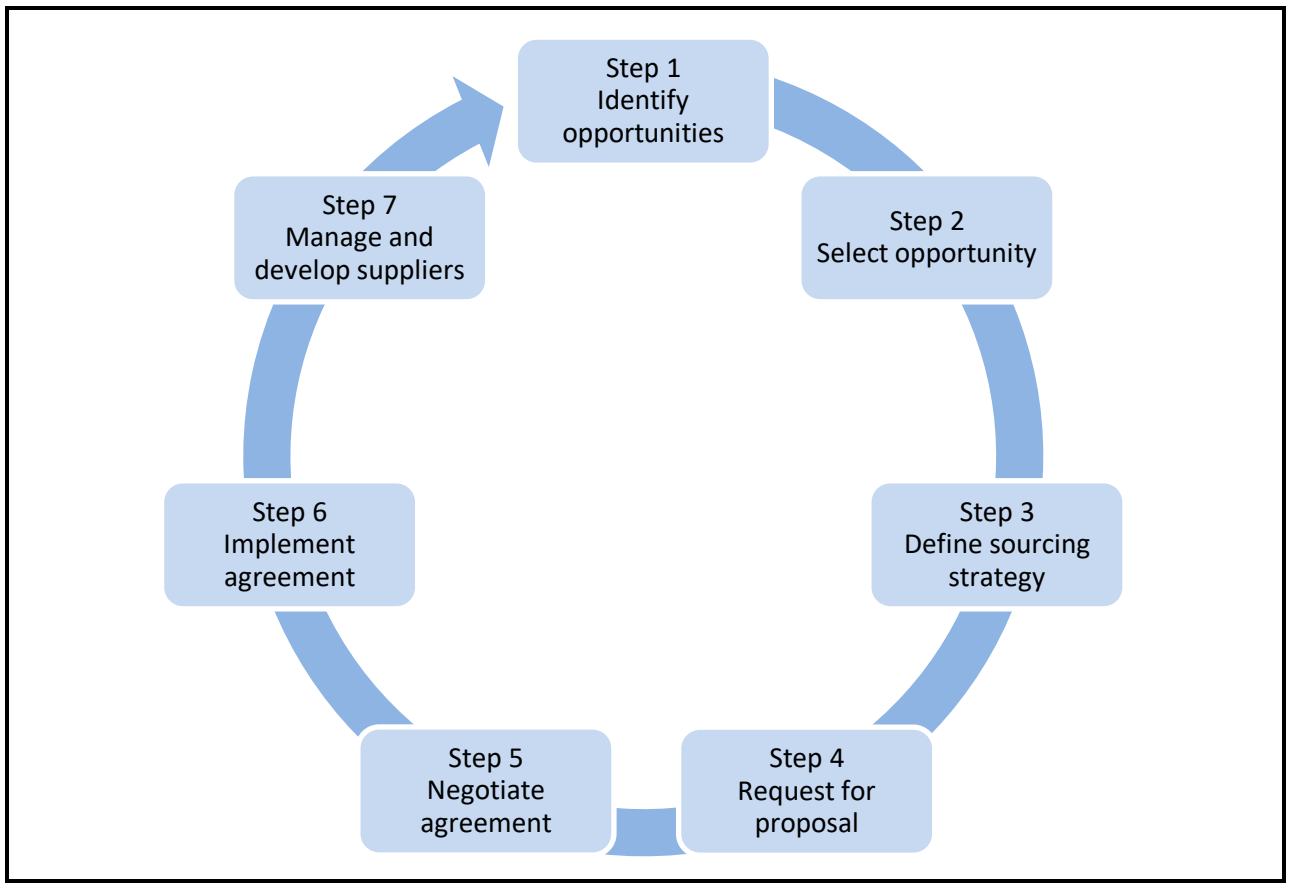


Figure 3.3: Typical e-sourcing cycle

Source: Sharma (2012:255)

As can be seen in Figure 3.3 above, the e-sourcing cycle process has seven steps, beginning with identification of opportunities, selecting an opportunity, defining sourcing strategy, request for proposal, negotiate an agreement, implement that agreement and finally manage and develop suppliers. Thus, the process is cyclical. Furthermore, e-sourcing has collaborative capabilities, which makes it much easier to involve relevant stakeholders early in the process.

3.4.2 E-design

E-design refers "to the setting of purchasing requirements on an online procurement system" (Chang, Tsai & Hsu 2013:35). E-design facilitates supplier involvement in the specification development process of a product. It also facilitates reduced time-to-market cycles by overcoming the silo effect of the traditionally sequential design activities (Presutti 2003:220). Thus, e-design is an important function in the e-procurement system as it enables the purchasing process to be quick and efficient.

3.4.3 E-informing

E-informing refers "to the gathering and distributing of purchasing information both from and to internal and external parties using Internet technology, for example, purchasing management information on an extranet that can be accessed by internal clients and suppliers" (Sharma 2012:251). In other words, e-informing involves information gathering, information distribution and purchasing information (Corina 2011:65; Ombat 2015:703). Thus, e-informing is important in distributing information to supply chain partners.

According to Coyle, Langley, Novack and Gibson (2013:189), information is the lifeline of business, driving effective decisions and actions. Information provides supply chain managers with insights and visibility into the supply chain activities taking place at the distant supplier and customer locations. This visibility of demand, customer orders, delivery status, inventory stock levels and production schedules provide managers with the knowledge needed to make effective situational assessments and develop appropriate responses. Chopra and Meindl (2004:18) argue that information is the most important driver of supply chain management because it enables other drivers of the supply chain to collaborate. In this regard, e-informing holds great promise for improving supplier integration and enhancing supply chain performance and organisational effectiveness.

3.4.4 E-negotiation

E-negotiation is defined as "the process of conducting negotiations between business partners using electronic means" (Rinderle-ma 2005:2). Thus, e-negotiation is used to make significant savings in the purchase of goods and services via the Internet (Scot & Morrison 2007:332).

Approaches to negotiation may be classified as adversarial or collaborative (Lysons & Farrington 2012:548). Adversarial negotiation also termed "distributive or win-lose negotiation" is an approach in which the focus is on "positions" stacked out by the participants and the assumption is that every time one party wins, the other party loses, so, as a result, the other party is regarded as an adversary. Collaborative negotiation also called "integrative or win-win negotiation" is an approach in which the assumption is that, by means of creative problem solving, one or both parties can gain without the other having to lose and as the other party is regarded as a collaborator rather than an adversary, the participants may be more willing to share concerns, ideas and expectation than would otherwise be the case. The characteristics of adversarial and collaborative negotiation are summarised in Table 3.1.

Table 3.1: Adversarial and collaborative negotiation contrasted

Adversarial negotiation	Collaborative negotiation
The emphasis is on competing to attain goals at the adversary's expense.	The emphasis is on ascertaining goals held in common with the other party.
Strategy is based on secrecy, retention of information and low level of trust in the perceived adversary.	Strategy is based on openness, sharing of information and high level of trust in the perceived partner.
The desired outcomes of negotiation are often misrepresented so that adversary does not know what the opponent really requires the outcome of the negotiation to be. There is little concern for or empathy with the other party.	The desired outcomes of the negotiation are made to be known so that there are no hidden agendas and issues clearly understood. Each party is concerned for and has empathy with the other.
Strategies are unpredictable, based on various negotiation plays designed to out-manoeuvre or "throw" the other party.	Strategies are predictable while flexible; such strategies are aimed at reaching an agreement acceptable to the other party.
Parties use threats, bluffs and ultimatums with the aim of keeping the adversary on the defensive.	Parties refrain from threats, which are seen as counterproductive to the rational solution of perceived problems.
There is an inflexible adherence to a fixed position that may be defended by both rational and irrational arguments.	The need for flexibility in the positions taken is assumed. The emphasis is on the use of imaginative and creative logical ideas.
The approach is essentially hostile and aggressive – "us against them".	The approach is essentially friendly and non-aggressive – "we are in this together". This involves downplaying hostility and giving credit to constructive contributions made by either party to the negotiations.
The unhealthy extreme of an adversarial approach is reached when it is assumed that movement towards one's goal is facilitated by blocking measures that prevent the other party from attaining the goal.	The healthy extreme of a partnership approach is reached when it is assumed that whatever is good for the other party to negotiate is necessarily good for both.
The key attitude is that of "we win, you lose".	The key attitude is "how can the respective goals of each party be achieved so that both win?". If an impasse occurs, this is regarded as a further problem to be solved.

Source: Lysons and Farrington (2012:549)

3.4.5 E-evaluation

E-evaluation refers to "the stage where extensive information about suppliers is collected for further evaluations and transactions via the internet" (Chang *et al.* 2012:35). According to Presutti (2003:231), an organisation implementing e-procurement tools needs to evaluate and improve its purchasing process to achieve full benefits.

According to Croom (2000:6), it is highlighted that an advantageous e-procurement strategy must be evaluated in its complexity, which includes numerous goals such as rationalising the internal expenditure, reduction of the administrative cost and confusion and fostering efficient operational models and automating certain procurement activities completely. Lysons and Farrington (2012:384) highlight that the purposes of e-evaluation are as follows:

Evaluation can significantly improve supplier performance.

Evaluation assists decision making regarding when a supplier is retained or removed from an approved list.

Evaluation assists in deciding with which suppliers a specific order should be placed.

Evaluation provides suppliers with an incentive for continuous improvement and prevents performance "slippage".

Evaluation assists in decisions regarding how to distribute the spend for an item among several suppliers to better manage risk.

The next section discusses the benefits of e-procurement to an organisation.

3.5 BENEFITS OF E-PROCUREMENT

The use of e-procurement also aids a firm's sustainability and ethical purchasing efforts, for example, e-procurement systems around the world have vastly reduced the use of paper from ordering to payment process (Cameron 2007:50; Wisner, Tan & Leong 2012:123).

According to Wisner *et al.* (2012:46-47), the benefits of e-procurement systems include:

Time savings - especially when making repeat purchases - are more efficient.

Cost savings – buyers can handle more purchases and the manual task of matching bids to purchase requisitions is reduced.

Faster order fulfilment, reduced inventory costs due to the ability to purchase on a more frequent basis.

Accuracy – the system eliminates double-key inputs – once by the materials users and then once by the buyers. The system also enhances the accuracy of communications between buyers and suppliers. More up to date information on suppliers, with goods and services readily available online, allows users to assess their options before preparing a purchase requisition.

Real-time – buyers have real time access to the purchase requisition once it is prepared. The system enables suppliers to respond in real time on a 24/7 basis.

Mobility – the buyer can submit, process and check the status of bids, as well as communicate with suppliers regardless of the buyers' geographical location and time of the day. Thus, an e-procurement system is highly flexible.

Trackability – an e-procurement system allows submitters and buyers to track each purchase requisition electronically through the process – from submission, to approval and finally conversion to a purchase order. Tracing an electronic bid is much easier and faster than tracking paper trails.

Management – the management can be designed to store important supplier information. Summary statistics and supplier performance reports can be generated for management to review and utilise for future planning.

Baily *et al.* (2008:396) cites more benefits of e-procurement which include:

reducing purchasing cycle time;

enhancing budgetary control;

eliminating administrative errors;

increasing buyer's productivity;

lowering prices through standardisation and consolidation of purchasing power; and

better information management.

In essence, it enables the e-procurement process to be redesigned, taking out the slow, costly transactional work, resulting in faster cycle times. Many non-value-added transactions can be eliminated, thus reducing the cycle times by several days. This provides companies with enormous efficiency improvements (the way people work). It allows staff to concentrate their efforts on more strategic aspects of value-added procurement. The improvement in information flow, especially improved sharing of sensitive information, allows for improved commercial relationships with suppliers.

E-procurement can reduce transaction costs; increase the efficiency and transparency of the e-procurement process, and thus improve the whole operational efficiency and competitive advantage of the supply chain (Mondragon, Lyons, Michaelides & Kehoe 2006:11; Li 2007:69; Samson 2011:39).

E-procurement can also simplify purchase payments (Min & Gale 2003:64). Lysons and Farrington (2012:205) state that the benefits of an investment in e-procurement can be both hard, that is, directly measurable and soft, that is, indirectly measurable.

Hard measures include:

"automated purchase to buy process (order processing time and cost of auction);

automation of P-card purchasing;

electronic payment of invoices;

lower prices by means of strategic sourcing;

reduced head-count; and

supply base rationalisation."

Soft measures include:

freeing up of purchasing staff time, enabling them to focus on more strategic procurement issues;

reduction in maverick buying (which is when staff buy from suppliers other than those with whom a purchasing agreement has been negotiated);

tracking and tracing of orders is improved;

management information availability is also improved.

The benefits of e-procurement are summarised below in Table 3.2 by Baily *et al.* (2008: 400) and in Figure 3.4 which shows a summary of the main savings drivers for e-procurement:

Table 3.2: Summarised benefits of e-procurement

Value drivers	Mitigation/savings estimate
Improved process efficiency	Requisition processing time reduction of 70-80 percent.
Reduced costs	Requisition process reduction up to 73 percent, prices of goods 5-10 percent less.
Improved compliance	Data improved via contract compliance improves leverage.
Reduced off-contract	Off-contract spending decreases by 50 percent.
Reduced inventory	Inventory expense reduction by 25-50 percent.

Source: **Baily *et al.* (2008:400)**

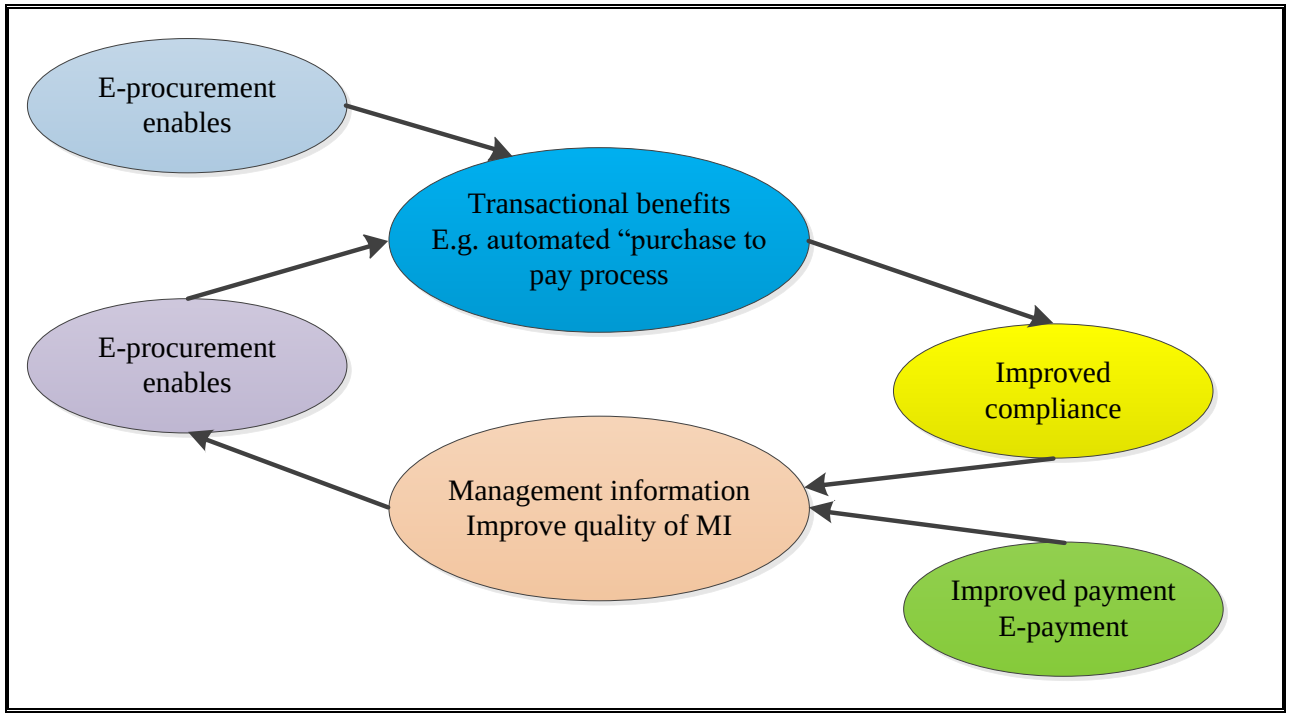


Figure 3.4: Summary of the five main savings drivers for e-procurement

Source: Baily (2008: 406)

Table 3.3 also shows summarised additional benefits of e-procurement (operational value and strategic value based).

Table 3.3: The main values added by e-procurement

Operational value based	Strategic value based
Cost savings	The management influence is greater over the purchasing process
Time savings	Purchasing power of the purchasing specialists is increased
Improved efficiency of the purchasing process	The opportunity to manage the total supply base is increased
Reduced operating and inventory costs	Relationships with suppliers is greater
Enhanced budgetary control	Profit margin is increased
Eliminated administrative errors	Customer service is improved
Increased buyer's productivity	Quality is improved through increased visibility in the supply chain
Reduced cycle times	Competitive advantage is gained

Source: Corina (2011:66) and Weele (2010:76)

Other potential benefits of adopting e-procurement:

Considerable reduction in the cost of transactions;

More efficiency of the processes due to a reduction in the involvement of human elements;

Reduction in the cost of inventory;

Reduced cycle times;

More compliance with the contractual agreement;

IT use in buyer-supplier exchanges leads to closer cooperative relationships;

Reduced staff time and paperwork (Presutti 2003:232; Subramani 2004:35; Aberdeen Group 2005:78; Briggs 2006:14; Wu *et al.* 2007:493; Rian & Walters 2009:257).

Croom (2001:515) suggests using e-procurement for more effective supplier relationships. Similarly, Croom and Brandon- Jones (2007:298) support that e-procurement enhances supplier relationships. Another study conducted by Smart (2010:427) also revealed that e-procurement reinforces supply chain partners' relations. Therefore, e-procurement is important in enriching the relationship between supply chain partners.

Although the advantages of having e-procurement outweigh the shortcomings, Li (2007:70) suggests some shortcomings of e-procurement which include "system-to-system integration and compatibility, the initial investment in hardware and software, system maintenance, information, data accuracy and re-engineering the procurement process". Thus, organisations need to consider the downside of e-procurement when implementing it in their organisation. The next subsection is on e-procurement system types.

3.6 E-PROCUREMENT SYSTEMS

An E-procurement system (EPS) is an opening system which promotes the information and transaction between buyer and seller in the market-place (Mettler & Rohner 2009:25). It can not only support the operation of the upstream supply chain; deal with the various activities, such as manufacturing plan, inventory control, order management, cost control, but also optimise the operation of the downstream supply chain, such as selling, distribution and after sales service (Samson 2011:63).

The different system types are discussed in the subsection.

3.6.1 System types

The current e-procurement systems can be classified mainly into four types: buyer e-procurement systems, seller e-procurement systems, industry procurement platform and procurement agency. These systems can be divided into many forms, as depicted in Table 3.4.

Table 3.4: Comparison of different e-procurement systems

	Forms	Cases	Advantages	Disadvantages
Buyer e-procurement system	• Procurement module in ERP • Independent e-procurement system based on intra/internet • Buyer e-market place	Oracle, Baan, IBM, My SAP	• Reduces purchasing price • Enhances process control • Improves production quality	Seller may be unwilling to participate because of difficult competition

	Forms	Cases	Advantages	Disadvantages
Seller e-procurement system	• Electronic production catalogue • Seller e-market place	e-chemicals; Petrocosm	• Collectsinformation of buyers • Increases selling price • Strengthens the status of seller	Buyer may be unwilling to participate because of difficult competition
Industry procurement platform	• Procurement platform within an industry • 3rd party procurement platform	Exostar; SNS	• Reducespurchasing price • Reduces search cost • Facilitates transaction	Supply chain relationship cannot be improved effectively
Procurement agency	• Enterprise catalogues • Neutral e-market places • E-auction • E-bidding	Yellow pages; MRO.com	• Reduces purchasing price • Reduces search cost • Improvesservice quality	The characteristics of different industries are different. Market liquidity is deficient.

Source: Samson (2011:63)

3.6.1.1 Buyer e-procurement systems

Figure 3.5 shows that buyer e-procurement systems are usually developed and operated by large buyers to realise purchasing, contract management, as well as the evaluation and selection of suppliers. The system focuses on transaction efficiency and process control (Lancastre & Lages 2006:774; Samson 2011:63).

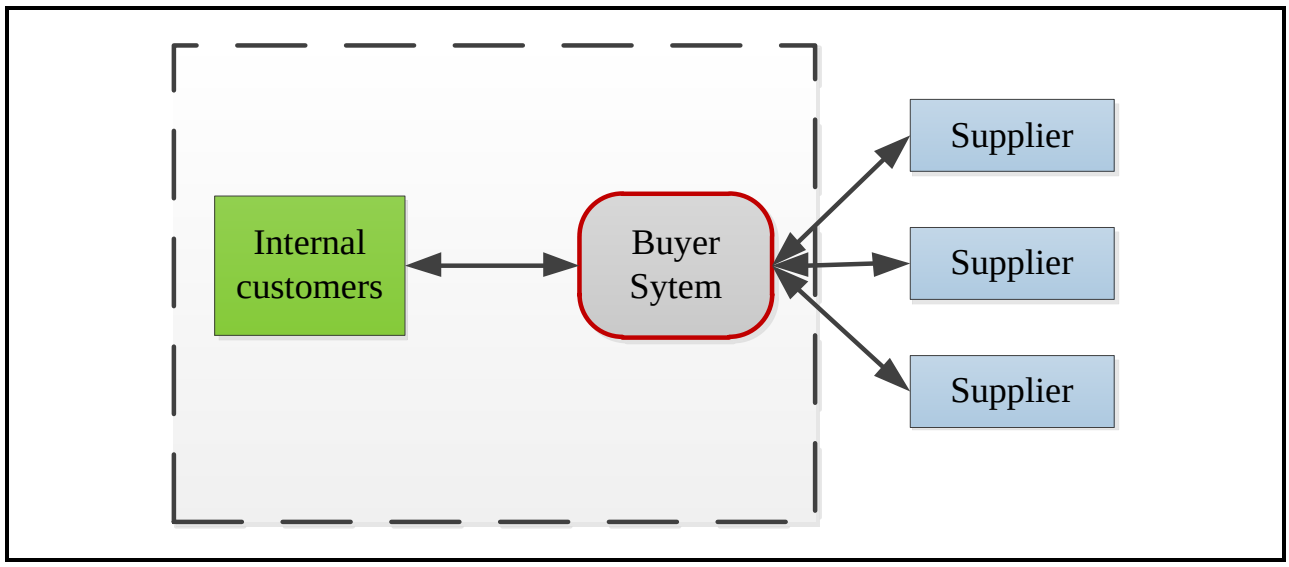


Figure 3.5: Buyer e-procurement systems

Source: Samson (2011:63-64)

3.6.1.2 Seller e-procurement systems

In Figure 3.6, seller e-procurement systems are usually developed and operated by large or dominant sellers in the industry to collect the information of buyers, and to maximise their own expected profit (Samson 2011:64).

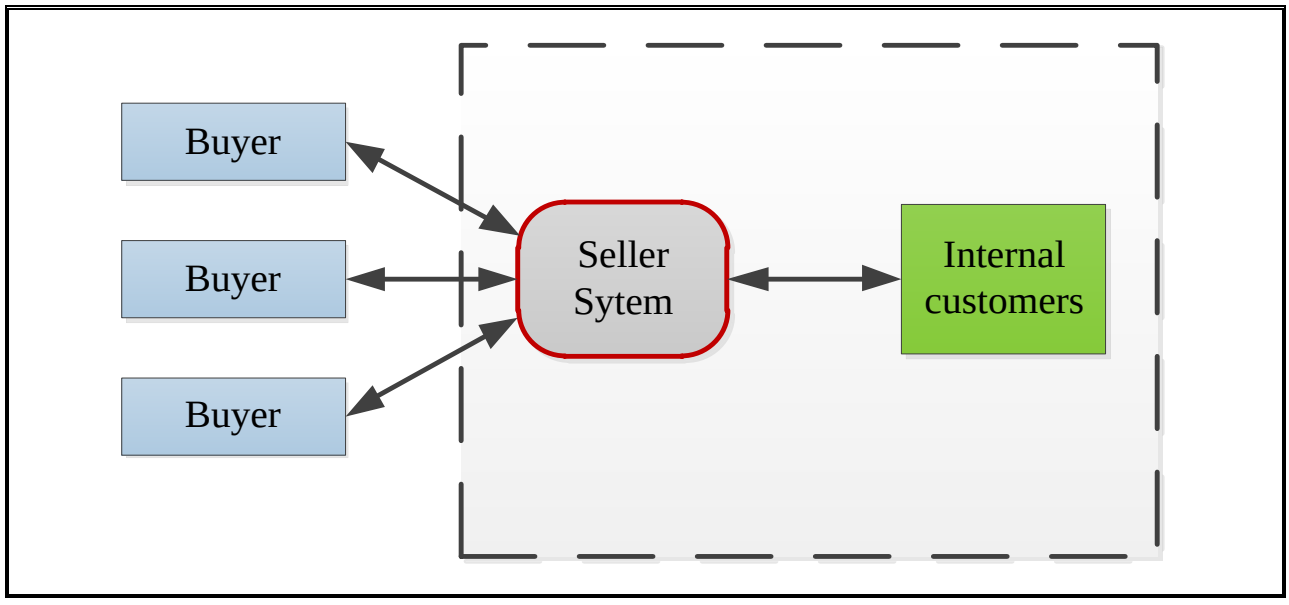


Figure 3.6: Seller e-procurement

Source: Samson (2011:63)

3.6.1.3 Industry procurement platforms

In Figure 3.7, the industry procurement platforms provide package deals and services for purchasing consortiums built by several buyers in a certain industry. The main objective of these platforms is to reduce search cost through enlarging procurement scale and increase competition among suppliers.

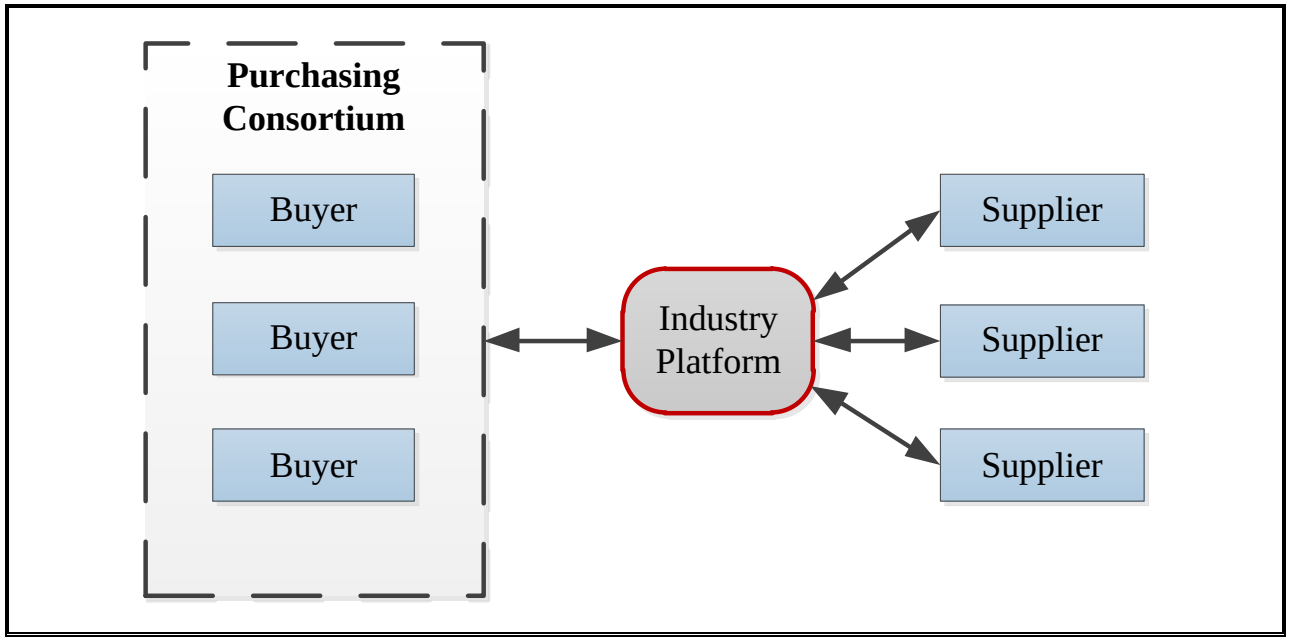


Figure 3.7: Industry procurement platforms

Source: Samson (2011:64)

3.6.1.4 Procurement agency

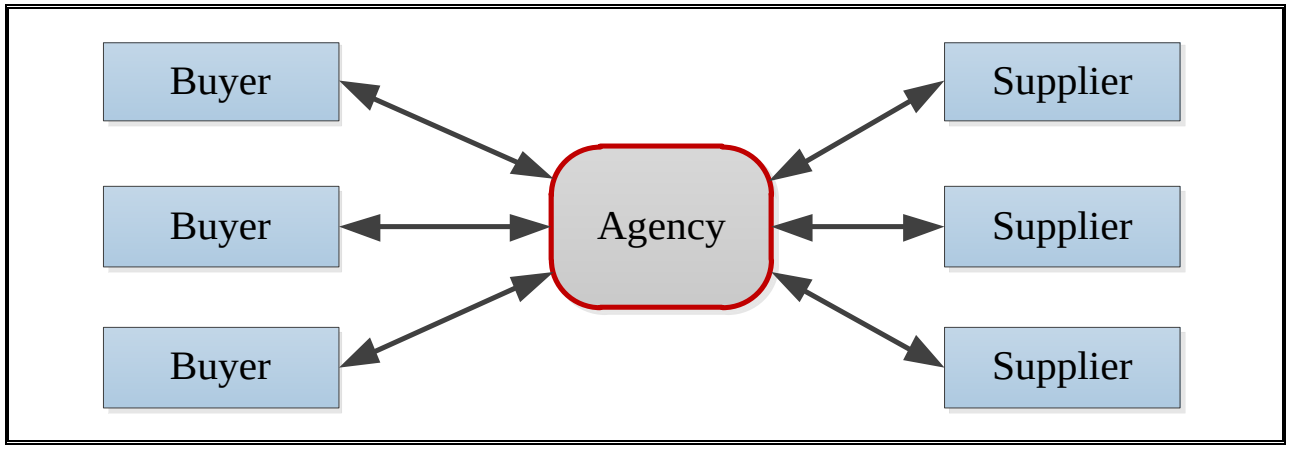


Figure 3.8: Procurement agency

Source: Samson (2011:64)

Figure 3.8 above shows procurement agency is developed and operated by third party logistics (3PL) and provides a transaction platform for buyers and suppliers from the same or different industries, so called "network market maker".

3.7 TECHNOLOGY TOOLS

The use of information technology facilitates links to potentially anywhere in the world (Monzka 1997:721). Technology is also important for managing inventory, contracts, demand and integration and driving performance and strategic fit in the supply chain (Hugo and Badenhorst-Weiss 2011:74). There are several different technology tools that may be used in managing supply chains. The study discussed Radio Frequency Identification (RFID), Electronic Data Interchange (EDI), Electronic Resource Planning (ERP), Collaborative Planning, Forecasting and Replenishment (CPFR), Intranets, E-market-places and Vendor Managed Inventory (VMI).

3.7.1 Radio frequency identification (RFID)

RFID technologies "automatically identify and locate physical freight" (Sakka & Botta-Genoulaz 2009:1). Individual items, batches of freight or the containers in which they are held can carry an RFID transporter (Chang, Tsai & Hsu 2013:35). With RFID, a line of sight is not required as is the case with the traditional bar code reading system (Tai 2011:5398).

The advantages of RFID are that inventory holding will be minimised across the supply chain, which will lead to reduced capacity and resource requirements and in turn dramatically reduce logistics costs (Sigal 2006:82; Hugo & Badenhorst-Weiss 2011:170).

3.7.2 Electronic data interchange (EDI)

Mangan, Lalwani, Butcher and Javadpour (2012:418) state that electronic data interchange (EDI) is a technology for the electronic interchange of data between two or more companies. The predominant forms of data transfer via EDI are purchase orders from customers to suppliers, invoices for payment from suppliers to customers, delivery schedule data and payment instructions. EDI can be linked to an Electronic Funds Transfer (EFT) application that enables payment (Wu *et al.* 2007:38).

Data transmitted via EDI is typically automated, that is it does not require human intervention. For example, when the delivery data of a particular order is reached, the supplier computer automatically sends an invoice to the appropriate customer's computer. When integrated with

other IT applications across the supply chain, EDI becomes a more powerful tool (Chirchir *et al.* 2015:29).

Some advantages of EDI include:

Fast turn-around time of large amounts of data.

Reduced administrative costs and data errors by eliminating re-keying of data, and secure transmission.

Problems associated with EDI technology:

High costs for investing in technology for EDI;

Recurring costs of value-added network (VAN) fees and telecom expenses prohibit much organisation;

The lack of standardisation of EDI communication architectures;

Organisations are moving towards the adoption of internet EDI due to lower costs involved (Subramanian & Shaw 2012:123).

3.7.3 Enterprise resource planning (ERP)

ERP systems are large, integrated systems which span an organisation and its supply chain (Gunasekaran & Ngai 2008:160). ERP systems are multimodal application software platforms that help organisations manage the important parts of their businesses (Wu *et al.* 2007:31). ERP systems focus on integrating information and activities across the organisation via a common software platform and centralised database-system. Key business processes linked via ERP include accounting and finance, planning, engineering, human resources, purchasing, production and inventory/materials.

Wisner *et al.* (2012:199) discuss the following advantages and disadvantages of an ERP system:

Table 3.5: Advantages and disadvantages of enterprise resource planning (ERP) systems

Advantages	Disadvantages
ERP uses a single database and common software infrastructure to provide a broader scope and up to date information, enabling informed decision making	ERP systems require a substantial capital investment to purchase and implement the system
ERP helps an organisation reduce supply chain inventories due to added visibility throughout the supply chain	The adopting firm must often change its business model and associated processes to fit the built-in business model designed into the ERP system
ERP systems help organisations standardise manufacturing processes	Implementation challenges remain unresolved and scores of ERP systems are grossly underutilised.
ERPs enables organisations to efficiently track employee's time and performance and to communicate with them via the standardised method.	

Source: **Wisner *et al*. (2012:199)**

3.7.4 Materials requirement planning (MRP)

The tool for planning and controlling the manufacture and assembly of orders with dependent demand is *Materials requirement planning (MRP)* (Simchi-Levi, Kaminsky & Simchi-Levi 2008:845). This is a software package consisting of the modules. MRP systems are necessary for planning production. Figure 3.9 represents MRP and its workings:

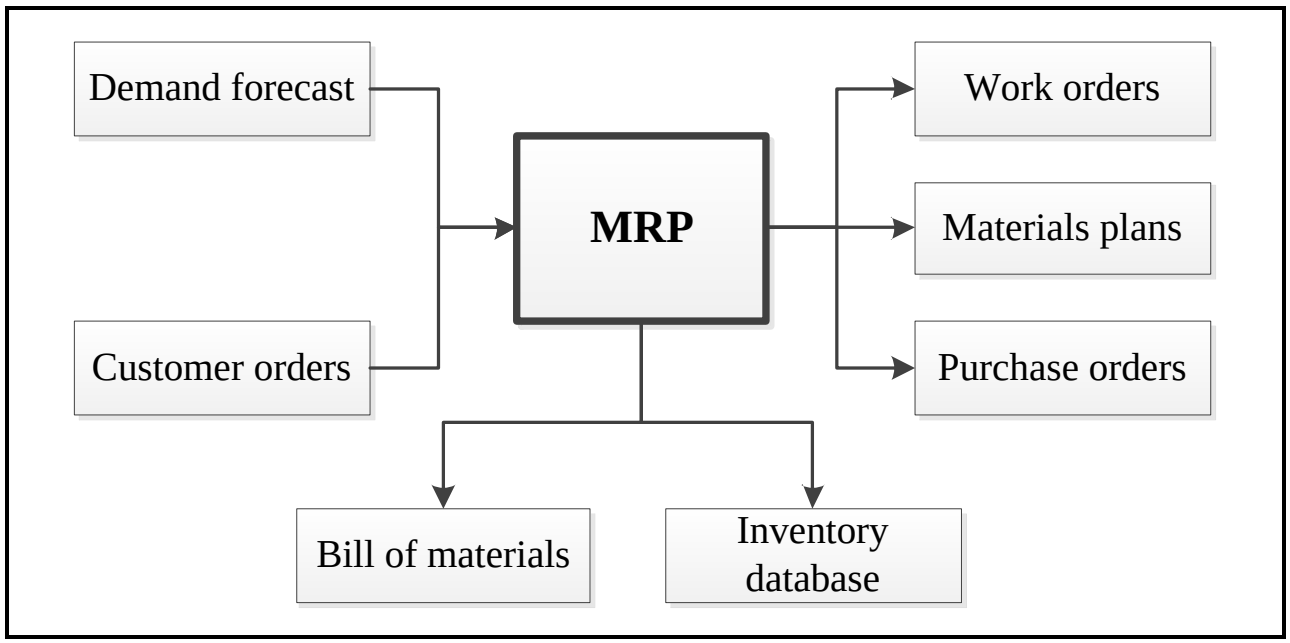


Figure 3.9: MRP systems

Source: Russel and Hoag (2004:104)

Demand forecasts and customer orders input into the Master Production Schedule (MPS), which informs the shop floor of what should be manufactured and assembled and when it is to be done. However, production cannot begin without the required materials, components and sub-assemblies. The MRP system, therefore, interrogates the bill of materials and the inventory database to generate orders for those materials as and when required. While some materials will be stored in-house others will be sourced from suppliers.

The final stage is for the MRP system to generate work orders to trigger production and assembly, material plans to call materials from in-house storage, and purchase orders to be sent to suppliers (Lee *et al.* 2004: 713). MRP forms the basis for wider business planning and control information systems, namely MRPII (Manufacturing Resource Planning) and ERP (Enterprise Resource Planning) that integrate information from beyond the ship floor (Mondragon *et al.* 2006:551). MRPII utilises the core function of MRP but integrates business functions beyond manufacturing and logistics to include finance, procurement, marketing and sales.

ERP requires a substantial financial, resource and time investment at implementation and for maintenance and development. ERP has one major flaw as it does not extend across the complete supply chain and therefore constrains collaborative planning and control between supply chain partners (Chirchir *et al.* 2015:41; Antonette, Guinipero and Sawchuk 2002:57).

3.7.5 Collaborative planning, forecasting and replenishment (CPFR)

CPFR was developed in the late 1990s to fill the inter-organisational gap that ERP cannot (Chopra & Meindl 2010:617). CPFR was first developed by Wal-Mart to enable collaborative scheduling with its first-tier suppliers (Coyle *et al.* 2013:253). It is fundamentally a new collaborative method of scheduling logistics between suppliers and customers. It is, however, dependent upon timely and accurate information sharing, visibility and transparency. The process of CPFR is illustrated in Figure 3.10.

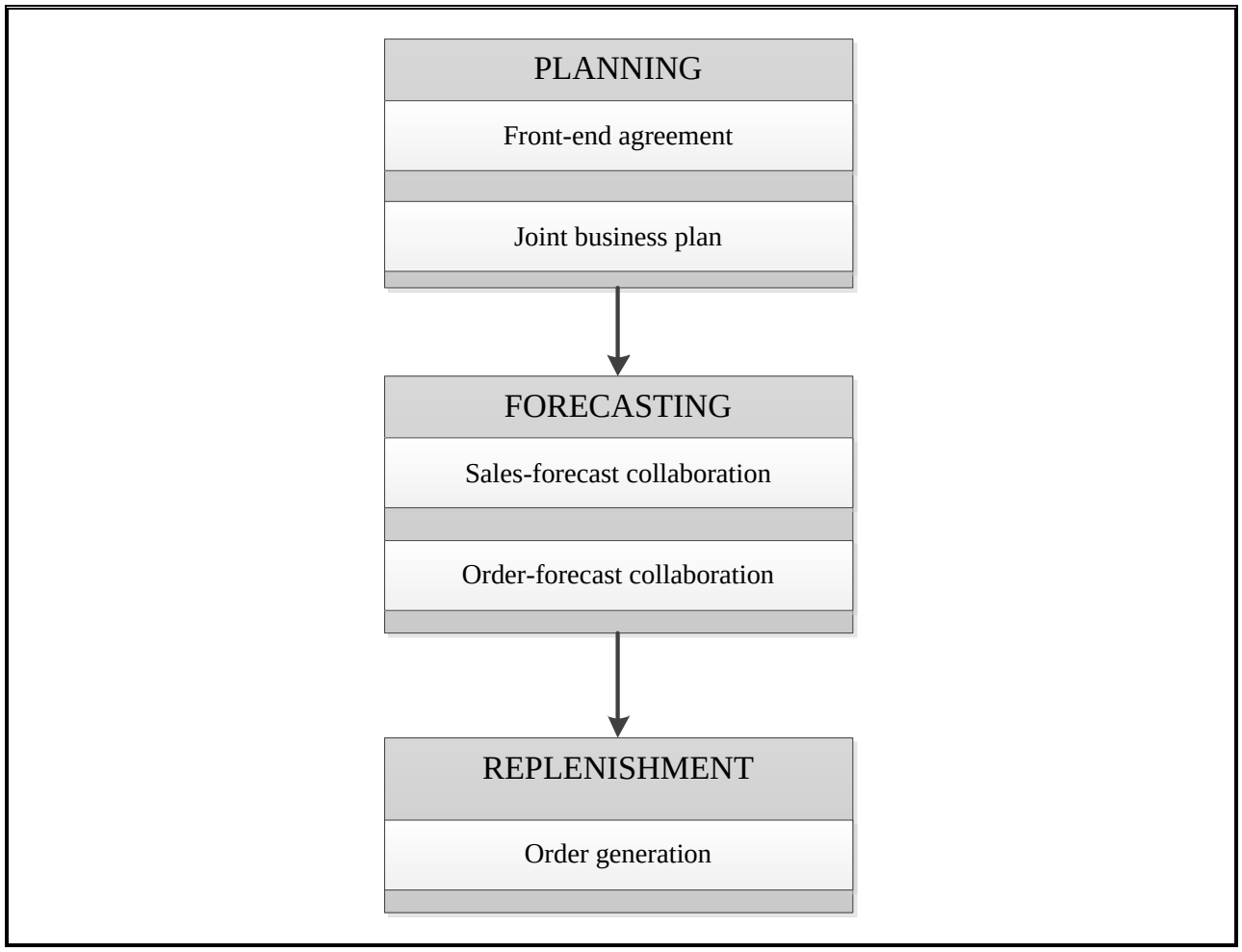


Figure 3.10: The CPFR process

Source: Chopra and Meindl (2013:617)

Conceptually, CPFR should enable significant scope and depth of collaboration across a supply chain. However, scale and complexity are significant constraints. Fundamentally it is difficult to forge close partnerships with many partners. Hence some CPFR solutions have greater scope and depth than others. As such, three modes of CPFR can be identified: basic CPFR, developed CPFR and advanced CPFR (Chu, Leung, Hui & Cheung 2007:154).

As implied, developed CPFR has greater scope and depth than basic CPFR (Germain & Iyer 2006:38). Advanced CPFR goes beyond "data exchanges to synchronise forecasting information systems and coordinate planning and replenishment processes". Hence, product development, marketing plans, production planning and transport planning are seamlessly integrated with forecasts based on actual consumer demand extracted from point-of-sale data. The integration and close collaboration is achieved through interfacing with retailers and first tier suppliers (Chirchir *et al.* 2015:26).

Basic CPFR involves, for example, a supermarket retailer and a selected first-tier supplier. There is usually a lead partner who selects those processes where CPFR is adopted (McCue & Roma 2012:5). The basic CPFR implementation is commonly the starting point of a data-sharing collaborative arrangement, which can potentially lead to developing CPFR (Lancastre & Lages 2006:774).

3.7.6 Vendor managed inventory (VMI)

For VMI, a holistic view of inventory levels is taken throughout the supply chain with a single point of control for all inventory management (Chu, Leung, Hui & Cheung 2007:154). Although VMI is nowadays centred on an IT solution, the concept of a customer merely defining its requirements and the supplier being accountable for fulfilling them predates contemporary IT (Chen *et al.* 2007:525). By providing improved supply and demand information visibility via centralised control, VMI can specifically reduce the impact of the following sources of the bullwhip effect: price variation, rationing and gaming, demand signal processing and order batching (Antonnette, Giunipero & Sawchuck 2002:56; Lee *et al*. 2004:775).

3.7.7 eXtensible mark-up language (XML)

XML uses identifying tags that allow information exchange without having to reformat the data for retrieval and viewing (Chang & Wong 2010:267). Designed for Web-based data exchange, XML makes it possible for computers to automatically manipulate and interpret data without human intervention. Some concerns with XML include: implementation costs, security, lack of standards, including the lack of standard tags and document type definitions (DTDs) for defining industry-specific data elements needed to execute specific transactions (Inkpen & Currall 1998:15; Chen *et al.* 2007:525).

3.7.8 Intranets and extranets

Intranet refers to a single and widely accessible network set up to share information and communicate with company employees (for authorised users only) (Puschmann & Alt 2005:124). It is a private, secure internal Web, based on Internet technology. Intranets serve to communicate information and facilitate collaboration among employees (Ageshin 2001:49). Supply professionals can use intranets to communicate information and incorporate Web-based technology into the supply processes. Intranets can be used to display supplier catalogues, provide lists of approved vendors, and post company supply policies. Supply processes can be enhanced by allowing employees to place orders via Web browsers, approving and confirming purchases electronically, and generating purchasing orders electronically. Supply-based intranets have low transaction costs and reduced lead times (Grieger 2003:280; Fortune & Ried 2012:415).

Extranet refers to a private intranet that is extended to authorise users outside the company such as suppliers (Oosterhout, Waarts, Heck & Hillegersberg 2007:52). Extranets can be used to improve supply chain coordination and share information with key business partners. Through a Web-based interface, suppliers can link into a customer's system and vice versa to perform any number of activities, such as checking inventory levels, tracking the status of invoices and the submission of quotes (Puschmann & Alt 2005:123).

3.7.9 E-marketplaces

Online marketplaces "make the entire business-to-business marketplace more efficient by expanding the range of sellers and buyers and by making the entire market mechanism more transparent (Standing, Standing & Love 2010:41). They reduce procurement and sales costs and improve the efficiency of the process. For buyers, these e-marketplaces aggregate content so it's easier to find new sources and pricing. For sellers, the e-marketplaces break down geographic barriers and make product catalogues available to a wider market of buyers (Soh, Markus & Goh 2006:705).

Businesses-to-business e-marketplaces are websites on which member companies buy and sell their goods and exchange information.

Public e-marketplaces are developed and owned by independent organisations and are "many-to-many" exchanges, for example, Global Health Care Exchange (GHE).

Industry-sponsored marketplaces are developed and owned by two or more industry players and can be aimed at a broad scope of supply chain activities, such as forecasting and replenishment, industry standards, or price clearing (Wang 2008:701).

3.8 THEORIES RELATED TO E-PROCUREMENT

There are numerous theories that are used to explain e-procurement. For the purposes of this study, only two theories, namely the Technology Acceptance Theory and Innovation Diffusion Theory were applied.

3.8.1 Technology Acceptance Theory

Most researchers agree that the Technology Acceptance Theory is one of the most popular theories in understanding of the adoption of IT or innovation (Rotich, Benard &Waruguru 2015:47). This theory was introduced by Devis (1986). According to this theory, organisational effectiveness and performance can only be achieved if the users accept change in the use of emerging technologies. The Technology Acceptance Theory is based on two assumptions: perceived usefulness of the system such us; improved performance, enhanced productivity, effectiveness and efficiency in operations and the perceived ease of use of the new systems such as ease to learn, ease to use, ease to control and ease to remember. Thus, this theory brings an understanding that acceptance and use of new technology is a function of the users' feelings about the system and its perceived benefits (Rotich *et al.* 2015:47). This theory therefore points that e-procurement is an innovation strategy and as such requires continuous improvement.

3.8.2 Innovation Diffusion Theory

The Innovation Diffusion Theory was proposed by Rodgers (1962). This theory states that innovation is a process aimed to improve economic development and it classifies the adopters of innovation into five categories; innovators, individuals who want to be the first to try the innovation, Early Adopters, people who represent opinion leaders, Early Majority individuals who need to see evidence that the innovation works before they can adopt it, Late Majority, skeptical individuals who only adopt an innovation after it has been tried by the majority and Laggards, individuals who are very skeptical of change and are the hardest group to involve in the innovation process (Rotich *et al.* 2015:47). Thus, these concepts in this theory are very relevant to this study as they help to build on the study and facilitate the understanding of the expected relationship between the variables.

In summary, these two theories explained above assist in enhancing the understanding of innovative strategies like e-procurement. Therefore, these theories are well related to this study.

3.9 CONCLUSION

This chapter discussed literature on the nature of e-procurement. E-procurement remains an essential development underpinning the supply chain management function in modern organisations. The conceptualisation of e-procurement was discussed in this chapter. The different e-procurement functions (e-sourcing, e-design, e-informing, e-negotiation and e-evaluation) were elaborated on separately. The benefits of e-procurement were highlighted. Some of the greatest benefits include, amongst others, considerable reduction in the cost of transactions; more efficiency of the processes due to a reduction in the involvement of human elements; reduction in the cost of inventory; reduced cycle times; more compliance with the contractual agreement; IT use in buyer-supplier exchanges leads to closer cooperative relationships and reduces staff time and paperwork.

The different e-procurement systems, including their pros and cons were also highlighted in this chapter. These different e-procurement systems include buyer e-procurement systems, seller e-procurement systems, industry procurement platforms and procurement agencies. Several different technology tools were also discussed. These include Radio Frequency Identification (RFID), Electronic Data Interchange (EDI), Electronic Resource Planning (ERP), Collaborative Planning, Forecasting and Replenishment (CPFR), Intranets, E-marketplaces and Vendor Managed Inventory (VMI).

The next chapter discusses supplier integration and supply chain performance.

CHAPTER 4
SUPPLIER INTEGRATION AND SUPPLY CHAIN PERFORMANCE

4.1 INTRODUCTION

Chapter 3 provided definitions and functions of e-procurement, which are the main constructs for this study. These functions include e-sourcing, e-design, e-informing, e-negotiation and e-evaluation. The aim of this chapter is to explore the concept of integration and illustrate the opportunities and challenges associated with supplier integration as well as how this integration may contribute to supply chain performance. The chapter reviews the literature on the conceptualisation of supplier integration and the benefits of supplier integration are outlined in this chapter. The chapter further discusses the different types of supplier integration, conceptualisation of supply chain performance and provides a brief explanation of the importance of measuring performance in organisations. Lastly, the benefits of supply chain performance; drivers and enablers of supply chain performance and frameworks of supply chain performance measurement are discussed in this chapter. The next section focuses on the conceptualisation of supplier integration.

4.2 CONCEPTUALISATION OF SUPPLIER INTEGRATION

Supply chain integration is a term that embodies various communication and linkages within a supply network (Cao & Zhang 2010:358). It is the alignment and interlinking of business processes (Mangaan, Lalwani, Butcher & Javadpour 2012:47). Supply chain integration is also defined as:

> *"the degree to which an organisation strategically collaborates with its partners and manages intra- and inter-organisational processes in order to achieve efficient and effective flows of products, services, information, money and decisions"* (Sillanpää 2012:374).

Walters (2009:235) acknowledges that it is this partnership or integration that forms the essential building blocks of supply chain management. Li *et al.* (2006:112); Deveraj, Krajewski and Wei (2007:1119) and Monczka *et al.* (2016:119) define supplier integration as one that involves professionally managing suppliers and developing close working relationships with different suppliers' groups. Supplier integration is also defined as the collaboration with suppliers by sharing information and resources to ensure efficient delivery schedules from them. It also involves collaboration with them in terms of new product/design development and initiatives for

long-term relationship and commitment (Sharma 2012:10). Collaboration refers to a relationship between supply chain partners which is developed over a period (Mangaan *et al.* 2012:47).

Supplier integration refers to the process of interaction and collaboration between the firm and its suppliers to ensure effective flow of supplies (Petersen, Handfield & Ragatz 2005:291; Das *et al.* 2006:563; Germain & Iyer 2006:29; Narasimhan *et al.* 2010:355; Flynn, Huo & Zhao 2010:58; Zhao, Huo, Selen & Yeung 2011:376). Supplier integration is also defined as "the development of a long-term relationship between a firm and its suppliers" (Li, Rangu-Nathan, Rangu-Nathan & Rao 2006:107).

Figure 4.1 shows supplier integration as a subset of supply chain integration.

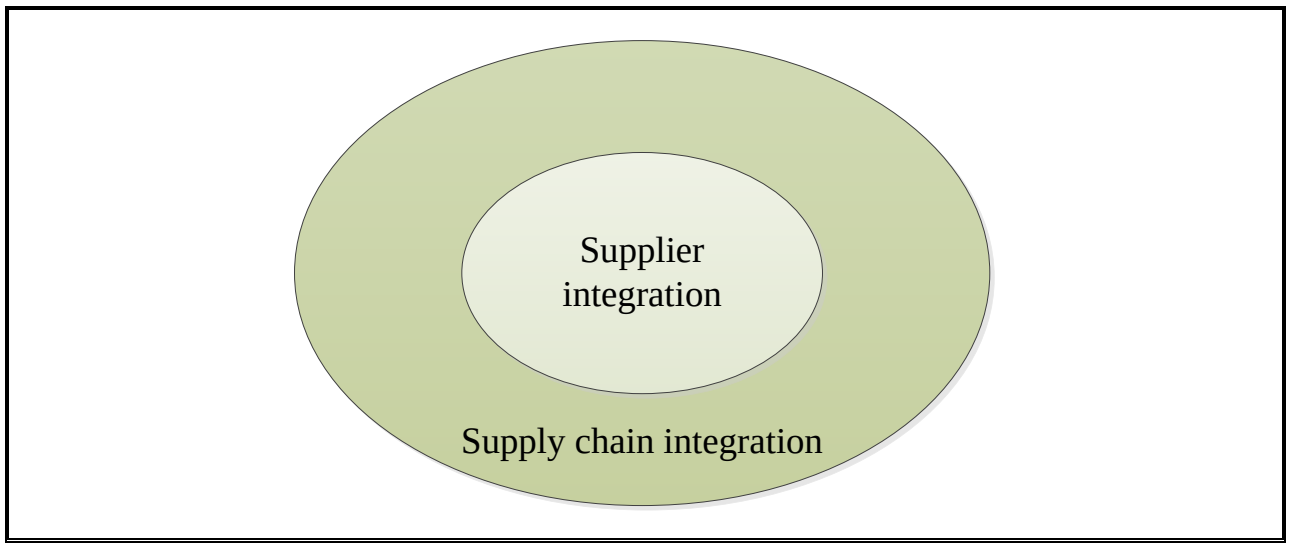


Figure 4.1: Supplier integration as a subset of supply chain integration

Source: Own model

Figure 4.1 shows that supply chain integration is a broader term which includes supplier integration. Therefore, supplier integration is a sub set of supply chain integration. The next paragraph discusses the ingredients for developing successful supplier integration or partnership.

According to Wisner *et al.* (2012:76), there are several ingredients for developing successful supplier partnerships or integration:

Building trust: trust must be built at all levels within an organisation not only at upper levels. Chao *et al.* (2013:1063) define trust as "confidence in the integrity and reliability of another party, rather than confidence in the partner's ability to perform a specific action". They further state that trust between partners constitutes one of the key factors for becoming long-term partners. Chao *et al.* (2013:1061) further describe trust as an important factor in relationship exchange, and Kwon

and Suh (2004:8) suggest trust is a central feature of a strategic partnership. Nyaga, Whipple and Lynch (2010:107) submit "trust refers to the subjective belief that partners in a relationship will fulfil their obligations and thus positively influence both parties in a relationship".

Tangpong and Ro (2009:6249) advocate that trust is the major differential component in facilitating relationship continuance. When there is trust, suppliers help each other during difficult times. Trumpfheller and Hofmann (2004:13) propose effective relationships and the performance possible through them, requires commitment and trust from the individual, communication and transparency from the organisation, together with coordination and technology; all interdependent and necessary for performance. Trust is conveyed through faith, reliance, honesty, credibility or confidence between the supply partners and is viewed as a willingness to forgo opportunistic behaviour (Chao *et al.* 2013:1062).

Chao *et al.* (2013:1065) suggest several factors that lead to trust:

Communication and information sharing;

The perceived benefits by parties;

Relationship tenure – the longer term a relationship is, the more likely that trust will exist; and

Asset specificity- if a relationship involves the transfer of assets or investment in assets in a partner to support a piece of work then this is a visible and demonstrable level of commitment that builds trust.

Shared vision and objectives: both partners must share the same vision and have objectives that are not only clear but mutually agreeable.

Personal relationships and mutual benefits and needs: personal relationships are beneficial for effective communication within the organisation while mutual needs create a conducive environment for better collaboration (Cox, Sanderson & Watson 2001:28).

Commitment and top management support: Commitment is a product of other factors, for example, if people build trust they build commitment (Chao *et al.* 2013:1063; Li 2014:114). Commitment is therefore central to strategic collaborative relationships. Commitment implies that the trading partners are willing to devote resources to sustaining the partnership relationship. Commitment can be described as a buyer's long-term orientation toward a business relationship that is grounded in both emotional bonds and the buyer's conviction. With commitment, supply chain partners become integrated into their major customers' processes and become more tied to

their goals. Therefore, commitment tends to have a direct and positive impact on supplier collaboration (Li 2014:114-115).

Figure 4.2 provides an overview of the interlocking components of strategic supplier relationships.

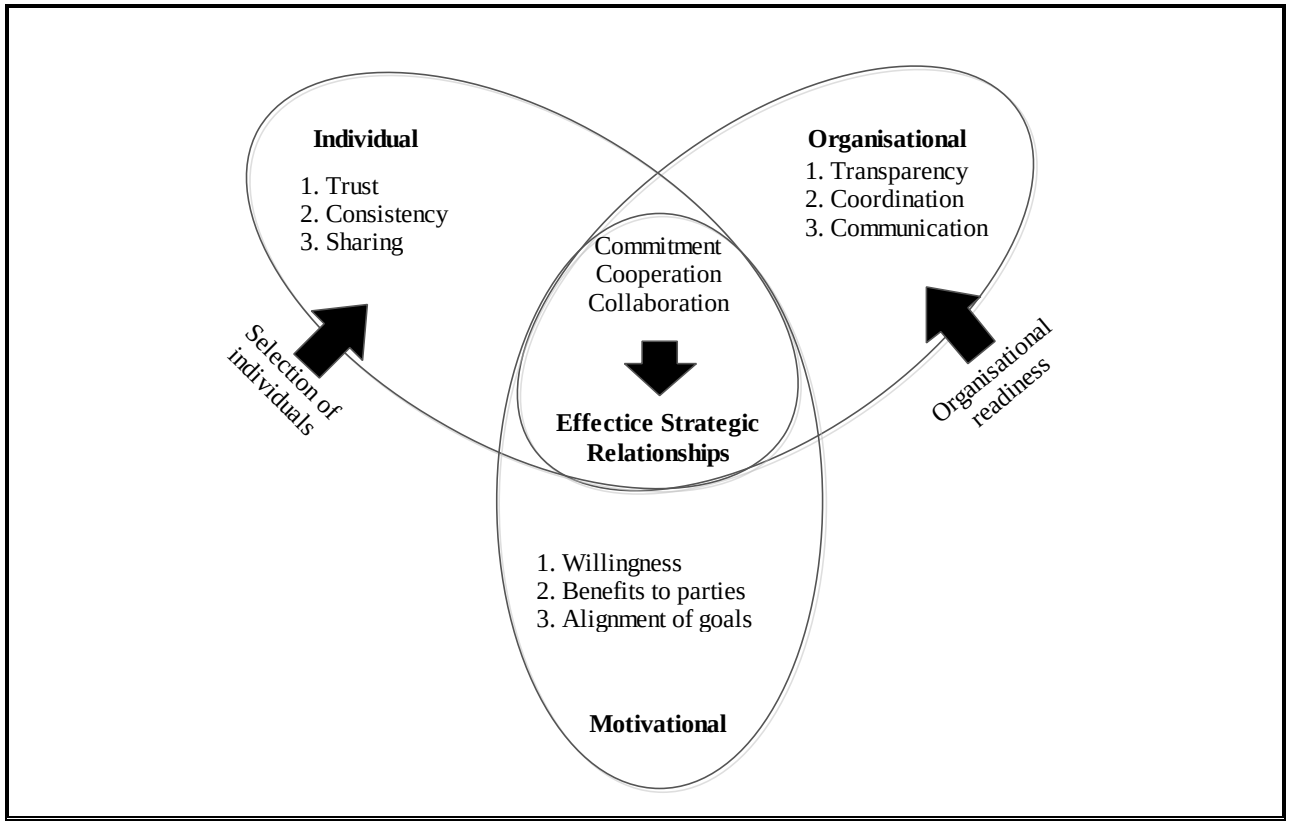


Figure 4.2: The interlocking components of strategic supplier relationships

Source: O'Brien (2014:320)

From Figure 4.2, strategic collaborative relationships are enabled through the interdependence of individual, organisational and motivational factors; these are trust, consistency, sharing, transparency, coordination, communication, willingness, the potential benefit to parties and alignment of goals. Together these factors converge to create real commitment and that collaboration leads to performance, achievement and longevity. Thus, this entire framework is enabled through careful selection of the individuals involved in the relationship, so they have the right characteristics and personality, and appropriate organisational structure and resourcing.

In summary, what emerges most is that the concept of supplier integration is wide and varied. The following emerged as four main ingredients for successful supplier integration: building trust, shared vision and objectives, personal relationships and mutual benefits, which needs commitment and top management support. The next section discusses the benefits of implementing supplier integration in an organisation.

4.3 BENEFITS OF SUPPLIER INTEGRATION

Monczka (1997:56) found that firms often realise many benefits from involving suppliers. Petersen *et al.* (2005:284) and Zhao *et al.* (2011:156) highlight three factors as being of importance to the integration of suppliers into new product development. The first and foremost factor is the customer knowledge of the supplier. Such knowledge helps a company know the buyer's needs and supplier's capabilities, from both standpoints (Chen *et al.* 2007:524). Secondly, technology and information sharing also become essential in supplier integration. Technology sharing can result in lower costs (Zhao *et al.* 2008:371). Thirdly, is supplier involvement in decision making (Das *et al.* 2006:563). Suppliers through good collaboration will be more involved in all business decision making thus allowing sharing of ideas.

According to Malhotra, Saeed and Jayaram (2008:71), collaborative activities with supplier's lead to operational performance. Other potential benefits of supplier integration include improved quality, reduced cost, shortened lead times and more innovation (Gust & Clegg 2007:4). The benefits or advantages of partnering/integration are summarised in Table 4.1.

Table 4.1: Advantages of partnering/integration

To the purchaser	To the supplier
Purchasing advantage resulting from quality assurance, reduced supplier base, assured supplies due to long-term agreements, ability to plan long-term advantage, delivery on time (JIT), and improved quality.	Marketing advantage resulting from stability due to long-term agreements, a larger share of orders placed, ability to plan and invest, ability to work with key customers on products and/ services, scope to increase sales without increasing procurement overheads.
Lower costs are resulting from cooperative cost-reduction programmes, such as EDI, supplier's participation in new designs, lower inventory due to better production availability, improved logistics, reduced handling, and reduced number of outstanding orders.	Lower costs resulting from cooperative cost-reduction programmes, participation in new designs, lower inventory due to better customer planning, improved logistics, simplification or elimination of processes, and payment on time

To the purchaser	To the supplier
The strategic advantage is resulting from access to supplier's technology, a supplier who invests shared problem-solving and management.	The strategic advantage resulting from access to customer's technology, a customer that recognises the need to invest, shared problem-solving and management.

Source: Lysons and Farrington (2012:412)

Collaboration with supply chain partners is a crucial driver for competitive advantage (profit) since it has the potential to alter public perception of the company as a socially responsible agent:

"Executives expect to see the benefits from collaborating within the supply chain. The biggest benefit they expect is financial profit. Participants believe that collaboration positively influences the public image of the companies involved. When companies work together, they are humanitarian, striving for the good of all, not just themselves. The end results of these benefits are expected to be improved returns, increased shareholder value and thus, a competitive advantage over other supply chains" (Mentzer 2004:57-59).

The benefits of supplier integration are further presented in Figure 4.3.

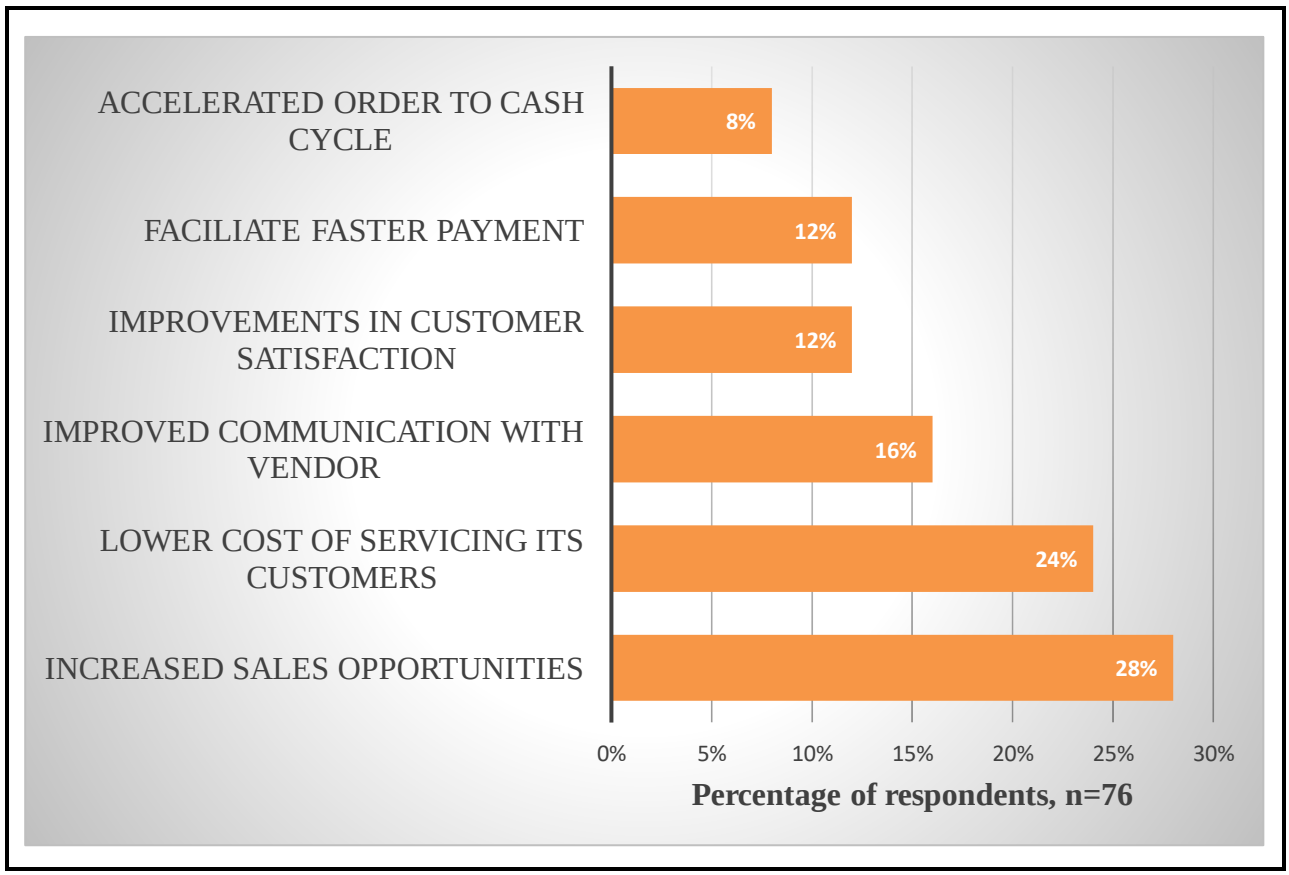


Figure 4.3: Benefits of supplier integration

Source: Aberdeen Group (2011:68)

A study of 76 participants was conducted by Aberdeen Group (2011:68) regarding the main benefits of supplier integration. As illustrated in Figure 4.3, the main benefits provided to their suppliers is an increased ability to promote their products through sales opportunities (28%), followed by the lower cost of servicing its customers through the network with the least being accelerated order to cash cycle (8%).

Many researchers have cited the benefits of supplier integration in SME's, some of the notable being Li and Li (2005:119); Chen *et al.* (2007:524); Leopoulos *et al.* (2007:2) and Fawcett *et al.* (2007:359). Table 4.2 presents the main potential benefits that were identified in those studies.

Table 4.2: Main potential benefits of supplier integration

(1) Lower the cost of labour	(9) Programming and follow-up
(2) Cutting costs	(10) Further performance improvements
(3) Integration of tasks and shared information	(11) Significant improvements in both customer and supplier services
(4) Generate and identify new business opportunities	(12) Generation of a coordinated work-flow
(5) Collaboration and coordination of all the components of the supply chain	(13) Sales, purchases, warehousing and production departments can share and process information simultaneously
(6) Product innovation lead times	(14) Increased access to financial support
(7) Improvements in inventory management	(15) Clear improvements in the productivity of the operational logistics system
(8) Cost of new product development	(16) Generation of proactivity about the process of supplier integration

Source: Palmero and Chalmeta (2014:376)

The different types of integration are discussed in the next section.

4.4 TYPES OF INTEGRATION

4.4.1 Early Supplier Integration (ESI)

Early Supplier Integration (ESI) is defined by Ray (2010:227) as a process of involving suppliers in the collaborative design process. This early involvement is to get supplier inputs before the design is frozen. This can save time in the design cycle and motivate the supplier as he feels he is part of the team. According to Sharma (2012:196), ESI is an approach to supply chain management to bring in the expertise and collaboration synergy of suppliers at the design stage itself. Involvement of suppliers at an early stage brings about better results of partnerships and yields better quality, delivery, cost and service levels to the customer.

The advantages of ESI include the following:

Reduced concept-to-customer development time;

Improved product specifications;

Enhanced quality;

Development costs are expected to be lower;

Joint problem-solving;

Improved manufacturability of products (Creswell 2009:112).

However, there are certain disadvantages and problems of ESI which are listed by Mikkola and Joeti-Larsen (2003:31); these include "leakage of information, loss of control or ownership, longer development lead time, conflicts due to different aims and objectives and collaborators becoming competitors".

4.4.2 Supplier Relationship Management (SRM)

Supplier relationships are critical to any organisation. Suppliers can directly impact the financial performance and profitability of a buying enterprise, as they influence product development costs, inventory levels, manufacturing schedules and the timeliness of delivery of goods and services (Hugo & Badenhorst-Weiss 2011:321). Supplier Relationship Management (SRM) includes "those processes focused on the interaction between the enterprise and suppliers that are upstream in the supply chain" (Chopra & Meindl 2010:520-521; Scott, Lundgren & Thompson 2011:44). Ray (2010:220) describes SRM as an umbrella term that includes all processes related to supply management like sourcing, planning and execution, sourcing analytics, supplier settlement, supplier performance monitoring, supplier collaboration and all processes that enable a retailer to analyse, control and optimise its sourcing.

O'Brien (2014:57) also defines SRM as the overarching strategy to determine and implement different supplier based interventions, including the development of collaborative relationships with the critical few suppliers who can make the greatest difference, prioritised against available resources, applied as appropriate across an entire supply base to maximise value to the organisation, reduce supply chain risk and enable the organisation to achieve its goals and enhance value to the end customer. SRM is "the end-to-end process of managing a supplier through the entire sourcing life cycle, which includes first identifying the abilities of a particular company regarding performing a service for the internal customer, completing a sourcing event, negotiating a contract, executing an order and determining payment". According to Hugo, Badenhorst-Weiss and van Biljon (2006:25), supplier relationship management, "*is a buying organisation's strategic philosophy for interacting with its supply base, with the objective of sustaining superior*

performance throughout the span of their association." The different models of supplier relationship approaches are illustrated in Figure 4.4.

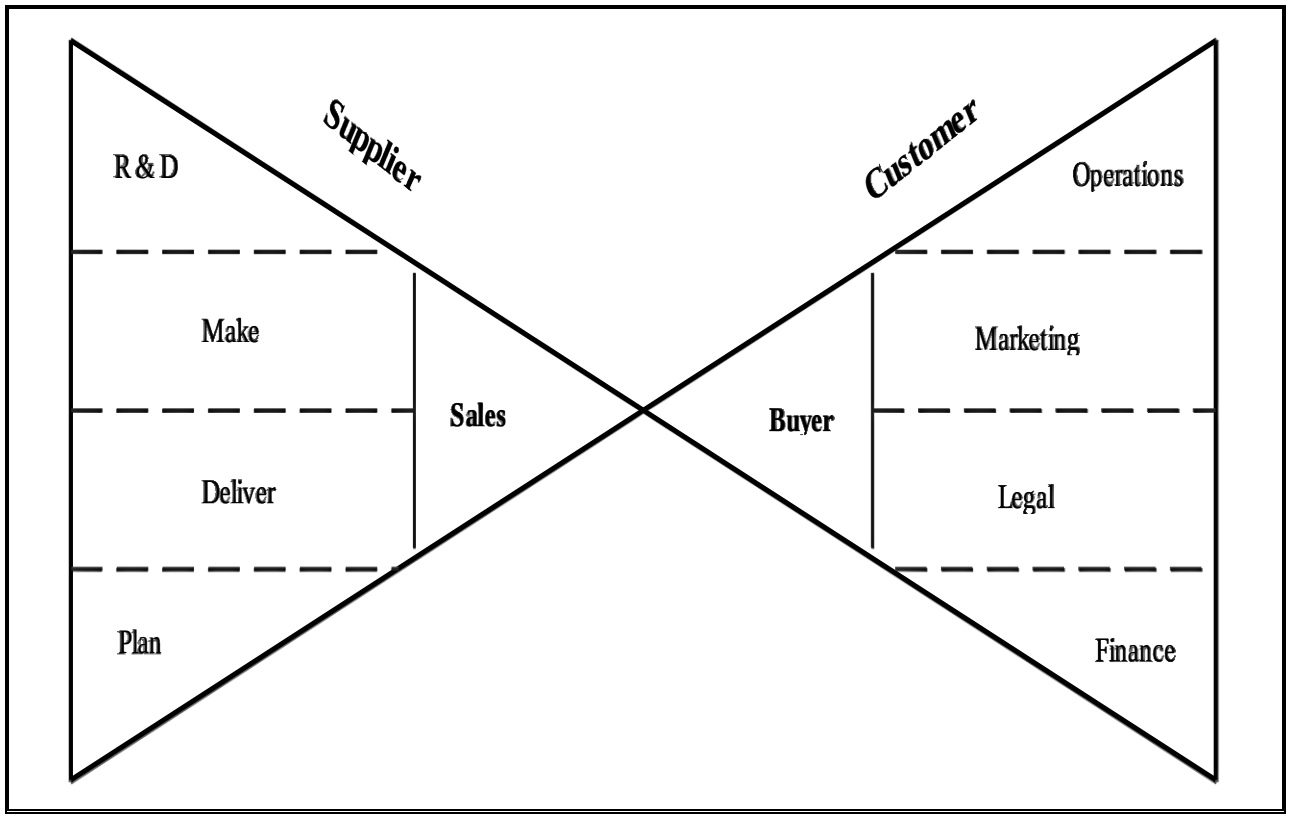


Figure 4.4: Basic relationship approaches

Source: McDonald and Woodburn (2006:283)

The basic relationship approach in Figure 4.4 is sometimes referred to as the "bow-tie model" (McDonald & Woodburn 2006:283; Scot *et al.* 2011:44). In this type of approach or model, the point of contact between supplier and customer is at only one point (Buzzell & Ortmeyer 1995:85). The advantage of this approach is that it is not difficult to manage since only two parties, that is, supplier and customer, are involved in the relationship. The only problem with this approach is that the relationship is dependent on two people and therefore decision making in this scenario might take longer than expected (Scot *et al.* 2011:45).

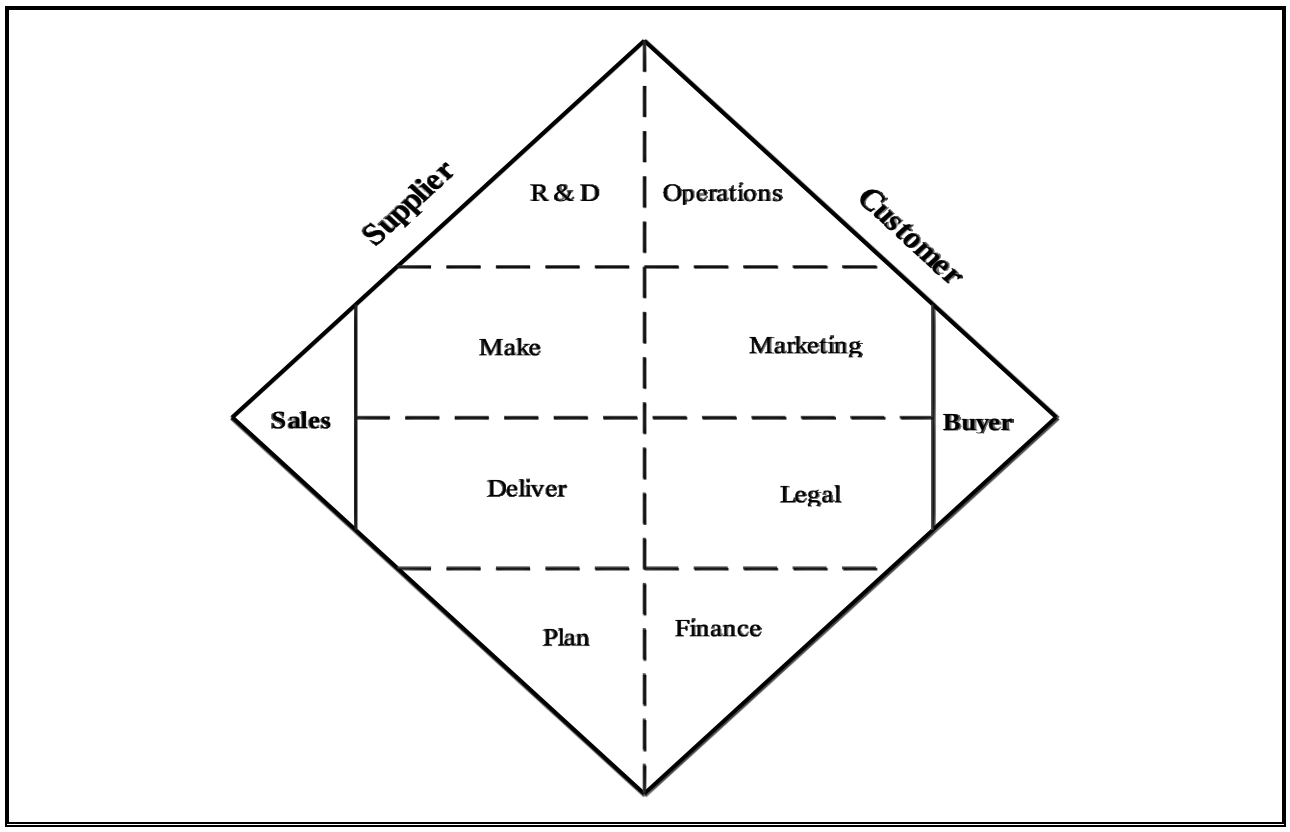


Figure 4.5: Interdependent relationship approaches

Source: **McDonald and Woodburn (2006:284)**

Figure 4.5 shows the interdependent relationship approach which is very different from the basic relationship model. This model resembles the shape of a diamond. In this approach unlike the basic relationship model, there are many points of contact (Buzzell & Ortmeyer 1995:85). There is also a lot of team-work. Every department within an organisation knows what is happening in another department of the same organisation.

In summary, managing supplier relationships demands a concerted effort of time and money from the purchasing company. Therefore effort should be concentrated on where it is most needed. Hugo, Badenhorst-Weiss and van Biljon (2006:239) highlight the necessary skills needed to manage supplier relationships effectively, as follows:

The ability to adopt a shared understanding between partners;

The ability to recognise the level of cultural match between partners;

The skills to foster high-quality relations;

The ability to manage relationships through changes in contractual obligations; and

The skills to manage consortium-based relationships.

4.4.3 Retailer-Supplier Integration (RSI)

"The formation of strategic alliances between retailers and their suppliers" is known as Retailer-Supplier Integration (RSI) (Nishiguchi & Beaudet 1998:50). It is important "to create cooperative efforts between suppliers and retailers to leverage the knowledge of both parties" (Buzzell & Ortmeyer 1995:85). There are four main types of RSI: basic quick response strategy, continuous replenishment strategy, an advanced form of continuous replenishment and Vendor-Managed Inventory (VMI) (Scot *et al.* 2011:44).

Table 4.3 below shows the main characteristics of each type of retailer-supplier integration.

Table 4.3: Main characteristics of retailer-supplier integration

Criteria Type	Decision maker	Inventory ownership	New skills employed by vendors
Quick response	Retailer	Retailer	Forecasting skills
Continuous replenishment	Contractually agreed-to all levels	Either party	Forecasting and inventory
Advanced replenishment	Contractually agreed-to and continuously improve all levels	Either party	Forecasting and inventory
VMI	Vendors	Either party	Retail management

Source: Simchi-Levi (2003:225)

As illustrated in Table 4.3 above, that in a quick response, the retailer is the decision maker. Inventory ownership lies with the retailer too, and the new skills employed by vendors are the forecasting skills. In a continuous replenishment system, the decision is contractually agreed at all levels; inventory ownership lies with either party. The new skills employed are forecasting and inventory skills. In an advanced replenishment system, the decision making is contractually agreed upon and continuously improved at all levels while inventory ownership is with either party. Forecasting and inventory are new skills employed by vendors. The decision makers in VMI are the vendors. The inventory ownership lies with either party. The new skills employed are retail management skills.

4.4.4 Other types of supplier relationships

Relationships can be based on the distant or close association of the parties according to the nature of the interactions between them. A comparison of the characteristics is listed in Table 4.4.

Table 4.4: Comparison between distant and close association

Distant association	Close association
No collaboration	Collaboration is the main reason for the relationship
Short-term focus	Long-term focus
Focus on negotiating a price reduction	Focus on understanding and reducing costs
Opportunistic	Joint optimisation
Low level of trust	High level of trust
Minimum information sharing	Information sharing to promote optimal decision making
Minimal investment in the relationship	Investments made to improve the efficiency and effectiveness
Disputes resolved with reference to contracts	Disputes resolved by discussion
Minimal personal relationships	Strong personal relationships
Little effort required to manage supplier relationships	Involves significant effort to manage the relationship

Source: Hugo and Badenhorst-Weiss (2011:321)

Contract types range from the distant to close relationship contracts and therefore have a low or high involvement. The types of contracts (from low to high) are as follows (Hugo *et al.* 2006:541):

4.4.4.1 Spot purchases

A spot purchase occurs when a buying organisation places the purchase order with any supplier who offers the best deal at the time of the purchase. A supplier is expected to fulfil only the immediate contractual obligations and not-any-additional responsibilities, as there is no expectation of future business. This type of buyer/supplier relationship can lead to a large supply base; which-in-turn can lead to a lack of effective and efficient supply base management and lost supplier leverage opportunities.

4.4.4.2 Regular trading

Regular trading can be regarded as several spot purchases from one or more suppliers, although each purchase is still treated individually. There are no long-term contracts involved and purchasing organisations must ensure that these suppliers remain competitive over time and continue to deliver acceptable products or services. Suppliers in this situation can often obtain preferred supplier status.

4.4.4.3 A call-off contract (framework agreements or standing orders)

A call-off contract is a negotiated agreement with a supplier to offer a certain price for products or services that remains valid for all purchases made within a certain period, without any commitment on the part of the purchaser to purchase a certain amount - typically for the term of a year or more. These contracts are frequently used for regularly required products or services to avoid the time and cost associated with individual purchases. Care should be taken to ensure that suppliers under call-off contracts remain competitively priced and that their service levels are satisfactory.

4.4.4.4 Fixed contracts

Fixed contracts are like call-off but with important differences, such as the commitment to purchase a certain number of products or services within a certain time frame. This type of contract is more attractive to the supplier as there may be penalties involved if the purchasing organisation does not comply with the contractual obligations, and suppliers are more likely to offer better prices and supply conditions. In this case it is necessary for purchasing and supply to become involved in the contract to ensure operational efficiency. It is advisable to ensure the maintaining of a certain level of service by writing a performance measurement into the contract.

4.4.4.5 Partnerships (strategic alliances)

Partnerships (strategic alliances) are long-term collaborative forms of relationships that are based on high levels of trust. Some of the reasons why these relationships are entered into, include amongst others: to improve the overall efficiency of the supply chain, increase competitiveness, reduce cost by sharing information, reduce supply risk and collaborate on product development.

Selecting the right partner is of fundamental importance as cost, effort and time are invested in the partnership. Important factors to consider when selecting potential partners are the hard and soft factors.

The *hard factors* include quality; delivery; cost; environment; safety; continuing improvement; financial and management stability and technological accomplishment.

For potential partners, *soft factors* also become important such as congruence of management values on issues like customer satisfaction; concern for quality; employee involvement; supplier relationships and personal compatibility between functional counterparts.

4.4.4.6 Joint venture

Joint venture is a separate entity formed by parent organisations (such as a purchasing organisation and a supplier) and owned by them (Maehan & Muir 2008:516). In this case, there is no need to depend on the co-operation of individual organisations to achieve success as direct influence can be exerted through ownership. Joint ventures are, however, more expensive to set up and manage, but the issue of trust is less important because all organisations involved will have the ability to control the joint venture, deliver a product or service that is significant to them and thereby their competitive advantage. Performance management is of vital importance as products or services delivered by the venture will still influence the organisation's competitive advantage.

4.4.4.7 Internal provision

Internal provision is undertaken if the relationship with a key strategic supplier cannot be amended. Internal provision occurs where an organisation decides to make provision for certain products and services itself by vertical integration (making or providing an item or service internally which was previously bought externally) rather than rely on the supply market (Lockstroom & Lei 2010:267).

4.4.5 Supplier relationship management process

The supplier relationship management process is illustrated in Table 4.5.

Table 4.5: Supplier relationship management process steps

Phase 1 **Demarcating the strategic suppliers (strategic sourcing)**
Step 1 - Creating supplier relationship teams Step 2 - Analysing spend Step 3 - Segmenting suppliers
Phase 2 **Negotiating with strategic suppliers and reconstructing buyer/supplier relationships**
Step 4 - Negotiating with strategic suppliers Step 5 - Reconstructing buyer/supplier relationships (contracts)
Phase 3 **Supplier performance management**
Step 6 - Contract management Step 7 - Performance evaluation Step 8 - Programme for long-term improvement Step 9 - Leveraging of suppliers

Source: Hugo *et al.* (2006:112)

The supply chain management process starts with strategic sourcing, as depicted in Table 4.5. The second phase of the supplier relationship management process consists of negotiations with strategic suppliers and the creation or conclusion of relationship agreements. The third phase consists of supplier performance management, and contract management. These phases and steps culminate in the last step - the leveraging of suppliers.

Hugo *et al.* (2006:112) provide an extensive list of practices which may help to improve supplier relationships from a distant to a closer association. These are listed below:

Create dedicated supply development teams.

Invest in the supplier's operations.

Conduct visits to the supplier's site to offer advice on improving performance.

Teach a supplier how to develop itself after initial guidance from the supplier development team.

Focus on underlying causes of long cycle times.

Focus on wasteful activities of all supplier efforts.

Involve suppliers of new products and process development in the purchasing organisations.

Provide training programmes and training time to suppliers.

Provide education programmes offline that go beyond training.

Provide improvement-focused seminars to suppliers.

Provide tooling and technical assistance to suppliers.

It must be recognised by an organisation that, although there are different types of supplier relationships, what matters most is that the company or organisation adopt the right relationship with the right supplier and for the right reasons as well. Various studies have found that supplier integration has a positive influence on supply chain performance (Childhouse & Towill 2003:25; Gimenez & Ventura 2003:79; Koufteros *et al.* 2005:847; Villena *et al.* 2009:635; Cao & Zhang 2010:163; Allred & Peterson 2011:129).

Hair, Bush and Ortinau (2000:235) use the example of Proctor and Gamble (P&G) to illustrate the drive towards integrating the supply chain. P&G had the desire to design the supply chain to meet the needs of end customers and started by working backwards to deliver the right product, in the right place, at the right time and of the right quality. The principles followed by P&G during the integration can be summarised as:

produce every product that needs to be produced every day through short cycle production;

communicate with suppliers in real time;

draw demand data from the point nearest to the end customer; and

collaborate with all supply chain partners focusing on delivering to the end customer (Zushi & Morgan 1998:78).

These principles involve integration at both the internal and external level. In a supply chain context, integration is concerned with coordinating and establishing the flows of materials and information between supply chain partners. The availability of information is vital for integration (Simchi-Levi *et al*. 2012:188). The next section conceptualises supply chain performance.

4.5 DEFINITION OF SUPPLY CHAIN PERFORMANCE

Supply chain performance is defined as the performance of the various processes included within the firm's supply chain function (Sakka & Botta-Genoulaz 2009:1; Srinivasan, Mukherjee & Gaur 2011:268; Hooley, Mettler, Greeney & Rohner 2005:28; Wong & Merrilles 2007:386). Chan and Qi (2003:180) found that measuring supply chain performance leads to improvements in the overall performance of a firm. The next section discusses the purpose of measuring organisational performance.

4.6 PURPOSE OF MEASURING PERFORMANCE

According to Monczka *et al.* (2016:45), the following illustrate reasons for measuring and evaluating supply chain activity and performance:

Measure contributions to company competitive performance: appropriate measurements can determine contribution levels to company competitiveness and financial performance. Measuring and monitoring provide data that can inform judgements about the standards of performance achieved and provides signals about what is important (Scot *et al.* 2011:86). Measurements have a motivational influence, and they help to shape perceptions of what is important and to concentrate energies on actions relevant to them (Chan 2003:536; Melnyk & Peterson 2004:11). The next section illustrates the drivers and enablers of supply chain performance.

4.7 DRIVERS AND ENABLERS OF SUPPLY CHAIN PERFORMANCE

4.7.1 Drivers of supply chain performance

The model below, which shows four drivers of supply chain performance "proposes a structure that supports the supply chain strategy" (Danese 2007:199; Chopra & Meindl 2010:543).

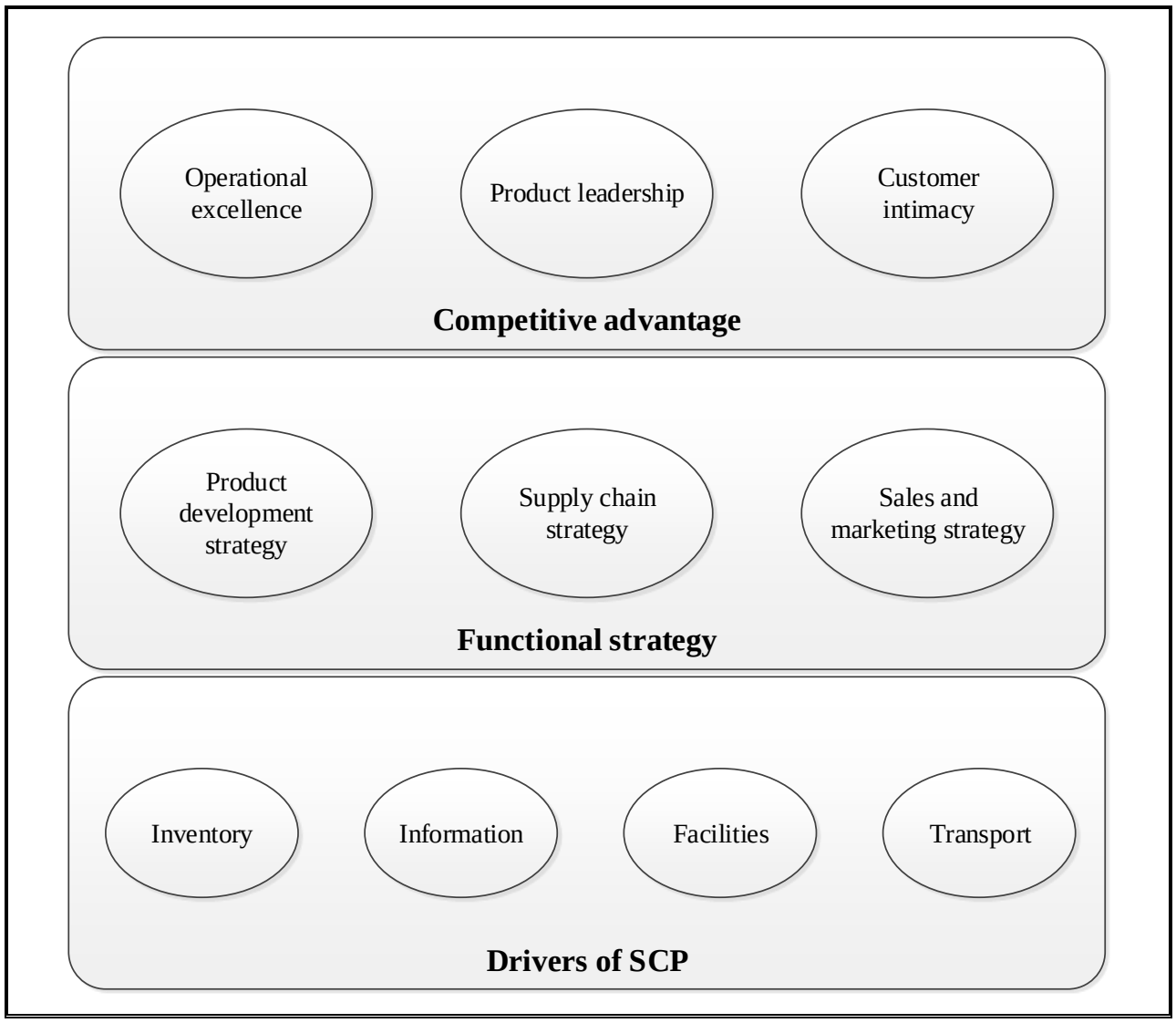


Figure 4.6: The four drivers of supply chain performance

Source: Scot *et al.* (2011:115)

Figure 4.6 shows a model of the four drivers of supply chain performance. The four drivers are inventory, information, facilities and transport. Inventory is an important driver as this includes raw materials, finished and semi-finished goods. An inventory decision is very important for the organisation as it determines what stock should be held and in what quantities (Monczka *et al.* 1997:46). Transportation is also a critical driver as it moves goods from one point to another. Hence, transport choices have a huge impact on an organisation's performance as it influences responsiveness and efficiency. Therefore, management should play a vital role in selecting the correct mode of transport. Information presents management with the opportunity to make supply chains more responsive and efficient. Therefore, information is the most critical supply chain performance driver as it influences other drivers.

4.7.2 Enablers of supply chain performance

Managing supply chains are becoming increasingly complex (Shah 2009:12). Despite this, firms have managed to reduce their logistics costs. The three major enablers that have helped firms and nations in reducing supply chain costs are an improvement in communication and IT; entry of third-party logistics providers and enhanced inter-firm coordination capabilities. The computing power has become cheaper, and communication costs as well have come down. This has helped firms in coordinating global supply chains in a cost-effective manner. Advances in ERP systems have helped firms in automating several business processes resulting in seamless information flow throughout the companies across different functions.

Traditionally, many firms have been managing their logistics activities internally. Lately, companies have realised that they need to focus their energies on managing core business activities and hence have been exploring the possibility of outsourcing logistics activities to third-party logistics (3PL) service providers.

A final enabler of SCP is the enhanced inter-firm coordination capabilities. Better understanding and coordination of issues greatly help in diffusing the third supply chain revolution across all industries (Chen *et al.* 2007:524). The next subsection discusses the frameworks of supply chain performance measurement.

4.8 FRAMEWORKS OF SUPPLY CHAIN PERFORMANCE MEASUREMENT

There are various models developed to measure organisations' performance. For this study, six measurement frameworks are discussed. The frameworks were chosen because they incorporate tangible and intangible supply chain performance measures which befit this current study. These frameworks are described in the subsequent section.

4.8.1 Beamon's model of performance measurement

As depicted in Figure 4.7, Beamon (1999:123) identifies three measures as important elements in assessing supply chain performance for an organisation. These measures are resources, output and flexibility. The resource measures included in the model include cost, equipment utilisation and staff requirements. The output measures include customer responsiveness, product quality and product quantity produced and customer satisfaction. The final measure, flexibility, refers to how well the system is reacting to uncertainty (Chen *et al.* 2007:526).

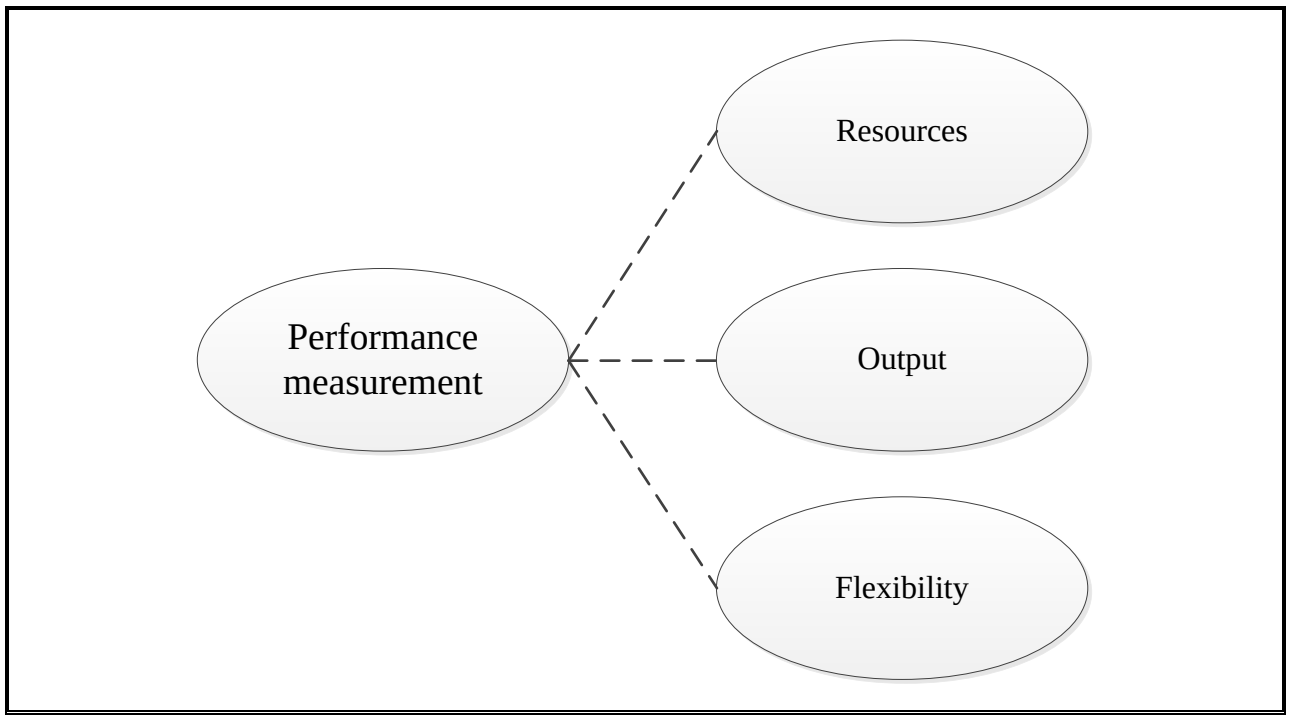


Figure 4.7: Beamon's model of performance measurement

Source: Anvari, Nayeri and Razavi (2011:63)

This framework clearly shows the intangible dimension of supply chain performance.

The next subsection discusses Gunasekaran's model of performance measurement.

4.8.2 Gunasekaran's model of performance measurement

Gunasekaran *et al.* (2001:82) presented a framework for measuring the performance of a supply chain. They divided the SC performance measures into financial and non-financial measures so that a suitable costing method based on activity analysis can be applied. In addition, they used three measurement levels (strategic, tactical and operational). The emphasis is on performance measures dealing with suppliers, delivery performance, customer-service, inventory and logistics. This type of framework includes both tangible and intangible dimension of supply chain performance measurement. The performance metrics proposed by Gunasekaran *et al.* (2001:78) are presented in Figure 4.8.

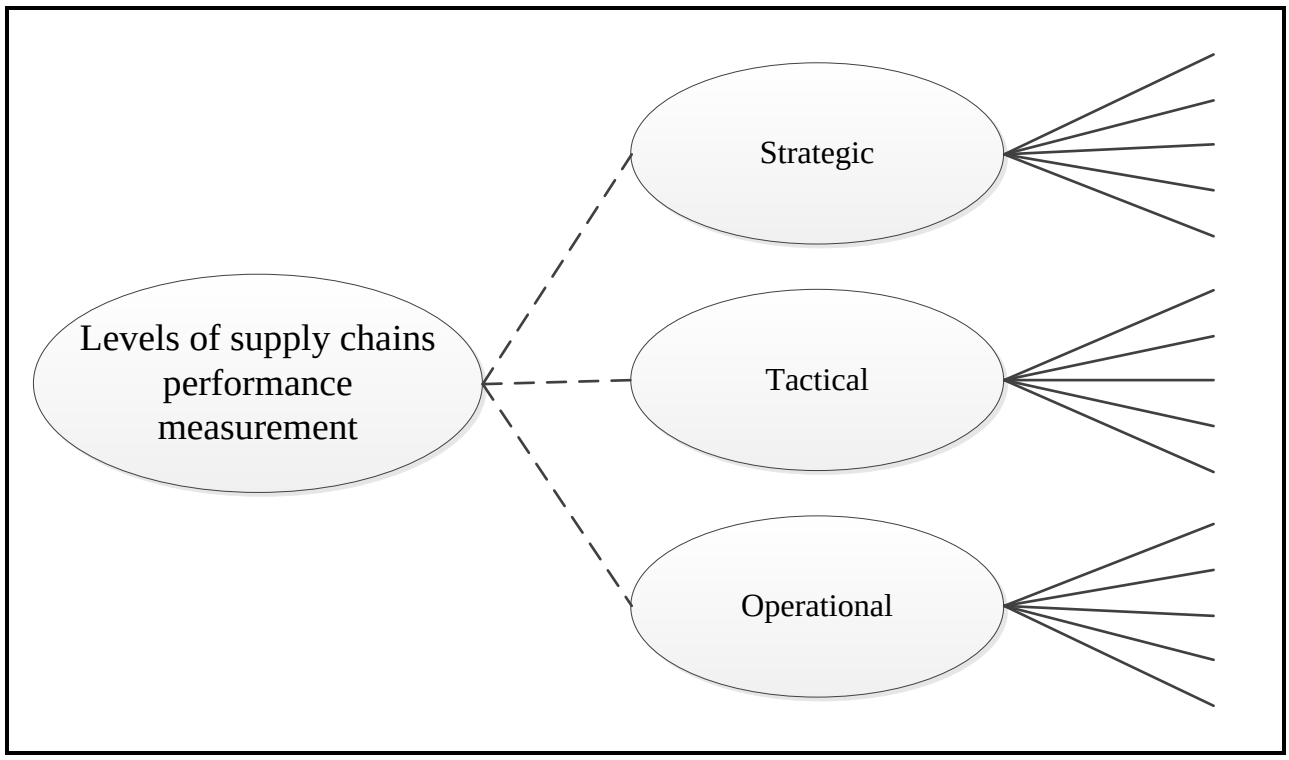


Figure 4.8: Gunasekaran's 2001 model of performance measurement

Source: Anvari, Nayeri and Razavi (2011:64)

4.8.3 Gunasekaran's 2004 supply chain performance metrics framework

Gunasekaran (2004:345) further developed a model which includes four processes: plan, source, make/assemble and deliver against the strategic, tactical and operational to counteract the challenges faced in his earlier model of 2001. The reasons for developing this framework was to develop a better understanding of the importance of supply chain management. These metrics are elaborated on in Table 4.6.

Table 4.6: Gunasekaran's supply chain performance metrics framework

Supply chain activity/ process	Strategic	Tactical	Operational
Plan	Level of customer perceived value of the product Variances against budget Order lead time	Customer query time Product development cycle time The accuracy of forecasting techniques	Order entry methods Human resource productivity

Supply chain activity/ process	Strategic	Tactical	Operational
	Information processing cost Net profit versus productivity ratio Total cash flow time Product development cycle time	Planning process cycle time Order entry methods Human resource productivity	
Source		Supplier delivery performance Supplier lead time against the industry norm Supplier pricing against market The efficiency of cash flow method Supplier booking in procedures	The efficiency of purchase order cycle time Supplier pricing against market
Make/ Assemble	The range of products and services	Percentage of defects Cost per operation hour Capacity utilisation Utilisation of economic order quantity	Percentage of defects Cost per operation hour Human resource productivity index

Supply chain activity/ process	Strategic	Tactical	Operational
Deliver	Flexibility of service system to meet customer needs The effectiveness of enterprise distribution planning schedule	The flexibility of service system to meet customer needs The effectiveness of enterprise distribution planning schedule The effectiveness of finished goods in transit Delivery reliability performance	Quality of delivered goods On time delivery of goods Effectiveness of delivery invoice methods Number of faultless delivery notes invoiced Percentage of urgent deliveries Information richness in carrying out delivery Delivery reliability performance

Source: Scot *et al. (*2011:209)

4.8.4 Chan and Qi's performance measures

Chan and Qi (2003:184) propose a new model for performance measurement, which is a process-based approach to mapping and analysing the practically complex supply chain network. The model divides the measurement into two distinct phases: quantitative and qualitative. The quantitative measures include cost-based, response based, and productivity based. The qualitative measures include flexibility, integration of information and material flow, effective risk management, supplier performance and satisfaction. Overall, this type of framework includes both tangible and intangible supply chain performance measurements. These performance measures are depicted in Figure 4.9.

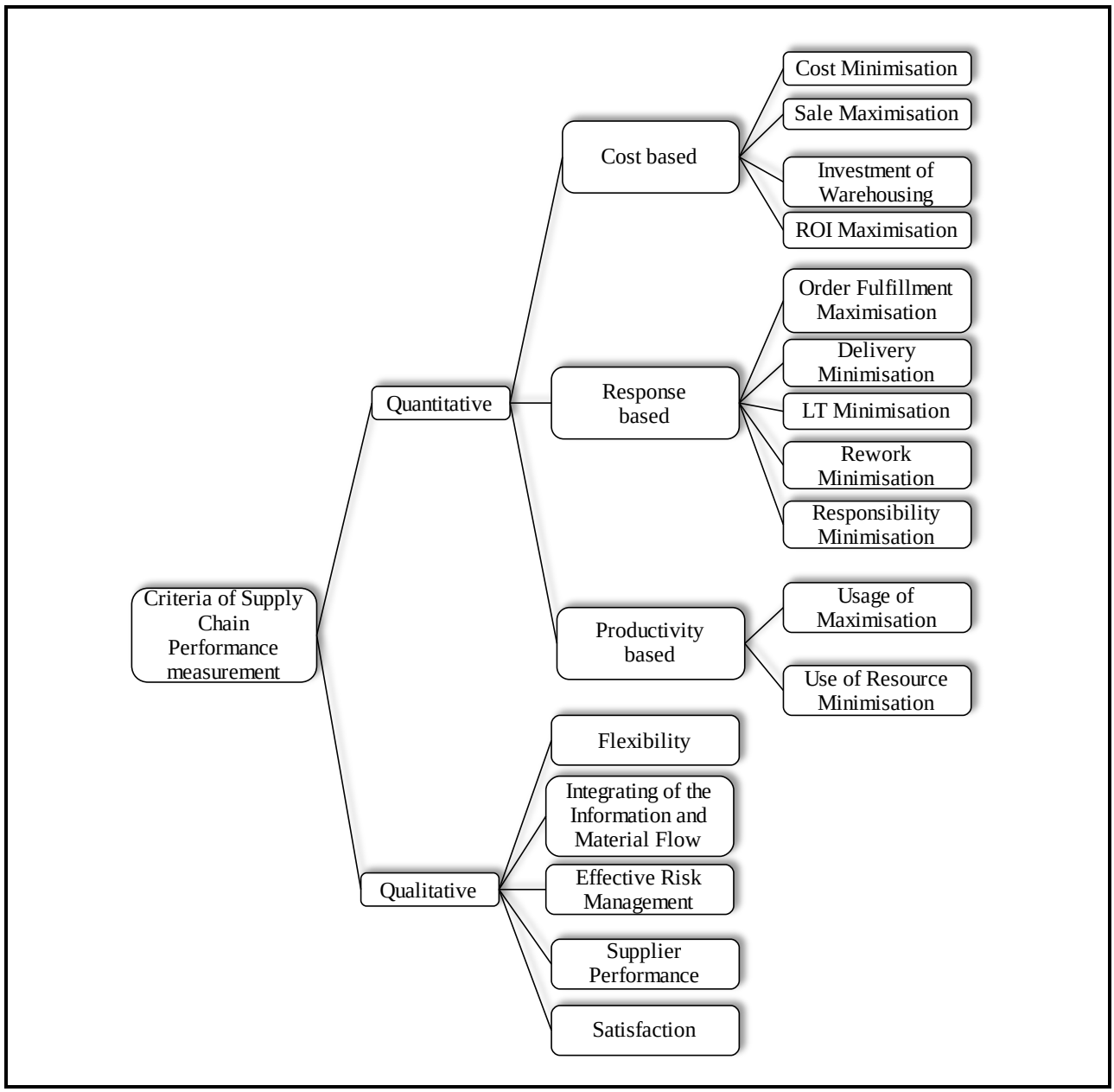


Figure 4.9: Chan and Qi's performance measures

Source: Chan and Qi (1999:174)

4.8.5 The Balanced Scorecard

Kaplan and Norton (1992:76) developed a balanced scorecard which includes four measures: customer perspectives, internal business perspectives, financial perspectives and innovation and learning perspectives. This framework seeks balanced measures to buttress company strategy. An example of the balanced scorecard is illustrated in Table 4.7.

Table 4.7: Example of the balanced scorecard measures for supply chain

Customer perspective:	**Internal business perspective:**

• Customer query time
• Level of customer perceived value of the product
• The range of products and services
• Order lead time
• The flexibility of service systems to meet particular customer needs
• Buyer-supplier partnership level
• Delivery lead time
• Delivery performance
• Effectiveness of delivery invoice methods
• Delivery reliability
• Responsiveness to deliveries
• The effectiveness of distribution planning schedule
• Information carrying cost
• Quality of delivery documentation
• Driver reliability for performance
• Quality of delivered goods
• Achievement of defect-free deliveries
	• Total supply chain cycle time
	• Total cash flow time
	• The flexibility of service system to meet particular customer needs
	• Supplier lead time against industry norms
	• Level of supplier's defect-free deliveries
	• The accuracy of forecasting techniques
	• Product development cycle time
	• Purchase order cycle time
	• Purchase process cycle time
	• The effectiveness of the master production schedule
	• Capacity utilisation
	• Total inventory cost as:
	  o Incoming stock level
	  o Work-in-progress
	  o Scrap value
	  o Finished goods in transit
	• Supplier rejection rate
	• The efficiency of purchase order cycle time
	• Frequency of delivery

Financial perspective:	**Innovation and learning perspective:**
• Customer query time • Net profit versus productivity ratio • The rate of return on investment • Variations against budget • Buyer-supplier partnership level • Delivery performance • Supplier cost saving initiatives • Delivery reliability • Cost per operation hour • Information carrying cost • Supplier rejection rate	• Supplier assistance in solving the technical problem • Supplier ability to respond to quality problems • Supplier cost saving initiatives • Supplier's booking in procedures • Capacity utilisation • Order entry methods • The accuracy of forecasting techniques • Product development cycle time • The flexibility of service system to meet customer needs • Buyer-supplier partnership level • The range of products and services • Level of customer perceived value of the product

Source: Bhagwat and Sharma (2007:74)

4.8.6 Activity-based costing (ABC)

This supply chain performance measurement framework was developed in the 1980s (Cao & Zhang 2010:163). The main aim of this framework was to analyse costs and margin but further went to analyse the calculation of return costs. This framework groups activities by the process logic and interweaves accounting data into this concept. Therefore, this framework falls under tangible supply chain performance measurement which is used in this study.

4.9 APPLICATION OF THE CONFIGURATION THEORY TO SUPPLIER INTEGRATION AND SUPPLY CHAIN PERFORMANCE

The Configuration Theory has been used in this study to explain supplier integration and supply chain performance. This is because supplier integration leads to belongingness, improves communication and collaboration and ultimately leads to better supply chain performance. Supplier integration has long been recognised as a critical construct in the literature of supply chain management affecting both tangible and intangible dimensions of supply chain performance of the organisation (Monczka *et al.* 2016:46). Thus, a configuration view of supplier integration suggests that it is not the impact of isolated integration practices that matters so much as the synergies that emerge from specific arrangements of practices.

4.10 THE RELATIONSHIP BETWEEN SUPPLIER INTEGRATION AND SUPPLY CHAIN PERFORMANCE

It is suggested that as a result of integration within firms, positive organisational performance might be enhanced because of the sharing of risks, sharing business information which includes demand forecasts, inventory level and production planning decisions as well as synchronising business processes (So & Sun 2010:474). The relationships between integration and SME performance have been extensively studied (Lau *et al.* 2007:1; Kim 2009:328; Kristal *et al.* 2010:415) and these findings confirm that integration can be transformed into competitive capabilities thus contributing to positive supply chain performance. In addition, there are further studies that confirmed the positive significant relationship between supplier integration and supply chain pefromance (Bowersox *et al.* 1999; Frohlich & Westbrook, 2001:196; Childerhouse & Towill 2003:31; Gimenez & Ventura 2005:123 Thietart 2007:82; Zhao *et al.* 2008:78; Flynn *et al.* 2010:13). Thus, this study intended to confirm or dispute the findings of the results of this relationship as found from other researches.

4.11 CONCLUSION

The conceptualisation of supplier integration and supply chain performance were discussed in this chapter showing the linkages between the two. In summary, the following were noted as key to effective supplier integration: the capability to participate in the design processes, the willingness to participate in the design process including the ability to reach agreements on intellectual property and confidentiality issues, the ability to commit sufficient personnel and time to the process and sufficient resources to commit to the supplier integration.

The benefits of supplier integration were highlighted in this chapter considering the benefits to the firm as well as to the supplier. These benefits include lowering the cost of labour; integration of tasks and shared information; significant improvements in both customer and supplier services and further performance improvements. Further to this, the different types of supplier integration including early supplier integration, supplier relationship management and retailer supplier integration were discussed.

Different definitions of supply chain performance were explained. The most emerged definition of supply chain performance in this chapter was defined as the performance of the various processes included within the firm's supply chain function. The purpose of measuring performance was also explained. The main facets from this chapter include measuring and monitoring data that can inform judgements about the standards of performance achieved and provide signals about what is important. It was also noted that measurements have a motivational influence, and they help to shape perceptions of what is important and to concentrate energies on actions relevant to them. The drivers and enablers of supply chain performance were discussed. These drivers include inventory, information, facilities and transport. The enablers include an improvement in communication and IT; entry of third-party logistics providers and enhanced inter-firm coordination capabilities. Lastly the frameworks of supply chain performance were discussed. These include Beamon's model; Gunasekaran's 2001 and 2004 models as well as Chan and Qi's performance measurement.

The next chapter discusses the research methodology deployed in this study.

CHAPTER 5
RESEARCH METHODOLOGY

5.1 INTRODUCTION

In the previous chapter, a review of the literature on supplier integration and supply chain performance was provided. The key concepts for both variables were conceptualised, and a theoretical overview highlighted. The status of research regarding the relationship between supplier integration and supply chain performance was also explored.

The purpose of this chapter is to provide an in-depth discussion of the research methodology used in this study. The first sections of the chapter focus on deductive and inductive research, before moving on to research paradigms. Thereafter, the research approach adopted in the study is highlighted, followed by a discussion of the research method. This is succeeded by a discussion of the sampling design used in this study and data collection.

In discussing the issues, the chapter identifies the approaches that were adopted and provides motivations for choosing them ahead of available options. The pre-testing of the research instrument and the pilot study was conducted. Lastly, the statistical analysis and the ethical considerations followed in this study are discussed.

5.2 DEDUCTIVE AND INDUCTIVE RESEARCH

There are two main forms of research reasoning: deductive and inductive reasoning (Zushi & Morgan 1998:222; Terreblance & Durrheim 1999:109; Bryman 2012:94). Deductive research involves developing and applying theory before the collection of data (Saunders, Lewis & Thornhill 2009:241). Deductive reasoning uses a top-down approach. Deductive theory testing is normally used in quantitative research. The study uses the literature to identify the variables, develop a theory about the causal relationship between them, operationalise how they are going to be measured and then tests them statistically (Babbie & Mouton 2005:273; Saunders *et al.* 2009:241). In other words, deductive theory testing starts with a theory and tests that theory through observation.

Inductive approaches start from observations of the real world (Newsome 2016:17). The inductive theory is often used in qualitative studies where little is known, or alternative explanations (theories) for occurrences are sought (Mertens 2009:18). Inductive reasoning relies on a bottom-

up approach. Inductive research refers to collecting data and thereafter developing a theory (Saunders *et al.* 2009:241).

A deductive research reasoning approach was applied in this study. This choice was facilitated by the view that deductive reasoning is linked to objectivity, scientific rigour, controlled nature of research and the representativeness of the sample despite its limitation of mostly being concerned with the testing of hypotheses (Mertens 2009:18). The next subsection discusses the research paradigm.

5.3 RESEARCH PARADIGM

A paradigm in research is defined as "a cluster of beliefs and dictates, which for scientists in a particular discipline influence what should be studied, how research should be done and how results should be interpreted" (Bryman 2012:630). Filstead (1979:19) defines a paradigm as "a set of interrelated assumptions about the social world, which provides a philosophical and conceptual framework for the organised study of that world". Knowing what paradigm a researcher ascribes to is important because it determines what questions are considered worthy of investigation and what processes are required for the answers to be acceptable (Kuhn 1970:175; du Plooy-Cillers; Davies & Bezuidenhout 2014:19).

Many paradigms are used to guide research studies. Some of them include positivism, post-positivism, interpretivism (phenomenology), transformative and critical realism traditions (Wildemuth 1993:350; Robison 2007:673). Easterby-Smith (2009:8) distinguishes between two fundamentally opposed views on research. These are logical positivism and phenomenology. Logical positivism encourages the use of quantitative and experimental methods to test hypothetical-deductive generalisations. Researchers who are led by this view of research believe in the need for the researcher to separate himself or herself from the subject he or she will be studying hence the use of experiments to arrive at conclusions on what is being researched. Newsome (2016:324) defines phenomenology (also known as interpretivism) as the branch of philosophy focusing on how humans interpret observations. In phenomenology, the view is taken that what researchers observe is not reality as such, but an interpreted study (Fox & Bayat 2007:70).

In critical theory, researchers start with many assumptions that differ from assumptions made by persons operating within qualitative or quantitative designs (Fox & Bayat 2007:10). Mertens (2005:17) acknowledges that there is also another paradigm known as "transformative". This paradigm arose due to dissatisfaction from the mentioned paradigms above. Creswell (1999:9)

states that transformative researchers might utilise "mixed method research" in which the qualitative and quantitative methods are combined in one research study.

Brienschke (1992:174) defines post-modernist research as follows:

> "*Post-modernist research in the social arena at its most evolved has been multi-dimensional, that is, reciprocal and mutual, moving back and forth from self to other(s), concerned with the social structures that enable the self and other(s) to communicate symbolically and intersubjective. It values and is based on the sense of connectedness that recognises the interdependent construction of both self and other different ways of knowing. Philosophically, post-modernist paradigms view rationality itself as a social symbolic construction".*

For this study, the post-positivism paradigm (also known as post-modernism) was adopted to guide the study in the selection of tools, instruments, participants and methods used in the study. The post-positivism paradigm was selected for this study because of the causal relationships being investigated between the variables (which are e-design, e-negotiation, e-sourcing, e-informing, e-evaluation, supplier integration and supply chain performance). This method also allows the testing of hypotheses as well as reliability and validity. The research approach is discussed in the next subsection.

5.4 RESEARCH APPROACH

There are two main research approaches namely quantitative and qualitative approaches (Tillman 2003:4; Cresswell 2013:113). According to Borrego, Douglas and Amelink (2009:54), a study of the relationship of cause and effect among constructs is well suited to a quantitative research strategy. Creswell (2015:18) and Punch (2005:237-238) describe quantitative studies as those "based on testing a theory composed of numerical variables and are analysed with statistical procedures".

The qualitative research approach refers "to research that elicits participant accounts of meaning, experience or perceptions" (Richards 2005:231). According to McKinney (2011:77), qualitative research adopts a naturalistic enquiry theory. This means that situations are studied in the real world or as they unfold naturally. However, Easterby-Smith (2009:63) argues that in qualitative research the procedures are not as strictly formalised as in quantitative research. According to Erisson and Kovalainen (2008:4), the variables which define the quantitative method are described in Table 5.1.

Table 5.1: Quantitative research approach

Quantitative approach
Measures objective facts
Focuses on variables
Reliability is key
Value-free
Theory and data are separate
Independent of context
Many cases, subjects
Statistical analysis
Larger sample size
The researcher is detached
Draws conclusions for a large number of people or items
Analyses data efficiently
Appeals to people's preference for numbers
Specifies numerical assignment to the phenomena
The analysis involves descriptive and inferential statistics
Verification takes place after theory building is completed
Concepts are firmly defined before research begins
Nomological thinking
Value-neutral; value-free inquiry
Its purpose is to explain social life
Is etiological – interested in "why" things happen
Employs high levels of measurement

Quantitative approach
Employs reductive data analysis
Is a closed approach – is strictly planned
Employs assistants
Highly integrated findings

Source: Neuman and Kruger (2003:13,157); Vanderstoep and Johnston (2009:7); Creswell (2015:5).

In this study, a quantitative research methodology was adopted and considered more appropriate because addressing the research problem depended on the analysis of quantitative data collected on many survey questions around e-procurement, supplier integration and supply chain performance in SMEs. Moreover, the quantitative approach was adopted because it was very difficult to include all 283 participants with qualitative research. It was also necessary to generalise the results to other environments of SMEs, hence the need to choose a quantitative approach. The current study also used a quantitative method to assist in establishing the causal relationship or influence of e-procurement on supplier integration and supply chain performance amongst SMEs.

From a total of 350 questionnaires that were distributed to respondents, 294 were returned, and 11 were discarded due to incomplete responses to different parts of the questionnaire. A total of 283 questionnaires were eventually used in the study.

The next subsection discusses the research method.

5.5 RESEARCH METHOD

Quantitative research designs are categorised into four main research methods, namely: cross-sectional, longitudinal, observational and experimental (Creswell & Garret 2008:322). Cross-sectional survey design is used to create an overall picture of a phenomenon at one point in time (Maree 2007:118). Longitudinal studies are useful in determining changes in phenomena over time. The advantage of this method is that it elucidates trends and temporal changes in variables (Mouton 1996:56; Watson 1998:41; Davies & Bezuidenhout 2014:19). The dropping out of participants over time (attrition) is a major blow for this type of design (Vanderstoep & Johnston 2009:39). Another disadvantage of this method is its immense cost in terms of time and effort and as well the long-time period required to yield results.

Observational studies compare cases with controls. The comparison is made of the exposure to something suspected of causing the case (Keyton 2011:231). Experimental designs deal largely with experimental type studies where the researcher generates data through experimentation, experiment to make a discovery, test hypothesis and demonstrate a belief. Experimental studies are done in laboratory settings. The major advantage of the experimental study is the degree of control it provides (Cohen, Manion & Morrison 2007:781). One of the most important disadvantages of experimental studies is that the nature of the experiments may be very unlike what people experience in the real world (Vanderstoep & Johnston 2009:35; Babbie & Mouton 2001:118).

Quasi-experiments share characteristics of a true experiment which seek interventions or treatment (Awang, Muhammad & Sinnaduai 2012:5). A factorial design is the modification of true experimental design with the further complication that additional independent variables (usually moderator variables) are included in addition to the treatment variable (Awang *et al.* 2012:16). Factorial designs allow the researcher to test the effect of more than one independent variable in the same experiment (Brink 1996:104). In ex-post facto designs, the treatment is not developed purposely to test the respondent. It can be considered as "after-the-fact" treatment to an outcome or dependent measure (Awang *et al.* 2012:16). In ex-post facto research, there is "no manipulation of the independent variable", because the event of interest (the dependent variable) has already passed (Brink & Wood 1994:110-111).

The present study made use of a cross-sectional strategy to create an overall picture of a phenomenon at one point in time (Maree 2007:118). Thus, data were collected from respondents once without repeating the process. A cross-sectional strategy was adopted in this study because it offers advantages such as allowing researchers to collect a large amount of information quickly and generally cross-sectional studies are inexpensive. The other advantage of cross-sectional strategy is that it allows researchers to compare many different variables at the same time. Hence, the cross-sectional strategy was deemed as appropriate for this study. The next subsection discusses the research design.

5.6 RESEARCH DESIGN

The research design is "the basic plan for a piece of research and includes four main ideas: strategy, conceptual framework, the question of who or what will be studied and the tools and procedures to be used for collecting and analysing empirical materials" (Punch 2005:63). Therefore, a research design must specify the methods to be used, including how variables will be measured (Awang *et al*. 2012:1).

In the present study, a descriptive survey design was adopted. A survey is a method of collecting data from people about who they are and how they think and what they do (Balnaves & Caputi 2001:76). Descriptive survey studies are concerned with gathering information from a sample of the population (Brink 1996:109). The purpose of descriptive research is to describe the relations between variables or relationships between phenomena as accurately as possible (du Plooy-Cillers *et al.* 2014:75). According to Neuman (2006:34) and Kumar (2011:10), a descriptive study aims to:

describe a situation or phenomenon systematically;

provide information about certain phenomena, such as living conditions of a community; and

draw comparisons.

The descriptive survey was chosen for this study because this approach is highly formalised and more explicitly controlled than phenomenology (Balnaves & Caputi 2001:76; Robinson *et al.* 2006:237). Surveys provide the advantage of sampling a large group of randomly selected people to measure their attitudes and behaviour for a relatively low cost in time and money (Vanderstoep & Johnston 2009:37). The research design used in this study involved a literature review and an empirical study.

5.6.1 Literature review

A literature review is a critical assessment and summary of the range of past and contemporary literature in each area of knowledge (Fox & Bayat 2007:35). Relevant literature is conducted for the researcher to gain a broader perspective on the problem and provide a basis for the research. The main purposes or aims of literature reviews are to:

Provide a sound theoretical overview of the existing research findings, theories and models in terms of the specific research problem.

Indicate to the reader that the researcher is familiar with recent related developments.

Show that the researcher has been selective and critical in listing only relevant research findings.

Provide insight into previous work, and

Situate and locate the research project and outline its context (Fox & Bayat 2007:36).

To achieve the aims of the present study, an appropriate literature study utilising both national and international sources was conducted. This literature review was conducted in Chapters 2, 3 and 4. Chapter 2 analysed literature on supply chain management. Chapter 3 analysed literature on e-

procurement. Chapter 4 analysed literature on supplier integration and supply chain performance. This provided a clear understanding as to how the study constructs influence each other. The researcher examined key concepts, conclusions, theories and arguments that underlie research in this study area. These provided a platform to analyse the literature by comparing and constructing the perspectives, viewpoints and arguments by other researchers in similar studies. Sources of the literature, such as textbooks, articles, newspapers, theses/dissertations, as well as information on the Internet were used to develop a theoretical background.

5.6.2 Empirical Study

The empirical study involved the target population, sample size, the sampling approach and technique, questionnaire design, scale validation and statistical analysis procedures.

5.6.2.1 The target population

According to Keyton (2011:121), target population "consists of all units or universe – people or things – possessing the attributes or characteristics in which the researcher is interested". A target population is also defined by Wiid and Diggines (2013:186) as "the total group of people or entities (social artefacts) from whom information is required". Neumann (2006:224) further defined target population as the specific pool of subjects that the researcher is interested in studying. A target population as the entire group of persons or objects that meet the criteria the researcher is interested in studying (Burns & Grove 1993:114; Brink & Wood 1994:231; Polit & Hungler 1995:325; Roberts & Burke 1989:633; Wilson 1989:72). The target population in this study consisted of all SME owners and managers in the Gauteng Province, South Africa.

The actual number of SMEs in the Gauteng province is not known, although a report by Statistics South Africa (2015) estimated that there were 687 556 SMMEs in the Gauteng province in 2015. Whilst this provides a rough guide of the number of SMEs existing in the province, the actual number of SMEs operating in the province remains elusive. It was therefore difficult to find a single sampling frame from which a list of SMEs in the Gauteng province could be found. To identify SMEs for inclusion in this study, an extensive Internet search was conducted using key words such as contacts/number of SMEs in the Gauteng province. From this search, approximately 1993 formal SMEs were identified from the different sectors of the economy. These SMEs were subsequently contacted through emails and telephonically to request permission to conduct this current study. Out of this total number of SMEs in the province, 294 were conveniently surveyed.

5.6.2.2 Sample size

The sample is defined as the part of the population to be studied (Awang *et al.* 2012:31). A sample size is a function of change in the population parameters under study and the estimation of the quantity that is needed by the researcher (Wegner 2012:86-87). The determination of the final sample size also involves judgment, especially where convenience sampling is employed, and calculation where random sampling is used by the researcher (Chadwick, Bahr & Albrecht 1984:189). Effective judgement when it comes to sample size determination requires the use of a sample size similar to those of the previous studies, so as to provide the researcher with a comparison of other researchers' judgements (Kumar 2011:318).

Since this study used a convenience sampling technique, the sample size for this study was based on the historical evidence approach or previous research studies. The historical evidence approach is one in which the researcher reviews past related research articles on the sample sizes used (McKinney 2011:34). Studies by, Pearcy, Parker and Giunipero (2008:28); Flynn *et al.* (2010:62); Danese and Romano (2011:223); Chirchir *et al.* (2015:31) and Ombat (2015:708), which were conducted within the SME sector in different countries were considered in determining the sample size for the present study, since they used sample sizes ranging between 97 and 617. For example Antony and Bhattacharyya (2010:42) used a sample of 407 respondents, Fatoki and Odeyemi (2010:2763) used a sample size of 417, Chinomona and Pooe (2013:4) used a sample size of 180, Pfanelo (2015:72) used a sample size of 271, Ombat (2015:708) used a sample of 97 respondents and Pooe, Mafini and Loury-Okoumba (2015:4) used a sample of 309 respondents. These studies focused on supply chain management in SMEs. Large sample sizes (above 300) are suitable for CFA and SEM in order to generate a good model fit (Schindler 2010:390).

Furthermore, according to Pallant (2007:185), the overall sample size in a quantitative study should be at least 150 elements. Tabachnick and Fidell (2007:613) also suggest that it is comforting to have at least 200 cases for a multivariate analysis. However, every attempt was made to reach a larger sample size for multivariate purposes analysis. According to Altunisik, Coskun, Bayraktaroglu and Yildirim (2014:125) sample sizes between 30 and 500 at 5% confidence level are generally sufficient for many researchers. However, every attempt was made to reach a larger sample size for multivariate purposes analysis. Therefore, based on this prescription, the sample size was set at n=350 and was deemed fit for the current study because it falls within the range of most previous related researches. The next subsection describes the instrument used in this study to collect data.

5.6.2.3 Sampling approach and technique

There are two approaches to sampling: probability sampling and non-probability sampling (Cohen, Manion & Morrison 2007:228). The probability sampling method "is one in which every unit in the population has a chance of being selected in the sample which can be accurately determined" (Awang *et al.* 2012:34). In non-probability sampling, the probability of the selection of each respondent is not known (Awang *et al.* 2012:35). This study used the non- probability sampling approach.

The various non-probability sampling techniques include quota sampling, convenience sampling, purposive sampling and snowball sampling (Neuman 2006:220). In quota sampling, "the researcher first identifies general categories into which cases will be selected and then selects cases to reach a predetermined number of cases in each category" (Derica 2014:65). Convenience sampling means selecting any group of individuals who are available for a study (Neuman 2003:78; McKinney 2011:34). This form of sampling has several disadvantages in that those surveyed might be of the same age, gender or background (McKinney 2011:34). Purposive or judgemental sampling uses the judgement of an expert in selecting cases whereas in snowball sampling, the researcher selects a sample where the elements are connected to one another, i.e. have an interrelationship. Other methods of non-probability sampling include voluntary sampling, snowball sampling, event sampling and time sampling.

In this study, a convenience sampling technique was used since there was no sampling frame from which the list of SMEs could be obtained. Additionally, use of this technique offers several advantages such as cost-effectiveness and the fact that it is very easy to carry out with few rules governing how samples should be collected. However, this type of sampling is usually recommended for pilot studies (Keyton 2011:342).

5.7 INSTRUMENTATION

Data were collected through a survey questionnaire. A questionnaire is a list of questions on a specific topic by a researcher and to which answers and information are required (Fox & Bayat 2007:88). The questionnaire used in this study was made up of closed-ended questions. Closed-ended questions are those which provide the answers from which the respondents have to choose (Neuman 2006:287). The research study used closed questions for the following reasons:

- "They are easier and quicker for respondents to answer;
- The answers of different respondents are easier to compare;

- Answers are easier to code and statistically analyse;
- The response choices can clarify question meaning for respondents;
- Respondents are more likely to provide answers pertaining to sensitive topics as is the case for this study;
- There are fewer irrelevant or confused answers to questions; and
- Replication is easier" (Neuman 2006:287).

The questionnaire was chosen as the research instrument. The benefits of employing questionnaires in this study are summarised below:

- "The cost per questionnaire is relatively low;
- Structured information in the questionnaire and few open-ended questions makes analysing questionnaires relatively straightforward;
- Questionnaires give respondents extended time to formulate correct answers;
- This method of data collection produces quick results;
- Questionnaires are a stable, consistent and uniform method of collecting data;
- Many subjects prefer to write rather than talk about certain issues; and
- This form of research instrument has a wider coverage" (Sarantakos 2005:263).

The questionnaire used in this study consists of four sections. Section A consists of seven items and sought general demographic information about the respondents and SME profile. Section B consists of 22 items, which cover all the five e-procurement elements (e-sourcing, e-design, e-negotiation, e-evaluation, e-informing), adapted from Chang *et al.* (2013: 39) and Ombat (2015:718). Questions in Section C sought respondents' views on supplier integration, using eight items adapted from Zhao, Huo, Sun and Zhao (2013:130). Section D covers supply chain performance and consists of 10 items, adapted from Chang *et al.* (2013: 39). All measurement scales are measured using five-point Likert-type scales, anchored by 1= strongly disagree and 5= strongly agree. Following the argument of Wegner (2012:86-87), most of the questions contained in the questionnaire are Likert scale questions for the following reasons: (i) they reduce the development of response bias amongst the respondents; (ii) they evaluate attitudes, beliefs, opinions and perceptions; (iii) Likert scales make the response items standard comparable amongst the respondents; and (iv) the Likert scale statement answers are easy to code and analyse directly from the questionnaires. All questions were closed-ended (Appendix B).

The next subsection describes the fieldwork and administration of the instrument.

5.8 FIELDWORK AND ADMINISTRATION OF THE QUESTIONNAIRE

The questionnaire was administered by a face-to-face survey method. Questionnaires were distributed by the researcher, who was assisted by three trained field workers. The field workers were students at a South African university of technology based in Southern Gauteng. A period of three months between May and July 2017 was set aside for administering the questionnaire and collecting the data. The large geographic location of the study (Gauteng) necessitated the appointment of three research assistants to assist with the data collection. The research assistants were trained for almost three hours. The training focused on how to approach the participants, anonymity of answers on the questionnaire and explanation of the informed consent form. The researcher also discussed all the questions in the questionnaire with the research assistants.

The advantage of the face-to-face survey method was that it is less expensive than other methods like mail surveys and interviews. This method could give quick results or feedback in a short space of time. The questionnaires were collected the same day they were distributed since data collection was via a face-to-face survey.

5.9 PRE-TESTING THE QUESTIONNAIRE

Most researchers spend a significant amount of time and effort on designing data collection instruments, such as questionnaires. It is therefore important to pre-test the instrument before data collection begins (du Plooy-Cillers *et al.* 2014:15). Babbie (2013:242) further acknowledges that "no matter how carefully researchers design a data-collection instrument, there is always the possibility – indeed the certainty – of error. They will always make some mistake: an ambiguous question, one that people cannot answer. The surest protection against such errors is to pre-test the questionnaire in full or in part". In this study, pre-testing of the questionnaire was conducted with three academics at a South African university of technology whose research interests lie within the field of supply chain management. A statistician also evaluated the questionnaire items to verify their clarity, relevance and interpretation. Feedback from these individuals was taken into consideration, and the questionnaire was modified to suit the purpose of the study. Language related inconsistencies such as grammatical errors and sentence construction were all rectified.

5.10 PILOT STUDY

According to Sarantakos (2005:256), a pilot study "is a small-scale replica and a rehearsal of the main study". The purpose of a pilot test is to eliminate problems that a researcher may not have

foreseen when designing the instrument **(**du Plooy-Cillers *et al.* 2014:15). The main goal of a pilot study is to find out the possible weaknesses, inadequacies, ambiguities and problems in every aspect of the research instrument so that they can be corrected (Sarantakos 2005:256). Therefore, conducting a pilot study makes it easier to correct areas of misunderstanding or confusion without wasting time and/or money. For this study, a pilot study was conducted with 42 SME owners and managers based in the Vaal Triangle region. These respondents were not included in the main study. The pilot study reported satisfactory reliability of Cronbach Alpha values above the minimum cut-off value of 0.7 across all four sections of the measuring instrument (refer to Section 6.2).

5.11 RELIABILITY

Reliability is defined as being able to retest the researcher's data and obtain the same results (Welman, Kruger & Mitchel 2006:145). Reliability also refers "to the fact that different research participants being tested by the same instrument at different times respond identically to the instrument" (Mouton 2001:144). The reliability of an instrument is its ability to give nearly identical results in repeated measurements under identical conditions, in other words reliability is about reproducibility (Blunch 2008:27). Reliability coefficients range from 0.0, for results that are completely inconsistent, to 1.0, for measurements that are entirely consistent (Vogt 2007:114).

Neuman and Kreuger (2003:179-180); Neuman (2006:190) and Salkind (2012:348) acknowledge that is difficult to have entirely consistent reliability (1.0) and suggest some means of increasing reliability. These means/ways include:

- clearly conceptualising all constructs;
- increasing the level of measurement;
- using pre-tests and pilot studies;
- removing items that are unclear; and
- standardising the conditions under which the test is undertaken.

Reliability in this study was ascertained using Cronbach's Alpha Coefficient, the Average Variance Extracted (AVE) and Composite Reliability (CR). Cronbach's Alpha measures the degree to which the items in an instrument are related (Vanderstoep & Johnston 2009:63). The AVE measures the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error and can be calculated using the following formula: (summation of squared factor loadings)/ (summation of squared factor loadings) (summation of

error variances) (Fornell & Larcker 1981:42). The composite reliability test directed to examine the internal steadiness of each research construct, as recommended by Nunnally (1967:56) and Chinomona (2011:108). The composite reliability was examined with the following formula:

$CR\eta = (\Sigma\lambda y_i)^2 / [(\Sigma\lambda y_i)^2 + (\Sigma\varepsilon_i)]$

Composite Reliability = (square of the summation of the factor loadings)/ {(square of the summation of the factor loadings) + (summation of error variances)}

For the Cronbach's Alpha Coefficient and the CR, the recommended values should be greater than or equal to 0.70 for each scale (Andrew, Arvind & Albert 2001:202; Babbie 2013:49). An alpha of 0.70 or higher is often considered satisfactory for most research purposes (Vogt 2007:115). According to Fraering and Minor (2006:284), the minimum acceptable value for the AVE for each scale is 0.40. Item-total correlations were also used to ascertain the reliability of the measurement scales. According to Nunnally (1967:57), item-total correlations should be above 0.40. Accordingly, these thresholds were applied in this study. The results for the measurement of reliability in this study are reported in Section 6.4. The next subsection discusses the validity.

5.12 VALIDITY

Validity is the extent to which the instrument that was selected reflected the reality of the constructs that were being measured (Collins & Hussey 2003:58; Babbie & Mouton 2001:122). Validity measures strength and accuracy of research design (Submarani 2004:45; Hair, Black, Babin & Anderson 2014:3). Validity is defined as the best available approximation to the truth or falsity of a given inference, proposition or conclusion (Awang *et al.* 2012:25). In this study, four validities, namely face, content, convergent and discriminant validities were assessed.

5.12.1 Face validity

Face validity refers "to a type of measurement validity in which an indicator 'makes sense' as a measure of a construct in the judgement of others" (Neumann 2006:192). To ensure face validity, the research study used three experts in supply chain management to judge the questions independently (Babbie 2013:65).

5.12.2 Content validity

Content validity is "the degree to which a measure covers the range of meanings included within a concept" (Babbie 2013:66). Firstly, to ensure content validity, an extensive literature review was

conducted to ensure that the instrument is related to previous studies. Thereafter, previous studies were consulted to construct the research instrument. To further ascertain content validity in this study, a pilot study was conducted with a conveniently selected sample of 42 SME owners and managers in the Vaal Triangle.

5.12.3 Convergent validity

Convergent validity is "a type of measurement validity for multiple indicators based on the idea that indicators of one construct will act alike or converge" (Neumann 2006:194). To ascertain convergent validity, the factor loading for each item was checked and assessed whether individual measurement's factor loadings for each corresponding research construct were above the minimum threshold value of 0.5 (Anderson & Gerbing 1988:55). All values were above 0.50 (Refer to Section 6.4.1).

5.12.4 Discriminant validity

Discriminant validity is "a type of measurement validity for multiple indicators based on the idea that indicators of different constructs diverge" (Neumann 2006:194). Discriminant validity was ascertained by assessing whether correlations between constructs were positive (Litwin 2005:135). The researcher performed CFA to illustrate discriminant validity among e-procurement functions, supplier integration and supply chain performance. The study also measured discriminant validity using the correlation matrix coefficients of less than 1 and the AVE values of less than 1. Where the AVE values were greater than the highest shared variances between variables, discriminant validity was established (Fornell & Larcker 1992:45; Watson 1998:43). The next subsection discusses the data analyses and statistical techniques.

5.13 DATA ANALYSES AND STATISTICAL TECHNIQUES

Data were subjected to statistical analysis with the use of the following techniques: descriptive statistics, CFA model fit and hypotheses testing using SEM with the Analysis of Moment Structures (AMOS) programme version 24.0. The respondents' biographic information and the composition of the sample were analysed using descriptive statistics in the form of frequencies and charts. The other constructs were analysed using the Statistical Package for Social Sciences (SPSS), version 24.0 for Windows. The descriptive statistics, CFA, model fit and SEM are discussed in this section.

5.13.1 Descriptive statistics

Descriptive statistics are focused on helping the researcher to describe and analyse data. Descriptive statistics refers to a description of a set of data displayed diagrammatically in the form of graphs, tables and charts or describing the measures of central tendency such as means, mode, median and standard deviation. The use of descriptive statistics helped the sample profile of SMEs conducted. Data collected from the questionnaire survey were presented in frequency tables and bar graphs. The percentages were calculated using the number of responses to questions on the questionnaire compared to the total number of questionnaires that were returned.

5.13.2 Confirmatory factor analysis, model fit and structural equation modelling

This subsection discusses confirmatory factor analysis, model fit and structural equation modelling.

5.13.2.1 Confirmatory factor analysis

Confirmatory factor analysis (CFA) is "a way of testing how well variables measured represent a smaller number of constructs" (Hair *et al.* 2010:602). The CFA procedure was conducted using the Analysis of Moment Structures (AMOS), version 24.0 to assess the psychometric properties of measurement scales. The CFA allows for testing the hypotheses that a relationship between observed variables and latent variables exists. The CFA was also performed to establish the model fit; that is if the data fits the conceptualised research model. The CFA Model Fit Indices results are shown in Chapter 6: Table 6.12.

5.13.2.2 Model fit

Model fit refers "to the extent to which a hypothesised model is consistent with the data" (Pallant 2007:195). Model fit refers to a process that assesses how well the model represents the data (Foster *et al.* 2006:100). In this study, model fit was ascertained by using the following indices: Chi-square/degrees of freedom, Comparative fit index (CFI), Incremental fit index (IFI), Normed fit index (NFI), Tucker-Lewis index (TLI) and the Root Mean Square Error of Approximation (RMSEA). The acceptable thresholds should be equal to or higher than 0.90 for, CFI, IFI, NFI, TLI; for Chi-square/degrees of freedom a ratio of 3:1 or less is recommended and RMSEA value should be equal to or less than 0.08 (Lysons & Farrington 2012:586). These model fit indices are described below:

Chi-square/degrees of freedom – this refers to the ratio of chi-square to the degrees of freedom. "The ratio on the order of 3:1 or less are associated with better-fitting models except in the circumstances with larger samples (greater than 750) or other extenuating circumstances such as a high degree of model complexity" (Hair *et al.* 2000:579; Bentler & Bonnet 1980:588).

Comparative fit index (CFI) – refers to a situation where two or more models are compared to see which one provided the best fit to the data (Foster *et al.* 2006:110). CFI is based on the non-centrality parameter and ranges from 0 to 1, with values exceeding 0.90 indicating a good fit to the data (Hu & Bentler 1999:78; Foster *et al.* 2006:110). CFI is an improved version of the NFI (Bentler & Bonnet 1980:765; Hu & Bentler 1999:78; Best & Kahn 2006:17).

Incremental fit index (IFI) – reintroduces the scaling factor, so that IFI values range from 0 to 1, with higher values indicating a better fit to the data (Bollen 1989:90). The IFI ranges from 0 to 1, values exceeding 0.90 indicating a good fit. The IFI assess how well the estimated model fits relative to some alternative baseline model (normally the null model) (Hoelter 1983:324; Kelloway 1998:27; Hu & Bentler 1999:79; Hair *et al.* 2014:580).

Tucker-Lewis index (TLI) – is a measure of incremental fit to capture the improvement of a hypothesised model over the null model and adjust this improvement for the number of parameters in the hypothesised model. A value of 0.90 is a widely used cut-off for establishing good fit to the data (Hu & Bentler 1999:78; Hair *et al.* 2006:580).

Root Mean Square Error of Approximation (RMSEA) – is based on the analysis of residuals, with smaller values indicating a better fit to the data. Narasimhan and Peters (2010:233) suggest that values below 0.10 indicate a better fit to the data and values below 0.05 a very good fit to the data. However, Hu and Bentler (1999:78) suggest a cut-off of 0.06 for the RMSEA to indicate a good fit to the data. The most recommended cut-off value is less than 0.08 (Allison 1999:65; Foster *et al.* 2006:109).

5.13.2.3 Path analysis and structural equation modelling (SEM)

Path analysis is a method of organising and illustrating relationships in data which makes it easier to comprehend or "see" relationships compared to portraying similar information in a matrix (Foster *et al.* 2006:102). Huang *et al.* (2002:149) suggest that the goal of path analysis is "to provide plausible explanations of observed correlations by constructing models of cause-and-effect relations". Path analysis allows path coefficients (the relationship between variables) to be determined. Additionally, path analysis requires recursivity (that the path direction is one way with no feedback loops) (Allison 1999:65). The advantage of path analysis is that the researcher can see which variables exert effects on others.

Structural equation modelling (SEM) is "a family of statistical models that seek to explain the relationships among multiple variables" (Hair *et al.* 2006:546). Structural equation modelling is "a confirmatory, multivariate technique that looks at causal relationships between variables in a diagrammatic form" (Foster *et al.* 2006:102). SEM was used in this study to estimate the relationship between the constructs. Therefore, SEM seeks to understand the relationships between latent variables and the observed variables, which form the structural framework from which they are derived (Hugos 2006: 543; Hox & Bechger 2007:356).

It is recommended that the researcher should choose absolute fit indices to determine how well a proposed conceptual model fits the sample (McDonald & Ho 2002:64). Absolute fit indices are "a direct measure of how well the model specified by the researcher reproduces the observed data" (Kenny & McCoach 2003:334). The measurement of model fit was done using the following indices: Chi-square/degrees of freedom, CFI, IFI, RFI, NFI and RMSEA, using the same thresholds to those applied in the CFA.

5.14 CONCLUSION

This chapter discussed the research paradigm, deductive and inductive reasoning, research design, philosophies of research, the sampling methods and the research instrument by which data was gathered. The deductive and deductive reasoning research method was explained, and the choice made about this study was motivated. The deductive reasoning approach was opted for because it facilitates the testing of hypotheses. The three main research approaches were discussed which are quantitative, qualitative and mixed methods and differentiated as the basis to motivate the chosen research methodology (quantitative research) in this study. The instrument used was a survey questionnaire. In addition to practically describing how this instrument was applied to the current study, that is, how it was constructed, administered and collected, the strengths and weaknesses from a theoretical point of view were also provided.

This chapter also described the target population and the sampling method used (convenience sampling method) concerning the distribution of the questionnaire. The pre-testing and piloting of the instrument were explained. Validity and reliability of the research instrument were also addressed. Lastly, ethical considerations for this research study were also explored.

The next chapter is concerned with the presentation of the research results and the discussion and interpretation of those findings.

CHAPTER 6
PRESENTATION OF FINDINGS AND ANALYSIS

6.1 INTRODUCTION

The previous chapter (Chapter 5) describes the research design and methodology used in this study. In the previous chapter, a theoretical exposition of the research methodology was outlined. The study is located within a quantitative research paradigm. In the research methodology chapter, reference is made to the target population, research procedure, measuring instruments, data analyses and statistical techniques.

This chapter addresses the research objectives posed in Chapter 1. Results of the main study are presented, discussed and interpreted. Descriptive statistics, reliability, confirmatory factor analysis (CFA), model fit and hypotheses testing using structural equation modelling (SEM) are also reported and interpreted. As noted in the previous chapters, SPSS Version 24.0 was used to statistically analyse and provide the descriptive analysis results (in the form of graphs and tables) of the respondents and firm profiles (see Section 6.3.2) in this study. SPSS version 24 was also used to perform principal component analysis utilised to reduce the measurement items for the research latent variables (see Section 6.4). The study employed AMOS version 24.0 to perform structural equation models of CFA for assessing the overall model fit as well as the path analysis for hypotheses testing. Some findings are also related to the literature review, showing how, and the extent to which they support the postulations made in the literature review. The next section discusses the pilot study analyses.

6.2 PILOT TEST ANALYSES

The targeted group completed forty-two (42) questionnaires. This group has similar characteristics to the population. The respondents from the pilot study were owners and managers in the Vaal Triangle SMEs. These respondents were not included in the main study. The purpose of performing this pilot study was to check the internal consistency of the questionnaire used in this study.

The Cronbach's alpha coefficient was used to determine the degree to which items that make up the scale reflect internal consistency. The generally agreed upon reliability is greater than or equal to 0.70 (Louw 2008:213; Chinomona 2013:47). The results of the pilot study are presented in Table 6.1.

Table 6.1: Pilot study reliability statistics

Constructs	Number of items	Cronbach alpha	Number of items deleted	Reason/s
E-design	7	0.713	2	Low-item total correlations. Deletion improved reliability
E-sourcing	6	0.765	2	Low-item total correlations. Deletion improved reliability
E-negotiation	5	0.702	2	Low-item total correlations. Deletion improved reliability
E-evaluation	5	0.710	0	-
E-informing	5	0.712	0	-
Supplier integration	8	0.907	0	-
Supply chain tangible performance	8	0.818	4	Low-item total correlations. Deletion improved reliability
Supply chain intangible performance	8	0.770	2	Low-item total correlations. Deletion improved reliability

Overall, the results of the pilot study are regarded as reliable since the alphas were all above the recommended 0.70.

The next section discusses the main study analyses.

6.3 MAIN STUDY ANALYSES

6.3.1 Response rate

The response rate for this research study is illustrated in Table 6.2.

Table 6.2: Response rate information

Employees available for research	350
Total responses	294
Usable responses	283
Response rate (percentage)	84.0

A total of 350 questionnaires was distributed to SME owners and managers across the Gauteng province and 294 were returned of which 283 questionnaires were used for data analysis. A total of 11 questionnaires were discarded as they were incomplete.

6.3.2 Demographics and SME profile

A descriptive analysis incorporating the demographic information regarding SME owners and managers and SME profile was conducted. A descriptive analysis of Section A (demographics and SME profile) is discussed in the subsequent section, which consists of gender, age category, qualifications, ethnicity, experience in the industry, number of employees and turnover. It was important to first perform a descriptive demographic and SME profile to enhance the researcher's understanding of the important aspects of key personnel and the SME.

The results in the ensuing sub-sections are indicated by means of pie charts and bar graphs.

6.3.2.1 Gender

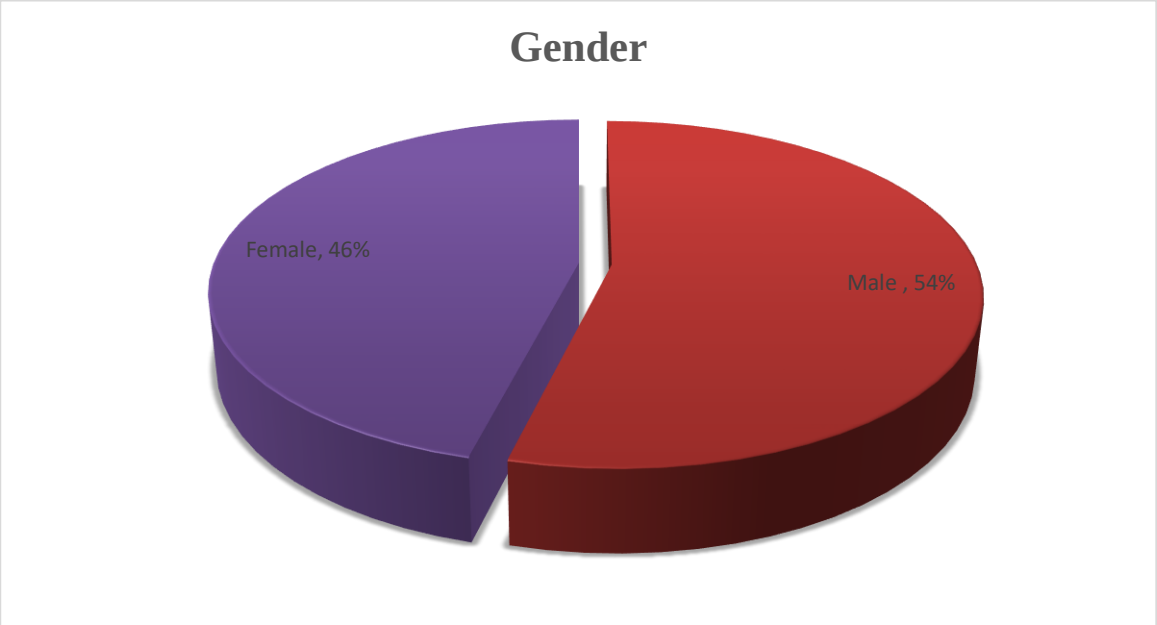


Figure 6.1: Gender of respondents

Figure 6.1 presents a graphical representation of the gender distribution of the sample. Males constitute 54.0 percent (n=153) and females constitute 46.0 percent (n=130) of the sample. Nieman and Nieuwenhuizen (2009:143) found that there are few women owning/managing businesses due to start-up capital problems. The next subsection discusses the distribution of sample according to age.

6.3.2.2 Age category

Figure 6.2 shows the percentage of respondents based on their reported age categories.

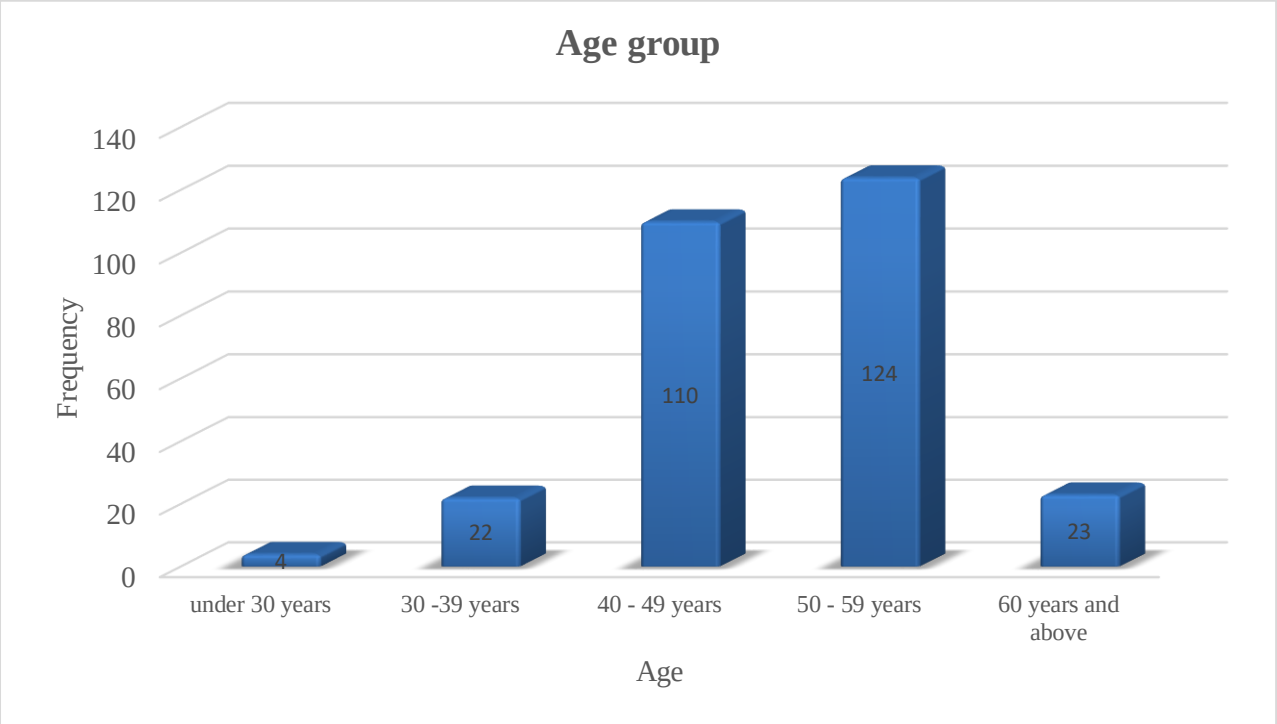


Figure 6.2: Age of respondents

Figure 6.2 shows that those who were older than 60 years of age comprised 8.1 percent (n=23) of the sample. The majority 43.8 percent, (n=124) of the sample is in the range of 50-59 years. The 40-49 age range comprised 38.9 percent (n=110) of the sample. A small percentage, 1.4 percent (n= 4) were younger than 30 years. The next subsection discusses the distribution of sample according to qualifications.

6.3.2.3 Qualifications

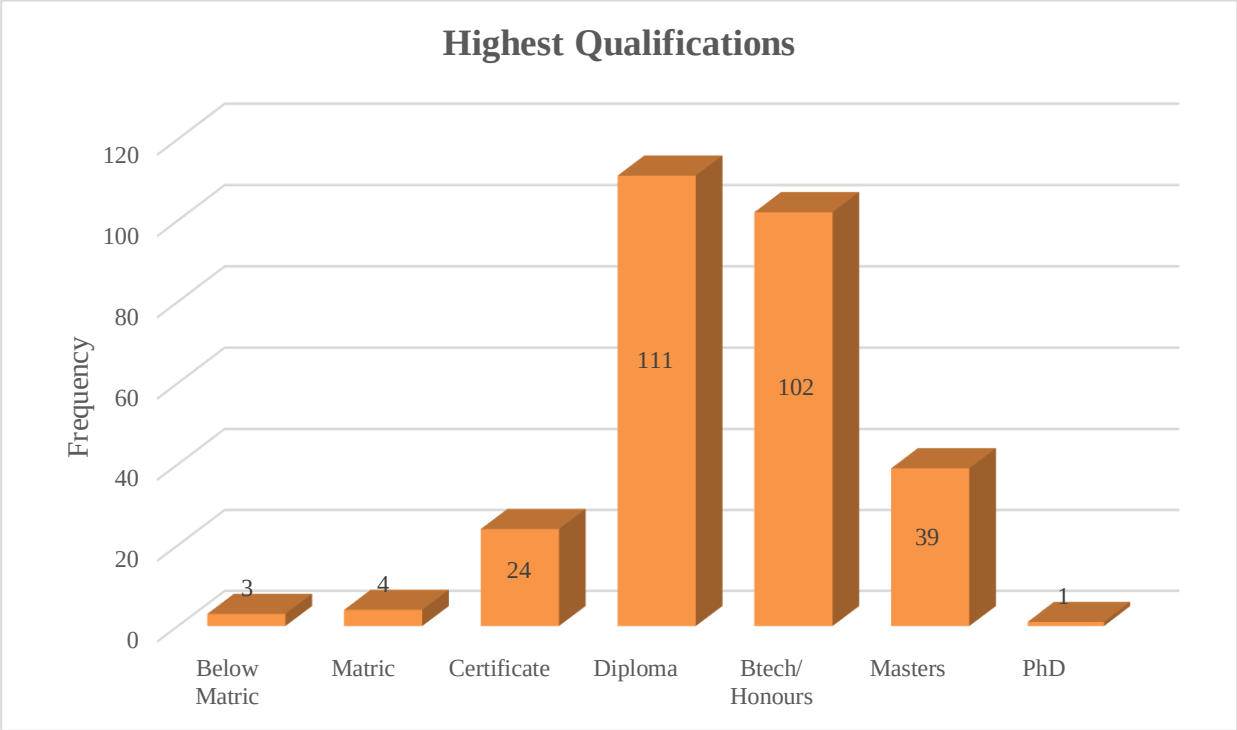


Figure 6.3: Highest qualifications

Figure 6.3 depicts respondents' highest academic qualifications. Approximately 36.0 percent (n=102) of respondents hold an Honours or a BTech degree. The results further indicate that 39.2 percent (n=111) of the respondents hold a diploma or a bachelor's degree. The respondents with a matric certificate are 1.4 percent (n=4). Respondents with a master's degree are 13.8 percent (n= 39). Only 0.4 percent (n=1) of the respondents hold a PhD qualification. The next subsection discusses the distribution of sample according to race.

6.3.2.4 Ethnicity

The racial distribution of SME owners and managers is depicted in Figure 6.4. This section enquired about the race of SME owners and managers based on four categories, namely: African, White, Indian/Asian, and other.

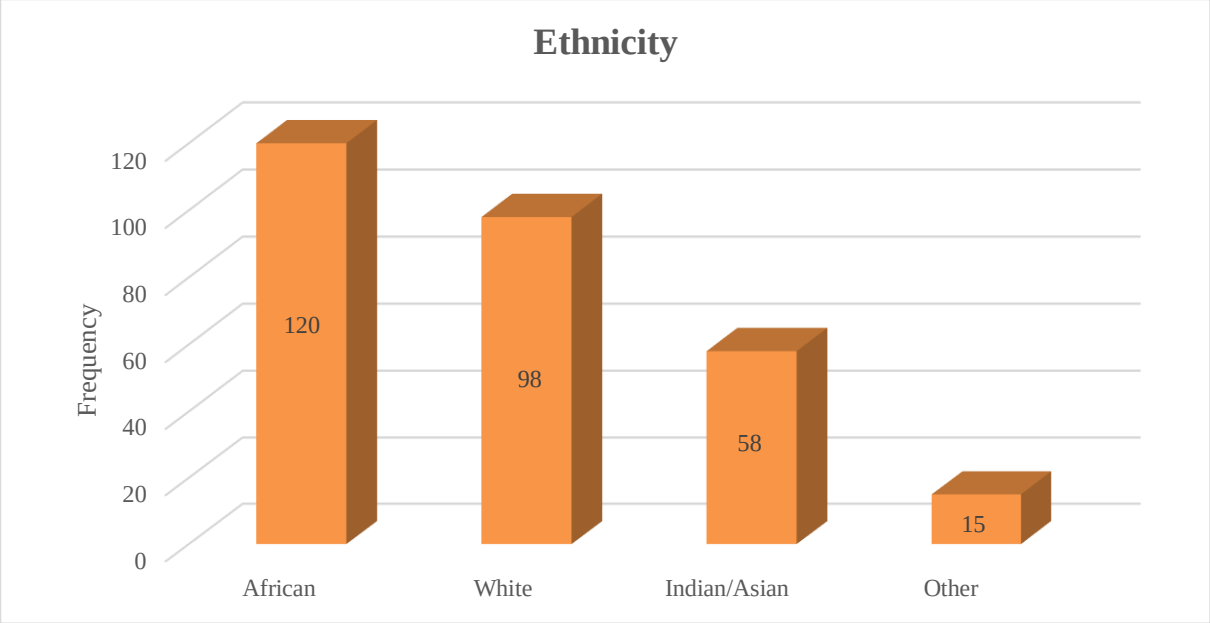


Figure 6.4: Ethnicity

Figure 6.4 depicts the ethnicity of the respondents. Approximately 42.4 percent (n= 120) were African. The study also reveals that 34.6 percent (n=98) of supply chain professionals were White. The Indian/Asian respondents of this study comprised 17.7 percent (n=50) whilst others comprised 5.3 percent (n=15). The next subsection discusses the distribution of the sample according to experience in the industry.

6.3.2.5 Experience in the industry

The SME owners and managers were asked about their length of time with the firm, which they chose from five categories, as follows: less than 1 year; between 1 and 5 years; between 5 and 10 years; between 10 and 15 years and above 15 years. The findings are depicted in Figure 6.5.

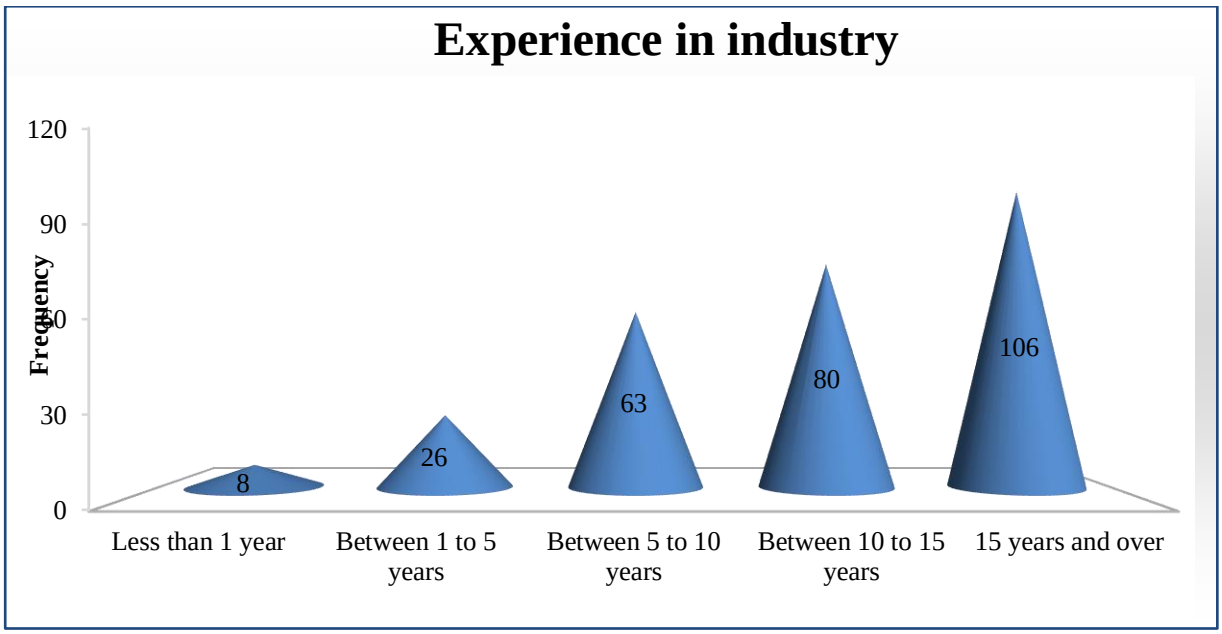


Figure 6.5: Experience in the industry

The study revealed that 2.8 percent (n=8) of respondents had served the institutions for less than one year. Approximately 9.2 percent (n=26) of respondents served their organisation between 1 to 5 years, while 22.3 percent (n=63) served the organisation between 5 to 10 years. Approximately 28.3 percent (n=80) of the sample had served their organisation between 10 to 15 years while 37.5 percent (n=106) of the respondents served their organisation for more than 15 years. The next subsection discusses the distribution of the sample according to the number of employees.

6.3.2.6 Number of employees

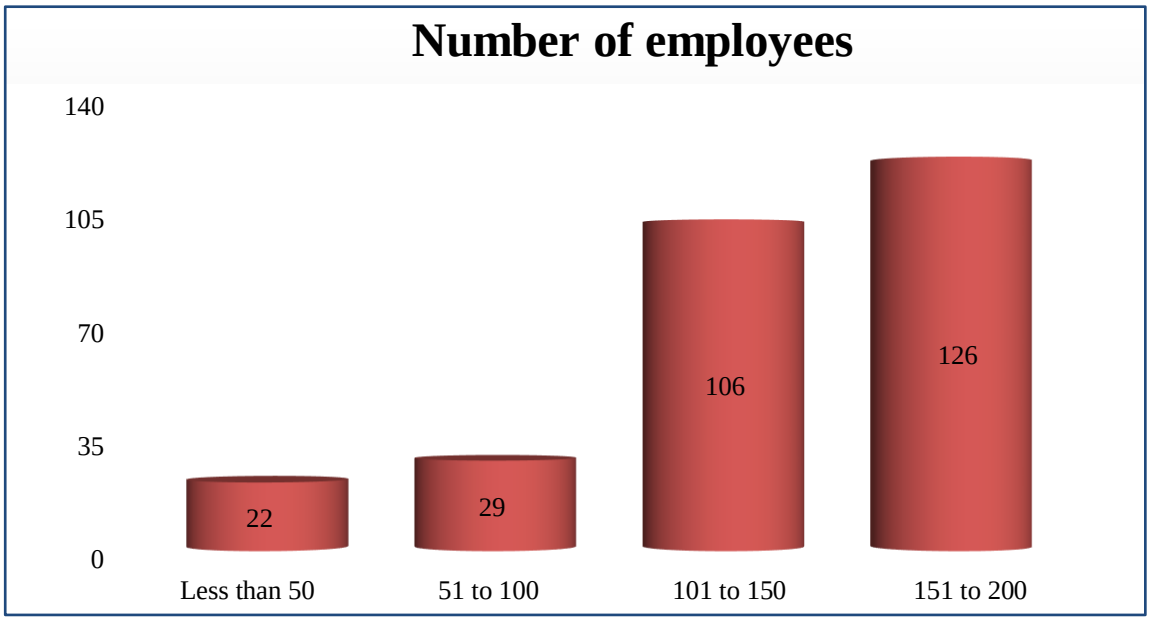


Figure 6.6: Number of employees at the firm

Figure 6.6 depicts the number of employees at the firm. Approximately 7.8 percent (n=22) of respondents indicated that they have less than 50 employees at their firms while 10.2 percent (n=29) indicated that their firms employed between 51 and 100 employees. The study further revealed that 37.5 percent (n=106) of the firms employed between 101 and 150 employees while 44.5 percent (n=126) of the firms employed between 151 and 200 employees. The next subsection discusses the distribution of the sample according to sales turnover.

6.3.2.7 Turnover per annum

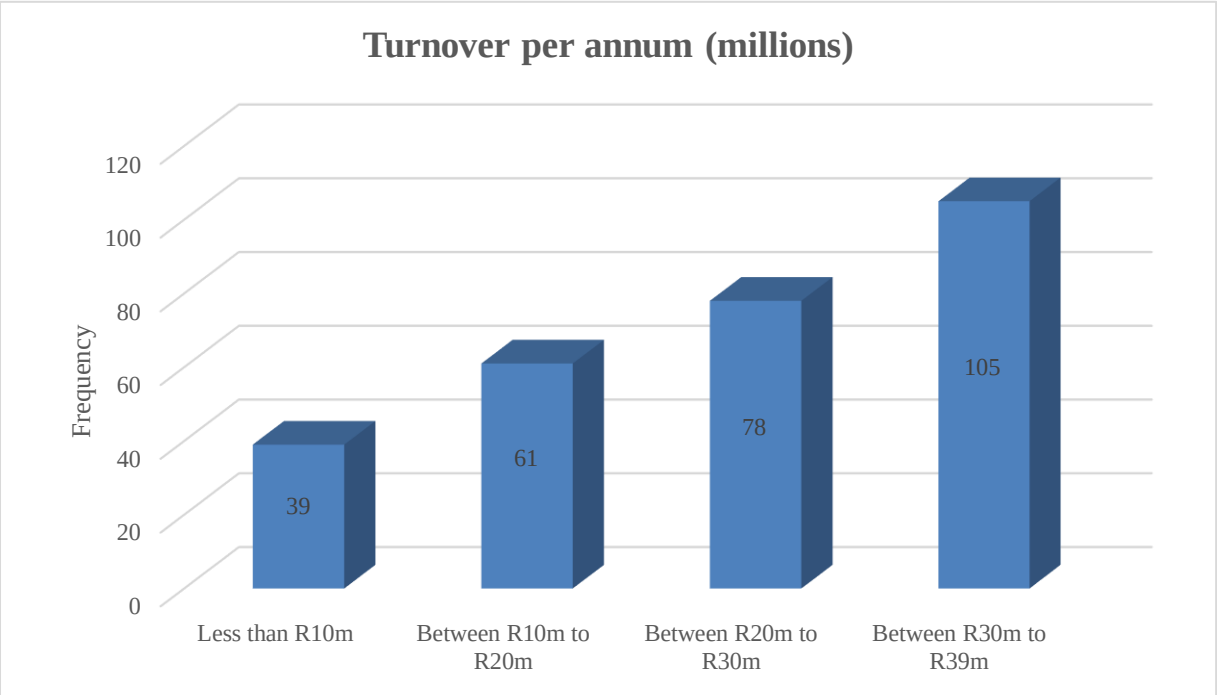


Figure 6.7: Turnover per annum (millions)

Figure 6.7 depicts the turnover per annum (millions) of the SMEs under study. Results show that 13.7 percent (n=39) of the respondents stated that their firms earn less than R10 million per year, whilst 21.5 percent (n=61) stated that their firms earn between R20million and R30million per year. The study further shows that 27.5 percent (n=78) of the firms earn between R20 million to R30 million in turnover. Approximately 37.1 percent (n=105) earn a turnover of between R30 million to R39 million per year.

6.3.3 Testing for the unidimensionality of scales

The different scales used in the study (See the questionnaire in Appendix B) was tested for unidimensionality through exploratory factor analysis. Prior to factor analysis, the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was computed to establish whether the data were suitable for factor analysis. The factor extraction through

principal component analyisis for each construct is reported on in Table 6.3 indicating that only one factor was extracted for each variable.

Table 6.3: Factor component matrix

Section B (one factor) e-design	Factor loadings
Each department within the company shares the same network platform for procurement requests	.733
Each department within the company requests purchases from one specific department unit	.693
There is a design of the purchase requirement	.605
The design of the purchase requirement or the standardised purchasing norm between the organisation and the supplier will be communicated or negotiated via the Internet	.698
Our company designs the format of marketing demands using the information system	.679
E-sourcing	**Factor loadings**
Our company selects the most appropriate supplier through its online information system	.721
Our company gathers the demand proposals about procurement information or related information through the online information system	.795
Our company releases the company requirements or rules through the online information system	.807
Our company notifies the supplier on the arrival of an authorised procurement contract through the online information system	.608
E-negotiation	**Factor loadings**
Our company negotiates the general procedures of purchasing with the supplier through the internet	.769
The use of the internet for negotiations results in significant savings for this company	.866
The use of the internet for negotiations results in lower purchase costs	.793
E-evaluation	**Factor loadings**

Our company documents past purchasing information in an electronic form	.614
Our company has a supplier database and utilises it in the purchasing process	.802
The evaluation of supplier performance is done using an online information system	.770
Our company uses an online information system to collect extensive information about suppliers	.677
Our company evaluates suppliers on a regular basis via the internet	.729
E-informing	**Factor loadings**
The use of e-informing has enhanced performance of the company	.716
The use of e-informing has facilitated effective communication within our company	.708
The use of e-informing has enabled the company to centralise strategic procurement processes	.731
The use of e-informing has enabled the company to decentralise operational procurement processes	.666
The use of e-informing has facilitated the dissemination of purchasing information to both internal and external partners	.606
Supplier integration	**Factor loadings**
There is extensive participation with our major supplier in the design stage	.617
Our major suppliers share their production schedule with our company	.733
Our major suppliers share their production capacity with our company	.775
Our major suppliers share available inventory with our company	.801
Our company shares production plans with its major suppliers	.787
Our company shares demand forecasts with its major suppliers	.777
Our company shares inventory levels with its major suppliers	.784
Our company helps its major suppliers to improve their processes to better meet the needs of our company	.747
Tangible performance	**Factor loadings**
Our company manages its supply chain costs effectively	.727

Our company manages its profit effectively	.734
Our company manages cash turnover effectively	.834
Our company manages returns on sales effectively	.812
Intangible performance	**Factor loadings**
Our company utilises its capacity effectively	.575
Our company manages inventory turnover effectively	.633
Our company has sufficient material availability	.807
Our customers are satisfied	.727
Our company manages lead times effectively	.760
Our company manages the deadlines for products/services effectively	.489

Table 6.3 shows that the factor loadings for e-design were all to close to 0.7 except one statement which reads as follows "there is a design of the purchase requirement" and had a factor loading of 0.605. In e-sourcing three out four statements had factor laodings above 07. Factor loadings for E-negotiation were all above the 0.7 threshold. In e-informing and e-evaluation almost all the factor loadings were close to or above 0.7, except one statement in each construct. In supplier integration, only one statement was below 0.7. In tangible dimension of supply chain performance all the statements had factor loadings above the 0.7 threshold. Lastly, the intangible dimension of supply chain performance had two out six statements below the 0.7 threshold. Therefore, both tests provided an indication that the data set was suitable for factor analysis since most of the factor loadings were above the 0.7 threshold. The next section discusses the results of the analyses of the descriptive statistics.

6.3.4 Descriptive statistics for e-procurement; supplier integration and supply chain performance

Section B of the questionnaire is focused on e-procurement which includes e-design, e-sourcing, e-negotiation, e-evaluation and e-informing. Section C of the questionnaire is focused on supplier integration while section D focuses on supply chain performance. The results of the descriptive statistics are reported separately below.

Table 6.4: Descriptive statistics for e-design

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
ED1	Each department within the company shares the same network platform for procurement requests	283	2	5	4.54	0.584
ED2	Each department within the company requests purchases from one specific department unit	283	1	5	4.56	0.606
ED3	There is a design of the purchase requirement	283	3	5	4.69	0.509
ED4	The design of the purchase requirement or the standardised purchasing norm between the organisation and the supplier will be communicated or negotiated via the Internet	283	2	5	4.65	0.571
ED5	Our company designs the format of marketing demands using the information system	283	1	5	4.68	0.551
Scale: 1=Strongly disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement:

There is a design of the purchase requirement ($\bar{x}$=4.69: SD ±0.509).

The lowest mean value was obtained for the following statement:

Each department within the company shares the same network platform for procurement requests ($\bar{x}$=4.54: SD ±0.584).

From the information above, the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, the mean scores were closer to the strongly agree position on the Likert-type scale indicating that the e-design elements are adhered to in organisations.

The above results support the findings of the study by Shafeek (2009:88), who found that the majority of SMEs in most African countries use a design of the purchasing requirement in their

firms and most departments within SMEs share network platforms for procurement purposes. The next subsection discusses the descriptive statistics for e-sourcing.

Table 6.5: Descriptive statistics for e-sourcing

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
ES1	Our company selects the most appropriate supplier through its online information system	283	2	5	4.81	0.447
ES2	Our company gathers the demand proposals about procurement information or related information through the online information system	283	1	5	4.61	0.581
ES3	Our company releases the company requirements or rules through the online information system	283	2	5	4.62	0.535
ES4	Our company notifies the supplier on the arrival of an authorised procurement contract through the online information system	283	1	5	4.67	0.541
Scale: 1=Strongly disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement:

Our company selects the most appropriate supplier through its online information system ($\bar{x}$=4.81: SD ±0.447).

The lowest mean value was obtained for the following statement:

Our company gathers the demand proposals about procurement information or related information through the online information system ($\bar{x}$=4.61: SD ±0.581).

From the information above the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the strongly agree position on the Likert-type scale indicating that the e-sourcing elements are adhered to in organisations.

The above results support the findings of studies by Li *et al.* (2011:53) and Presutti (2003:231) who found that the majority of SME firms now use an online system to buy, select suppliers, gather procurement information or release company requirements. The next subsection discusses the descriptive statistics for e-negotiation.

Table 6.6: Descriptive statistics for e-negotiation

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
EN1	Our company negotiates the general procedures of purchasing with the supplier through the internet	283	3	5	4.86	0.382
EN2	The use of the internet for negotiations results in significant savings for this company	283	1	5	4.60	0.624
EN3	The use of the internet for negotiations results in lower purchase costs	283	1	5	4.66	0.628
Scale: 1=Strongly disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement:

Our company negotiates the general procedures of purchasing with the supplier through the internet ($\bar{x}$=4.86: SD ±0.382).

The lowest mean value was obtained for the following statement:

The use of the internet for negotiations results in significant savings for this company. ($\bar{x}$=4.60: SD ±0.624).

From the information above the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the strongly agree position on the Likert-type scale indicating that most managers and owners of SMEs engage in e-negotiation.

The above results support the findings of a study by Presutti (2003:223), that the use of the Internet for negotiations results in significant savings and thus contributes to company financial performance. Thus, e-negotiation is a contributing factor to supplier integration and firm performance. The next subsection discusses the descriptive statistics for e-evaluation.

Table 6.7: Descriptive statistics for e-evaluation

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
EE1	Our company documents past purchasing information in an electronic form	283	4	5	4.85	0.360
EE2	Our company has a supplier database and utilises it in the purchasing process	283	3	5	4.77	0.452
EE3	The evaluation of supplier performance is done using an online information system	283	3	5	4.74	0.477
EE4	Our company uses an online information system to collect extensive information about suppliers	283	1	5	4.73	0.516
EE5	Our company evaluates suppliers on a regular basis via the internet	283	2	5	4.78	0.468
Scale: 1=Strongly disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement:

Our company documents past purchasing information in an electronic form ($\bar{x}$=4.85: SD ±0.360).

The lowest mean value was obtained for the following statement:

Our company uses an online information system to collect extensive information about suppliers ($\bar{x}$=4.73: SD ±0.516).

From the information above the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the strongly agree position on the Likert-type scale indicating that an e-evaluation system is being applied in most organisations.

The next subsection discusses the descriptive statistics for e-informing.

Table 6.8: Descriptive statistics for e-informing

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
EI 1	The use of e-informing has enhanced the performance of the company	283	2	6	3.77	0.835
EI 2	The use of e-informing has facilitated effective communication within our company	283	2	5	3.80	0.702
EI 3	The use of e-informing has enabled the company to centralise strategic procurement processes	283	2	5	3.97	0.785
EI4	The use of e-informing has enabled the company to decentralise operational procurement processes	283	2	5	3.95	0.786
EI5	The use of e-informing has facilitated the dissemination of purchasing information to both internal and external partners	283	2	5	3.93	0.816
Scale: 1=Strongly Disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement:

The use of e-informing has enabled the company to centralise strategic procurement processes ($\bar{x}$=3.97: SD ±0.785).

The lowest mean value was obtained for the following statement:

The use of e-informing has enhanced the performance of the company ($\bar{x}$=3.77: SD ±0.835).

From the information above the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the agree position on the Likert-type scale indicating that on average e-informing is applied in these organisations.

The above results support the findings of studies by Armistead and Mapes (1993:11) and Cousins and Menguc (2006:614), who found that the use of e-informing has enhanced the performance of the company. This therefore, makes it clear that the use of e-informing in the SME environment makes a valuable contribution to the performance of a firm. The next subsection discusses the descriptive statistics for supplier integration.

Table 6.9: Descriptive statistics for supplier integration

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
SI 1	There is extensive participation with our major supplier in the design stage	283	1	8	4.65	0.755
SI2	Our major suppliers share their production schedule with our company	283	1	8	4.28	0.782
SI3	Our major suppliers share their production capacity with our company	283	2	8	4.37	0.743
SI4	Our major suppliers share available inventory with our company	283	1	8	4.44	0.776
SI5	Our company shares production plans with its major suppliers	283	2	8	4.46	0.730
SI6	Our company shares demand forecasts with its major suppliers	283	1	8	4.47	0.750
SI7	Our company shares inventory levels with its major suppliers	283	1	8	4.47	0.740
SI8	Our company helps its major suppliers to improve their processes to better meet the needs of our company	283	2	8	4.53	0.675
Scale: 1=Strongly disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement:

There is extensive participation with our major supplier in the design stage ($\bar{x}$=4.65: SD ±0.755).

The lowest mean value was obtained for the following statement:

Our major suppliers share their production schedule with our company ($\bar{x}$=4.28: SD ±0.728).

From the information above the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the strongly agree position on the Likert-type scale indicating that most organisations adhered to all the above supplier integration elements.

The above results support the findings of studies by Droge *et al.* (2004:566) and Koufteros *et al.* (2005:89), which reported that through supplier integration most companies share inventory levels, demand forecasts and production plans with its major suppliers. This makes it clear that supplier relationships (integration) are key to firm performance. The next subsection discusses the descriptive statistics for supply chain performance.

Table 6.10: Descriptive statistics for supply chain performance

Item	Description	N	Minimum	Maximum	Mean	Standard deviation
Intangible dimension						
TD1	Our company manages its supply chain costs effectively	283	3	5	4.75	0.570
TD2	Our company manages its profit effectively	283	2	5	4.17	0.615
TD3	Our company manages cash turnover effectively	283	3	5	4.20	0.679
TD4	Our company manages returns on sales effectively	283	3	5	4.31	0.737
Scale: 1=Strongly agree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						
Tangible dimension						
ID1	Our company utilises its capacity effectively	283	2	5	4.72	0.487
ID2	Our company manages inventory turnover effectively	283	3	5	4.79	0.443
ID3	Our company has sufficient material availability	283	2	5	4.82	0.409
ID4	Our customers are satisfied	283	3	5	4.83	0.391
ID5	Our company manages lead times effectively	283	2	5	4.77	0.507
ID6	Our company manages the deadlines for products/services effectively	283	2	5	4.81	0.444
Scale: 1=Strongly disagree; 2= Disagree; 3=Neutral; 4= Agree; 5=Strongly agree						

The highest mean value was obtained for the following statement (tangible dimension):

Our company manages its supply chain costs effectively ($\bar{x}$=4.75: SD ±0.570).

The lowest mean value was obtained for the following statement:

Our company manages its profit effectively ($\bar{x}$=4.17: SD ±0.615).

From the information above, the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the strongly agree position on the Likert-type scale indicating that most organisations adhered to the statements above.

The highest mean value was obtained for the following statement (intangible dimension):

Our customers are satisfied ($\bar{x}$=4.83: SD ±0.391).

The lowest mean value was obtained for the following statement:

Our company utilises its capacity effectively ($\bar{x}$=4.72: SD ±0.487).

From the information above, the respondents agreed to the statements since the higher mean values indicated higher levels of agreement. Overall, mean scores were closer to the strongly agree position on the Likert-type scale indicating that most organisations adhered to the statements above.

The above results are consistent with the study by Prajogo and Olhanger (2012:515) who also found similar results. Therefore, both tangible dimensions and intangible dimensions of measuring company performance are critical. The next sections focus on the measurement accuracy assessment of the measures (which are the reliability and validity tests).

6.4 MEASUREMENT ACCURACY ASSESSMENT

The measurement accuracy assessment includes the reliability and validity tests of the measurement items of the study.

6.4.1 Reliability tests

Reliability in this study was ascertained using Cronbach's alpha coefficient, the Average Variance Extracted (AVE), item-to-total values and Composite Reliability (CR). Table 6.11 presents the results of the reliability tests.

Table 6.11: Accuracy analysis statistics: reliability tests

Research construct		Descriptive statistics		Cronbach test		C.R	AVE	Factor loading	Highest SV
		Mean	SD	Item total	Alpha value				
E-design	ED 1	4.62	0.56	0.53	0.71	0.88	0.60	0.57	0.47
	ED 2			0.48				0.48	
	ED 3			0.40				0.54	
	ED 4			0.48				0.59	
	ED 5			0.46				0.58	
E-sourcing	ES 1	4.68	0.53	0.51	0.75	0.94	0.79	0.61	0.58
	ES 2			0.59				0.73	
	ES 3			0.62				0.69	
	ES 4			0.49				0.61	
E-negotiation	EN 1	4.70	0.54	0.51	0.72	0.88	0.84	0.63	0.66
	EN 2			0.65				0.79	
	EN 3			0.55				0.68	
E-evaluation	EE 1	4.78	0.45	0.42	0.77	0.78	0.71	0.49	0.52
	EE 2			0.62				0.77	
	EE 3			0.59				0.76	
	EE 4			0.50				0.49	
	EE 5			0.56				0.58	
E-informing	EI 1	3.89	0.78	0.50	0.72	0.77	0.66	0.61	0.47
	EI 2			0.49				0.62	
	EI 3			0.52				0.65	
	EI 4			0.46				0.55	
	EI 5			0.41				0.48	

Research construct		Descriptive statistics		Cronbach test		C.R	AVE	Factor loading	Highest SV
		Mean	SD	Item total	Alpha value				
Supplier integration	SI 1	4.46	0.99	0.52	0.89	0.88	0.84	0.55	0.57
	SI 2			0.64				0.65	
	SI 3			0.70				0.67	
	SI 4			0.72				0.79	
	SI 5			0.70				0.79	
	SI 6			0.69				0.72	
	SI 7			0.70				0.68	
	SI 8			0.66				0.68	
Tangible dimension	TD 1	4.36	0.65	0.53	0.78	0.93	0.82	0.57	0.61
	TD 2			0.53				0.58	
	TD 3			0.67				0.82	
	TD 4			0.63				0.78	
Intangible dimension	ID 1	4.79	0.45	0.43	0.79	0.79	0.71	0.51	0.50
	ID 2			0.59				0.60	
	ID 3			0.48				0.45	
	ID 4			0.63				0.69	
	ID 5			0.56				0.69	
	ID 6			0.60				0.73	

Note: SD= Standard Deviation; CR=Composite Reliability; AVE=Average Variance Extracted; SV=Shared Variance

Table 6.11 is explained under different sections, that is, Cronbach's alpha coefficient, followed by the Average Variance Extracted (AVE), then Composite Reliability (CR) and finally item-to-total values.

6.4.1.1 Cronbach's alpha coefficient

Cronbach's alpha measures the degree to which the items in an instrument are related (Vanderstoep & Johnston 2009:63). For the Cronbach's alpha coefficient and the CR, the recommended values should be greater than or equal to 0.70 for each scale (Hair, Bush & Ortinau 2000:44; Babbie 2013:49). An alpha of 0.70 or higher is often considered satisfactory for most research purposes (Vogt 2007:115). Table 6.19 reveals that the Cronbach's alpha coefficients were between 0.71 and 0.89 for all the eight research latent variables. Thus, the Cronbach's alpha values for all the research variables used in this study were above the acceptable threshold value of 0.7 (Mujis 2011:131). In summary, the measurement items used in this study were reliable since all the Cronbach's alpha coefficients were above the recommended 0.7 threshold. The next section discusses the Average Variance Extracted (AVE).

6.4.1.2 The Average Variance Extracted (AVE)

According to Chinomona and Pretorius (2011:179), "the average variance extracted estimate reflects the overall amount of variance in the indicators accounted for by the latent construct. The minimum acceptable value for the AVE for each scale is 0.50 (Fornell *et al.* 1981:39; Fraering & Minor 2006:284; Sarsted *et al.* 2014:109).

Using the results of the construct "e-design" to demonstrate, the calculation for AVE was conducted as follows:

Step 1: $\Sigma\lambda y_i^2 = (0.57^2 + 0.48^2 + 0.54^2 + 0.59^2 + 0.58^2) = 1.529$

Step 2: $\Sigma\varepsilon_i = (1\text{-}0.57)^2 + (1\text{-}0.48)^2 + (1\text{-}0.54)^2 + (1\text{-}0.59)^2 + (1\text{-}0.58)^2 = 1.009$

Step 3: $V\eta = 1.529 / (1.529+1.009) =$ **0.60**

Therefore, the results of AVE range from 0.60 to 0.84 as shown in Table 6.10 and this authenticates satisfactory representation of the latent construct by the items as all the values were above the recommended value of at least 0.5. The next section discusses the Composite Reliability (CR).

6.4.1.3 Composite Reliability (CR)

The composite reliability test intended to examine the internal steadiness of each research construct, as recommended by Nunnally (1967:56) and Chinomona (2012:10128).

Using the results of the construct "E-sourcing" to demonstrate, the calculation for Composite Reliability was conducted as follows:

Step1: $(\Sigma\lambda y_i)^2 = (0.61+0.73+0.69+0.61)^2 = 6.969$

Step2: $\Sigma\varepsilon_i = (1\text{-}0.0.61)^2 + (1\text{-}0.73)^2 + (1\text{-}0.69)^2 + (1\text{-}0.61)^2 = 0.472$

Step3: $CR\eta = 6.969 / (6.969 + 0.472) =$ **0.88**

The recommended minimum CR value is 0.7 (Nunnally 1967:125; Hair *et al.* 2006:38; Martin 2007:93; Hair *et al.* 2010:334). In this study, the results of the CR range from 0.77 to 0.94 as shown in Table 6.10 and thus confirm the existence of internal reliability for all constructs of the study. The next section discusses the item-to-total values.

6.4.1.4 Item-to-total values

As shown in Table 6.10 above, the item-to-total values ranged from 0.40 to 0.48 for e-design; 0.49 to 0.62 for e-sourcing; 0.51 to 0.65 for e-negotiation; 0.42 to 0.62 for e-evaluation; 0.52 to 0.76 for supplier integration; 0.53 to 0.67 for tangible dimensions of supply chain performance and 0.43 to 0.63 for intangible dimensions of supply chain performance. All the measurement items for the five latent variables had item-to-total values greater than the acceptable threshold value of 0.4 or above (often $\leqq$0.4) (Anderson & Gerbing 1988:411; Dunn, Seaker & Waller 1994:145). The next section focuses on the validity of the research variables.

6.4.2 Validity tests

Validity is the extent to which the instrument that was selected reflects the reality of the constructs that are being measured (Babbie & Mouton 2001:122; Collins & Hussey 2003:58). Validity measures strength and accuracy of a research design (Stivastava & Rego 2011:35; Hair *et al.* 2014:3). Validity is defined as the best available approximation to the truth or falsity of a given inference, proposition or conclusion (Awang *et al.* 2012:25). In this chapter, two validities, namely convergent and discriminant validities are discussed. Face and content validities are discussed in Chapter 5, section 5.12.

6.4.2.1 Convergent validity

Convergent validity is "a type of measurement validity for multiple indicators based on the idea that indicators of one construct will act alike or converge" (Neumann 2006:194). To ascertain convergent validity, the factor loading for each item was checked. Most the values were above

0.50 as recommended by Anderson and Gerbing (2001) and Sin *et al*. (2005:569). Convergent validity was also demonstrated as all the AVE values were above the recommended 0.5 (ranging from 0.60 to 0.84). The results are shown in Table 6.10. The next subsection focuses on discriminant validity.

6.4.2.2 Discriminant validity

Discriminant validity is "a type of measurement validity for multiple indicators based on the idea that indicators of different constructs diverge" (Neumann 2006:194). The researcher performed CFA to illustrate discriminant validity among the constructs. This study employed the AVE values of less than 1 method and the AVE-highest shared variance test (comparing the two). As shown in Table 6.10, all the AVE values range from 0.45 to 0.51 and are all below 1, which confirms the existence of discriminant validity (Sin *et al*. 2005:569). More so, Table 6.10 indicates that the highest shared variance values of all the variables are between 0.47 and 0.66. All these figures are less than the AVE values (ranging from 0.66 to 0.84) of their respective latent variables thereby further confirming that the measures of seven different variables were indeed distinct and heterogeneous (Fornell & Larcker 1981:40). The next section provides a discussion on the overall fit of the measurement model (CFA).

6.4.3 Confirmatory factor analysis model fit/ acceptability

Confirmatory factor analysis (CFA) is "a way of testing how well variables measured represent a smaller number of constructs" (Hair *et al.* 2014:602). CFA was conducted using the Analysis of Moment Structures (AMOS) software, version 24.0 to assess psychometric properties of the measurement scales.

Model fit refers "to the extent to which a hypothesised model is consistent with the data" (Pallant 2007:195). Model fit refers to a process that assesses how well the model represents the data (Foster *et al.* 2006:100). In this study, model fit was ascertained by using the following indices: Chi-square/degrees of freedom, Comparative fit index (CFI), Incremental fit index (IFI), Tucker Lewis index (TLI) and the Root Mean Square Error of Approximation (RMSEA). The acceptable thresholds should be equal to or higher than 0.90 for CFI, IFI, TLI; for Chi-square/degrees of freedom, a ratio of 3:1 or less is recommended and the RMSEA value should be equal to or less than 0.08 (Lysons & Farrington 2016:586; Byrne 2013:129). The general CFA Model Fit Indices and acceptable levels are illustrated in Table 6.12.

Table 6.12: Confirmatory factor analysis model fit indices and acceptable levels

Goodness of Fit criterion	Acceptable level	Level interpretation
Absolute fit measures		
Chi-square (χ^2)	Low χ^2 value (relative to degrees of freedom) with a significance level < .05	A value greater than .05 reflects acceptable fit. Values between 0.05 and 0.20 indicate a good fit. Non-significant and small values show good fit. Significant and large values show poor fit.
Chi-square/df	Ratio 2:1 or 3:1	Values close to 1 reflect good model fit, values < 3 reflect acceptable fit.
Tucker- Lewis Index (TLI)	A value close to 1	Values >.90 reflect a good fit. Values below .90 indicate the need to re-specify the model. Compares an absolute null model with the theoretical model of interest, penalises for model complexity.
Incremental Fit Index (IFI)	.90 or higher	Values = or > .90 reflect a good fit.
Root Mean Square Error of Approximation (RMSEA)	< .08	Values < .05 reflect a good fit. Values between .05 and .08 reflect reasonable fit. Estimates how well the fitted model approximates the population covariance matrix per degree of freedom.
Comparative Fit Index (CFI)	A value close to 1	Values > .90 reflect a good fit. Penalises for sample size, gives the best approximation of the population value for a single model.

Source: Reisinger and Mavondo (2007:57)

Some of the CFA model fit acceptability guidelines are provided in Table 6.12. Table 6.12 shows that the value of chi-square over degrees of freedom (χ2/df) ranging between 1 and 3 provides an adequate model fit. More so, the table shows that the values of Comparative Fit Index (CFI), Incremental Fit Index (IFI), and Tucker-Lewis Index (TLI) equal to or greater than 0.90, and the Root Mean Square Error of Approximation (RMSEA) value equal to or less than 0.08 provides a good model fit. The next sections focus on the CFA results for the selected five model fit indices (see Table 6.13).

A confirmatory factor analysis (CFA) model of the five study constructs was assessed to check the model fit. The results are reported on in Table 6.13.

Table 6.13: Confirmatory factor analysis model fit indices results

Measures	Values
CMIN	1046.592
Chi-Square/df	1.49
The Incremental fit index (IFI)	0.91
The Tucker-Lewis index (TLI)	0.90
The Comparative-fit-index (CFI)	0.91
The Root mean square error of approximation (RMSEA)	0.04

Overall, all these measures confirm a robust and acceptable model fit (Schreiber, Stage, King, Nora & Barlow 2006:330; Chinomona & Pretorius 2011:114).

Given that all five goodness-of-fit indices provided in Table 6.13 meet their respective recommended thresholds, it can be concluded that the data are fitting the model. The next section provides a discussion of the structural model, starting with the SEM model fit to the hypotheses testing.

6.4.4 Structural equation modelling (SEM) conceptual model fit assessments

Table 6.14 describes the SEM model fit indices results for this study.

Table 6.14: Structural equation modelling model fit indices results

Measures	Values
CMIN	1038.61
Chi-Square/df	1.46
The Incremental fit index (IFI)	0.92
The Tucker-Lewis index (TLI)	0.91
The Comparative-fit-index (CFI)	0.92
The Root mean square error of approximation (RMSEA)	0.04

As shown in Table 6.14, this study reports a chi-square/df value of 1.46 as indicative of a good model fit. Table 6.14 further shows IFI, CFI and TLI values (0.92, 0.91, and 0.92 respectively) that are above the recommended threshold of 0.9 or above (Chinomona 2011:302; 2013:342). These results further confirm that the estimated model fits the sample data in this study well, which provides a good model fit. Table 6.13 also depicts an RMSEA value of 0.04, which provides a very good model fit (Chinomona, Lin, Wang & Cheng 2010:47). Overall, the model fit indices provide a good overall fitness of the SEM model to the specified sample data. The next section provides a discussion of the structural model.

6.5 STRUCTURAL EQUATION MODELLING (SEM) RESULTS AND THE CONCEPTUAL MODEL

This study theorised that e-procurement functions have a significant positive influence on supply chain performance through the mediation effect of supplier integration. This section focuses on the relationships hypothesised to show the influence that e-procurement functions have on supply chain performance through supplier integration. This relationship is shown in Figure 6.8.

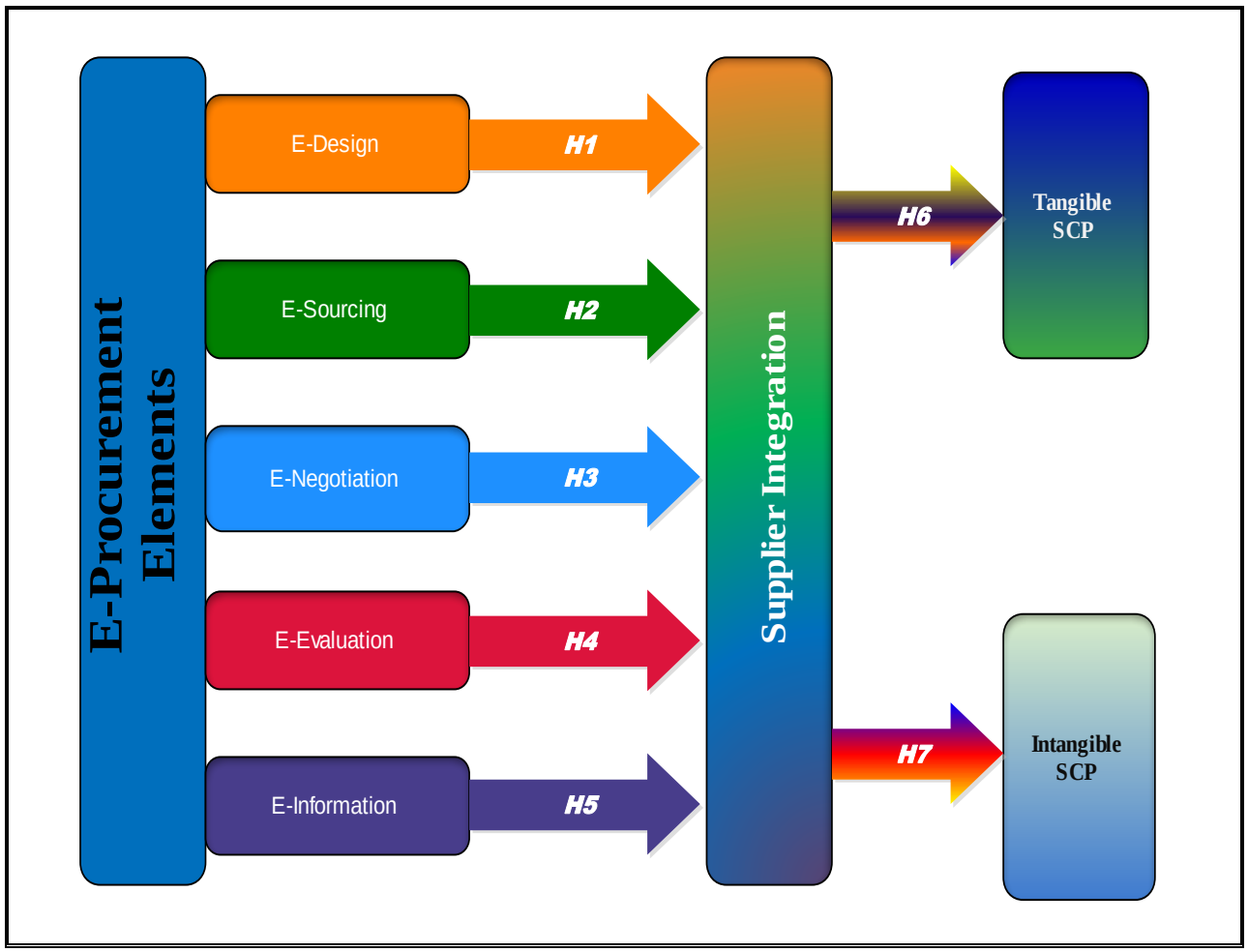


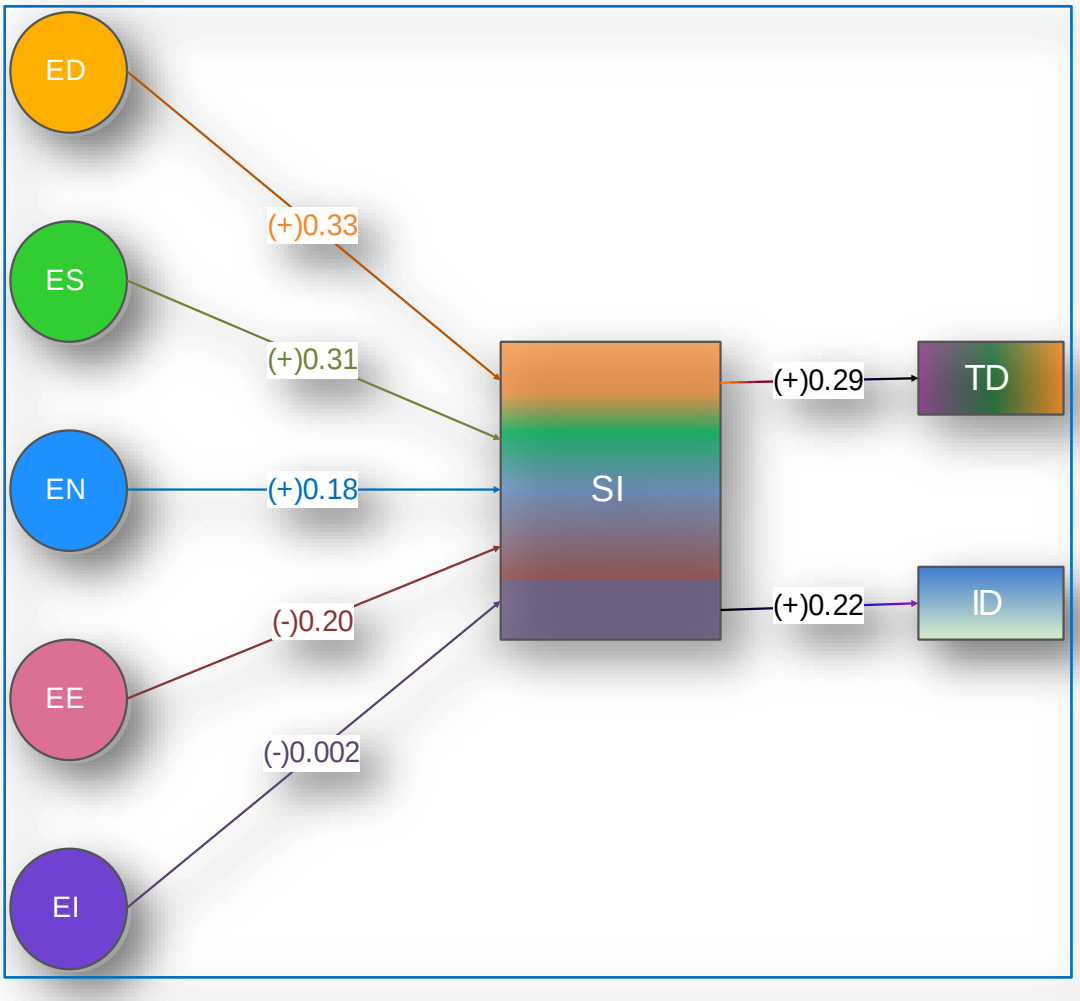
Figure 6.8: Research conceptual model

Figure 6.8 depicts the seven posited linear relationships between the eight research latent variables, namely: e-design, e-sourcing, e-negotiation, e-evaluation, e-informing, supplier integration, tangible supply chain performance and intangible supply chain performance. As can be seen in Figure 6.9, e-procurement functions are the predictor variables, supplier integration is the mediator variable while supply chain performance (tangible and intangible) is the outcome.

The hypotheses tests results are displayed in Figure 6.10 and are discussed in the next section.

6.5.1 The hypotheses testing stage and results

The following are the results of the hypotheses**.**



ED=E-Design. ES=E-Sourcing. EN=E-Negotiation. EE=E-Evaluation. EI= E-Informing. SI=Supplier Integration. TD=Tangible Dimensions. ID=Intangible Dimensions.

Figure 6.9: Structural equation modelling hypotheses testing results

- **E-design positively influences supplier integration in the SME sector (H1)**

A linear relationship (positive and significant) was hypothesised between e-design and supplier integration. This hypothesis was formulated from the objective that aimed to investigate the influence of e-procurement on supplier integration. Results are shown in Figure 6.9 above and Table 6.15.

Table 6.15: Hypothesis one structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
E-design	→	Supplier Integration	H1	0.33	0.153	2.126	$p < 0.05$

Structural model fit: Note significance level - ***p-value<0.001, significance level-**p-value<0.05, significance level- *p-value<0.1, ^{ns} significant level- insignificant (p-value>0.1).

As shown in Table 6.15, e-design has a positive and significant linear relationship with supplier integration. H1 is therefore supported. The current study posited a positive influence of e-design on supplier integration and the results of this study confirmed it. A positive path coefficient ($\beta = 0.33$; $p<0.05$) validates the hypothesised positive influence that e-design has on supplier integration. These findings mean that SMEs that effectively implement e-design systems, integrating with their suppliers increase their chances of improving performance as well as cutting supply chain costs.

These findings are consistent with those of Chang *et al.* (2012:342) who posit that e-design is the infrastructure aspect that brings in higher levels of partnerships and improved supply chain performance. This notion is also supported by Shank and Brown (2007:190), who found that successful companies or firms using e-design systems effectively, ultimately lead to greater supplier integration. Therefore, superior e-design systems are associated with greater supplier integration.

Thus, validation of a positive influence of e-design on supplier integration means that if SMEs effectively implement e-design systems they increase their chances of collaborating with their key supply chain members and this may result in minimisation of costs such as supply chain costs thus consequently improving supply chain performance. These findings further suggest that supply

chain member firms that invest in and use e-design tools for their buying and selling with each other can learn collectively and create a strong supplier integration.

- **E-sourcing positively influences supplier integration in the SME sector (H2)**

A positive and significant influence of e-sourcing on supplier integration was posited. The SEM results that validate or invalidate this hypothesis are shown in Figure 6.9 and Table 6.16.

Table 6.16: Hypothesis two structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
E-sourcing	→	Supplier Integration	H2	0.31	0.204	1.572	p >0.1

Structural model fit: Note significance level - ***p-value<0.001, significance level-**p-value<0.05, significance level- *p-value<0.1, ^{ns} significant level- insignificant (p-value>0.1).

As shown in Table 6.16, e-sourcing has a positive and insignificant relationship with supplier integration. H2 is not supported. The insignificance could be indicative of the fact that enterprises are not fully utilising the e-procurement systems such as e-sourcing in selecting their suppliers to effectively improve their collaboration with supply chain member firms. As posited in H2, the findings of this study suggest that the majority of firms surveyed are not collaborating in selecting their suppliers electronically.

- **E-negotiation positively influences supplier integration in the SME sector (H3)**

A positive and significant influence of e-negotiation on supplier integration was posited. The SEM results that validate or invalidate this hypothesis are shown in Figure 6.9 and Table 6.17.

Table 6.17: Hypothesis three structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
E-negotiation	→	Supplier Integration	H3	0.175	0.103	1.969	p <0.1

Structural model fit: Note significance level - ***p-value<0.001, significance level-**p-value<0.05, significance level- *p-value<0.1, ^{ns} significant level- insignificant (p-value>0.1).

As shown in Table 6.17, e-negotiation has a positive and significant relationship with supplier integration. H3 is supported. The current study posited a positive influence of e-negotiation on supplier integration. A positive path coefficient (β =0.175; p<0.1) validates the hypothesised positive influence that e-negotiation has on supplier integration.

A positive path coefficient may be because suppliers collaborate more often when they do their contract agreements electronically. These contract agreements will in turn improve their relations in business and thus contribute to higher levels of engagement and consequently improve supply chain performance. As posited in H3, the findings of this study suggest that in the firms surveyed there are some contract negotiations taking place with suppliers through technology.

- **E-evaluation positively influences supplier integration in the SME sector (H4)**

A positive and significant influence of e-evaluation on supplier integration was posited. The SEM results that validate or invalidate this hypothesis are shown in Figure 6.9 and Table 6.18.

Table 6.18: Hypothesis four structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
E-evaluation	→	Supplier Integration	H4	-0.018	0.143	-0.123	p>0.1

Structural model fit: Note significance level - ***p-value<0.001, significance level-**p-value<0.05, significance level- *p-value<0.1, ^{ns} significant level- insignificant (p-value>0.1).

As noted from Figure 6.9 and Table 6.18, the results of the fourth path (H4), e-evaluation has a weak negative (β = -0.018; p=0.902) and insignificant p-value greater than 0.1; t-value of -0.123 influence on supplier integration. H4 is therefore not supported. These findings mean that most firms do not collect extensive information about their suppliers for further evaluation via online information technology.

The weak negative path coefficient (-0.018) could be an indication that most surveyed firms are not collecting extensive information about their suppliers for further evaluations and transactions. Therefore, this ultimately results in lower supplier integration. Perhaps most of the surveyed SMEs in this study are still trying to determine the importance of further electronic evaluations and transactions of their suppliers before committing themselves to that task.

- **E-informing positively influences supplier integration in the SME sector (H5)**

A positive and significant influence of e-informing on supplier integration was posited. The SEM results that validate or invalidate this hypothesis are shown in Figure 6.9 and Table 6.19.

Table 6.19: Hypothesis five structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
E-informing	→	Supplier Integration	H5	-0.002	0.079	-0.023	p>0.1

Structural model fit: Note significance level - ***p-value<0.001, significance level-**p-value<0.05, significance level- *p-value<0.1, ^{ns} significant level- insignificant (p-value>0.1).

As noted from Figure 6.9 and Table 6.19, the results of the fifth path (H5), e-informing has a weak positive (β = -0.002; p=0.982) and insignificant p-value greater than 0.1; t-value of -0.023 influence on supplier integration. H5 is therefore not supported.

The assumption commonly made is that the majority of firms always share information with their supply chain partners. While this is true for some firms, the majority of the surveyed firms seem not to. This in turn prevents firms from collaborative learning and fails to create strong supplier integration. The negative influence of e-informing on supplier integration could also mean that supply chain member firms share very little information with their business partners or they are withholding crucial information which enables higher collaboration among supplier firms.

The findings suggest that e-informing is not connected to supplier integration. This therefore implies that the communication between enterprise and suppliers is not through technology. The findings of this study may also mean that although firms are distributing and sharing information to their supply chain members, it is not contributing to supplier collaboration as evidenced by the results. The weak influence might be due to some suppliers not sharing information in an effective way, such that information received is not playing a larger role in integrating suppliers.

The results of this study are inconsistent with other scholars (Presuti 2003:231; Wagner & Essig 2006:431). In their previous studies they reported high levels of significance between e-informing and supply chain performance.

- **Supplier integration positively influences tangible supply chain performance in the SME sector (H6)**

A positive and significant influence of supplier integration on tangible supply chain performance was posited. The SEM results that validate or invalidate this hypothesis are shown in Figure 6.9 and Table 6.20.

Table 6.20: Hypothesis six structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
Supplier Integration	→	Tangible SCP	H6	0.287	0.057	5.000	p<0.001

Structural model fits: $\frac{X^2}{df} = 1.46; IFI = 0.92; TLI = 0.91; CFI = 0.92; RMSEA = 0.04$. Note [C] significance level - ***p-value<0.001, [b] significance level-**p-value<0.05, [a] significance level-*p-value<0.1, [ns] significant level- insignificant (p-value>0.1).

As shown in Table 6.20, supplier integration has a positive and significant relationship with tangible supply chain performance. The current study posited a positive influence of supplier integration on tangible supply chain performance and the findings of this study confirmed it. A positive path coefficient (β =0.287; p=0.000) and significant p-value less than 0.001; t-value of 5.000 validates the hypothesised positive influence that SI has on tangible supply chain performance. H6 is therefore supported.

These results are also in agreement with previous evidence (Frohlich & Westbrook, 2001:196; Childerhouse & Towill 2003:31; Gimenez & Ventura 2005:123), which shows convincing empirical evidence for the relationship between supplier integration and performance. Some researchers found different results (Droge *et al.* 2004:56; Koufteros *et al.* 2005:44; Flynn *et al.* 2010:235).

- **Supplier integration positively influences intangible supply chain performance in the SME sector (H7)**

Finally, a positive and significant influence of supplier integration on intangible supply chain performance was posited. The SEM results that validate or invalidate this hypothesis are shown in Figure 6.9 and Table 6.21.

Table 6.21: Hypothesis seven structural equation modelling results

Variables	Path	Variables	Hypothesis	Path coefficient	Standard error	Critical region	p-value
Supplier Integration	→	Tangible SCP	H7	0.22	0.046	4.810	p<0.001

Structural model fit: Note significance level - ***p-value<0.001, significance level-**p-value<0.05, significance level- *p-value<0.1, ^{ns} significant level- insignificant (p-value>0.1).

As shown in Table 6.21, supplier integration has a positive and significant linear relationship with intangible supply chain performance. The current study posited a positive influence of supplier integration on intangible supply chain performance and the findings of this study confirmed it. A positive path coefficient (β =0.22; p=0.000) and a significant p-value less than 0.001; t-value of 4.810 validates the hypothesised positive influence that supplier integration has on intangible supply chain performance. H7 is therefore supported.

As posited in H7, the results of this study suggest that supplier integration is critical to improving firm performance especially in small businesses.

The findings of this study are also in line with the findings of Bowersox *et al.* (1999); Thietart (2007:82); Zhao *et al.* (2008:78) and Flynn *et al.* (2010:13), who affirm that in this dynamic world, firms especially SMEs, need to co-operate and collaborate with their key suppliers (thus SI) in order to survive, compete, prosper and gain competitive advantage and achieve excellence.

6.6 APPLICATIONS OF THE CONFIGURATION THEORY TO THE RESEARCH RESULTS

These results are consistent with the Configuration Theory, which states that supply chain integrative capabilities such as supplier integration are drivers or dominant gestalts of company performance (Schroeder, Bates & Junttila 2002:114; Amit & Jean 2005:342; Cernal, Babin, Anderson & Tatham 2006:88; Das *et al.* 2006:112; Huh, Yook & Kim 2008:99). In other words, through collaboration, firms can work together, learn collectively, build trust and achieve the set targets. It was evident in this study that supplier integration positively influences both tangible and intangible supply chain performance.

The results of this study also agree with the configuration theory, which claims that the investment in collaboration between supply chain partners can generate good organisational performance.

These results are also consistent with the Configuration Theory, which requires that collaboration by business partners will direct the development of the firm towards the desired configuration (supply chain performance) (Drazin, Van de Van & Andrew 1985:516).

Khandalla (1973:78), points out that, not only the optimisation of isolated elements, but also the harmony among these elements have a deep impact on performance. It is argued that a better fit between the elements of a system (e-procurement elements and supplier integration) will lead to higher performance. To this extent, Configuration Theory is found befitting the current study context. In reviewing these results, Delery and Doty (1996:267) conclude that while the Configuration Theory holds premise, additional testing is necessary to validate the efficacy of a configuration perspective.

6.7 CONCLUSION

Through the key findings of the empirical study, all the stated research hypotheses were addressed in this chapter. The demographic data describing the 283 participants in this study were presented. Descriptive statistics were presented representing the frequencies of responses. The results of this chapter were represented by graphs, charts, frequency tables and figures. The measures of central tendency (mean and standard deviation) were also used in analysing the data. The reliability results were also presented. A confirmatory factor analysis (CFA) was performed to establish scale accuracy. Through these procedures, it was determined that a high standard of validity and reliability was maintained throughout the study. Finally, the structural model was tested and four out of the seven postulated hypotheses were supported. Contrary to expectations, e-negotiation did not positively influence supplier integration in the SME sector (H2), e-evaluation did not positively influence supplier integration in the SME sector (H4) and e-informing did not positively influence supplier integration in the SME sector (H5). Hence, the hypotheses were rejected.

The next chapter (final chapter) presents the evaluation of research objectives, conclusions, the contribution of the study, recommendations, future research possibilities and limitations.

CHAPTER 7
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The previous chapter (Chapter 6) presented the findings and interpretation of the empirical study. Conclusions and recommendations form part of this chapter. Thus, this chapter summarises the research and its findings and presents some implications for further research. Therefore, this chapter was compiled in relation to the research objectives posed in Chapter 1. The summary of thesis chapters, evaluation of research objectives, the contribution of the study, limitations, recommendations, future research possibilities and the concluding remarks are provided. Recommendations were made to SME owners and managers on how e-procurement functions and supplier integration can be improved to enhance supply chain performance.

7.2 SUMMARY OF THE THESIS CHAPTERS

The main objective of this study was to investigate the relationship between e-procurement, supplier integration and supply chain performance in Small and Medium Enterprises (SMEs) in the Gauteng Province of South Africa. This thesis was divided into seven chapters, each serving its purpose.

Chapter 1 dealt with the introduction and general context of the study. It includes, amongst others, the background of the study, problem statement, primary objectives, theoretical and empirical objectives, conceptual framework, research methodology, data analysis and ethical considerations.

Chapter 2 provides the overview of literature focusing on supply chain management in SMEs within South Africa and beyond. Chapter 3 deals with literature related to e-procurement. The various e-procurement elements under consideration in this study, namely e-sourcing, e-design, e-informing, e-negotiation and e-evaluation are discussed. Chapter 4 provides an in-depth description of supplier integration and supply chain performance.

Chapter 5 covers the research design and methodology. It provides details of the quantitative methodology used in the study. This chapter also outlines the sampling design, the population and sample, data collection process, data collection tool (questionnaire) and ethical considerations. A subsection on data analysis and analysis of the psychometric properties of the instrument form part of this chapter.

Chapter 6 presents the results and findings of the study, displaying tables of computed statistics and graphs depicting results. The chapter also provides an analysis and interpretation of the findings. All the analyses and interpretations are made in relation to the research objectives, hypotheses as well as the literature reviewed in Chapters 2, 3 and 4.

Finally, Chapter 7 is based on the results, findings and discussion presented in Chapter 6, this chapter provides a conclusion in relation to the stated research objectives focusing on the relationship between e-procurement, supplier integration and supply chain performance in SMEs. This chapter also provides recommendations based on the literature reviewed, the primary as well as secondary data gathered throughout the study. Limitations of this research and suggestions for future research as well as the contribution of the study are also highlighted in this chapter.

7.3 CONCLUSIONS BASED ON THE THEORETICAL OBJECTIVES

This section discusses conclusions deduced from the theoretical objectives that were set for the study.

7.3.1 Conclusions drawn from the review of the literature on supply chain management

The first theoretical objective was addressed in Chapter 2. The aim of this objective was directed at understanding the nature of supply chain management in SMEs. This chapter conceptualises the definition of supply chain and supply chain management and further discuss the different types of supply chains as well as drivers and enablers of supply chain management. Also discussed in this chapter is the role and benefits of supply chain management. Lastly, supply chain characteristics and requirements were elaborated upon. Many definitions of supply chain management were reviewed in this chapter and this chapter reveals that supply chain management is a multi-dimensional construct. It also emerges that the SCM activities can be grouped into strategic, tactical and operational levels. Therefore, for the purpose of this study, the definitions provided by Mangan *et al.* (2012:231) and Wisner *et al.* (2012:8) are adopted to define the concept of supply chain management. They serve as the pertinent definitions because they contain the critical concepts such as coordination or integration, supply chain participants/organisations and flow of material, information and resources.

7.3.2 Conclusions drawn from the literature review on e-procurement

The second theoretical objective was addressed in Chapter 3. The aim of this objective was directed at understanding e-procurement and its five functions namely e-sourcing, e-negotiation,

e-informing, e-design and e-evaluation. These five functions were thoroughly discussed in each separate section and how they influence supplier integration and supply chain performance. It emerged that e-procurement is one of the most important developments in supply chain management in modern times. E-procurement involves the use of technology in facilitating transactions between buyers and suppliers. There is no single universal definition for e-procurement. E-procurement has evolved through four stages which are traditional procurement, electronic systems to support traditional procurement, internet as a communication channel and internet tools and platforms finally replacing traditional procurement. From the theoretical overview, it was clear that e-procurement has a significant and positive influence on supplier integration and supply chain performance.

7.3.3 Conclusions drawn from the literature review on supplier integration and supply chain performance

The third and fourth theoretical objectives were addressed in Chapter 4. The aim of these objectives was directed at understanding how supplier integration influences supply chain performance. By so doing, each construct was defined and elaborated on. In accordance with the literature, several factors were identified to have an influence on supplier integration, such as trust between suppliers, commitment and top management support. The different types of integration, including the benefits of integration were highlighted. The purpose of measuring supply chain performance was elaborated on. The drivers and enablers of supply chain performance were discussed. Lastly, the frameworks of supply chain performance measurement were also discussed.

From the theoretical overview, it is clear that supplier integration has a significant and positive influence on supply chain performance. The literature shows that when suppliers integrate in their functions, the organisation's performance is enhanced. It also became evident in the theoretical findings that organisations that commit themselves to supplier integration are more likely to succeed in their businesses. The literature search further revealed that the relationship between supplier integration and supply chain performance (both tangible dimensions and intangible dimensions) are positive and significant. The literature acknowledges that supply chain performance is influenced by many factors; however, supplier integration seems to be the key contributing factor, especially when supplier trust, commitment and information sharing matters most.

7.4 CONCLUSIONS BASED ON EMPIRICAL OBJECTIVES

In this section, conclusions drawn from the empirical objectives are discussed.

7.4.1 Conclusions on the influence of e-design on supplier integration

To achieve the first empirical objective, the SEM test was conducted to examine the effect of e-design on supplier integration. The test revealed a statistically positive and significant relationship. This relationship is shown in Table 6.14. These findings mean that firms that effectively implement e-design systems, integrating with their suppliers increase their chances of improving performance as well as cutting supply chain costs.

7.4.2 Conclusions regarding the influence of e-sourcing on supplier integration

To achieve the second empirical objective, the SEM test was conducted to examine the effect of e-sourcing on supplier integration. The relationship was found to be insignificant. This relationship is shown in Table 6.15. Thus, the findings of this study suggest that majority of firms surveyed are not collaborating in selecting their suppliers electronically.

7.4.3 Conclusions regarding the influence of e-negotiation on supplier integration

To achieve the third empirical objective, the SEM test was conducted to examine the effect of e-negotiation on supplier integration. The test revealed a statistically positive and significant relationship. This relationship is shown in Table 6.16. Thus, the findings of this study suggest that in the firms surveyed there are some contract negotiations taking place with suppliers through technology.

7.4.4 Conclusions regarding the influence of e-evaluation on supplier integration

To achieve the fourth empirical objective, the SEM test was conducted to examine the effect of e-evaluation on supplier integration. The relationship was found to be insignificant. This relationship is shown in Table 6.17. These findings mean that most firms do not collect extensive information about their suppliers for further evaluations.

7.4.5 Conclusions regarding the influence of e-informing on supplier integration

To achieve the fifth empirical objective, the SEM test was conducted to examine the effect of e-informing on supplier integration. The relationship was found to be insignificant. This relationship

is shown in Table 6.18. The findings suggest that e-informing is not connected to supplier integration. This therefore implies that the communication between enterprises and their suppliers is not through technology.

7.4.6 Conclusions regarding the influence of supplier integration on tangible supply chain performance

To achieve the sixth empirical objective, the SEM test was conducted to examine the effect of supplier integration and the tangible dimensions of SCP. The test revealed a statistically strong positive and significant relationship. This relationship is shown in Table 6.19. The findings of this study suggest that supplier collaboration is a very important factor in influencing supply chain performance in SMEs.

7.4.7 Conclusions regarding the influence of supplier integration on intangible supply chain performance

To achieve the seventh empirical objective, the SEM test was conducted to examine the effect of supplier integration and the intangible dimensions of supply chain performance. The test revealed a statistically strong positive and significant relationship. This relationship is shown in Table 6.20. The findings of this study suggest that supplier integration is critical in improving firm performance especially in small business.

7.5 RECOMMENDATIONS

The study has provided an overview of the relationships that exist between e-procurement, supplier integration and supply chain performance. Based on the findings of the empirical study, the researcher has made several recommendations to guide SME owners and managers in South Africa in order to enhance their supply chain performance. The recommendations are singled out as per postulated relationships between study constructs.

The results of this study showed that e-design has a positive influence on supplier integration. This serves as an implication that SME owners and managers should begin to work towards developing a deeper understanding of e-design tools and systems - so that they can develop strategies that will contribute to the improvement of supplier integration, which will in turn positively influence supply chain performance. Therefore, it means that the SME owners and managers should invest more in e-design systems for their buying and selling as this will create further collaborations.

The results further revealed that e-sourcing has a negative influence on supplier integration and this points to the need to improve e-procurement dimensions in order to improve collaboration with supply chain member firms, which will in turn improve performance. The researcher, therefore, suggests that SME owners and managers should start looking into what factors may lead to this negative influence on supplier integration. The insignificant relationship might be that enterprises are not fully utilising e-sourcing tools to engage with other suppliers. Therefore, if this is the case, the SME owners and managers might encourage training and education to improve the use of e-sourcing tools to effectively collaborate with their suppliers. This might in turn have a positive influence on supplier integration and performance.

The results also showed that e-negotiation has a positive influence on supplier integration. Therefore, it is recommended that SME owners and managers recognise e-negotiation as an important e-procurement element in order to foster ongoing relationships with supply chain member firms. SME owners and managers must also enrol for e-procurement training workshops or courses. This training should emphasise the importance of e-procurement functions such as e-design and e-negotiation as the key drivers of supplier integration and supply chain performance. This can help them to maximise the benefits of effectively implementing e-procurement functions and the development of supplier relationships.

Since the results of the study revealed e-evaluation has a negative influence on supplier integration, it is recommended that SME owners and managers should encourage their staff to collect extensive information about their suppliers as this will aid more collaborations and create good business relationships thus contributing to positive supply chain performance.

The study revealed that e-informing has a negative influence on supplier integration. If the assumption made earlier is true that the majority of firms might be holding crucial information to themselves and sharing very little information with their counterparts, the SME owners and managers are encouraged to hold regular meetings with their supply chain member firms in such a way that crucial information is shared and supplier collaboration is encouraged, thus contributing to positive supplier integration and consequently might lead to positive supply chain performance.

This study found the relationship between supplier integration and tangible supply chain performance to be positively significant. Therefore, it is recommended that SME owners and managers prioritise supplier collaborations by having regular seminars, training workshops or courses and conferences.

Lastly, this study also found the relationship between supplier integration and intangible supply chain performance to be positively significant. Therefore, it is recommended that SME owners and management need to co-operate and collaborate with their key suppliers. This will enable them to prosper and gain competitive advantage. To co-operate and collaborate more often, they need to create forums such as education forums and business forums, among other forums, aimed at bringing together all supply chain members to discuss business issues. These discussion forums will have to happen often. Because of these discussions, supplier integration might be enhanced and is likely to boost performance.

Other general recommendations include:

SME owners and managers may use the integrative model developed in this study to be in a better position to increase levels of supplier collaboration and may consequently improve their supply chain performance.

Inter-organisational factors such as trust and commitment between supply chain partners proved to have an influence on supplier integration and SME owners and managers are encouraged to monitor and put measures in place to maintain relationships between suppliers to improve supply chain performance.

Finally, although this study used five e-procurement functions, namely: e-sourcing, e-negotiation, e-informing, e-design and e-evaluation, the study suggests that SME owners and managers also make use of other functions, such as e-MRO, e-quotations, e-tendering, e-reverse auctioning, ERP, e-transportation, amongst others, relevant to their organisation to enhance supply chain performance.

Given the robust relationship between supplier integration and supply chain performance, SME owners and managers in the retail sector should invest in information sharing infrastruture such as IT, inorder to facilitate timeous exchanges of vital business information. Vibrant information sharing between supply chain partners tends to foster the building of trust and long-term relationships which are very critical in the success of any business. Eventually, trust and long-term relationships have been reported to yield good positive results for the firm in the exant literature (Premus & Sanders 2010:176; Renko & Ficko 2010: 218; Olhanger & Prajogo 2012:516).

7.6 THEORETICAL AND PRACTICAL CONTRIBUTIONS OF THE STUDY

The ever-increasing importance of South African SME e-procurement and supplier integration can not be over-emphasised. In particular, the efficacy of supply chains might be difficult to achieve without proper supplier integration and advances in e-commerce particularly e-procurement. The

current study is an attempt to undertake research in a commonly neglected, yet important, sector of the South African economy. This section addresses both the theoretical and practical value of the study.

7.6.1 Theoretical value

Firstly, a contribution is made to the existing literature on SMEs in South Africa, particularly in the context of developing countries that was noted to be scant. Secondly, a pioneering attempt was made to apply the Configuration Theory in order to explain the interrelationships of the research constructs, in which supply chain performance was the ultimate construct. A cross examination of the extant theory indicates that the Configuration Theory have been applied in large firms and mostly developed countries and to the best knowledge of the researcher, the Configuration Theory has never been applied in the conxtext of retail SMEs in South Africa. The findings of this thesis, therefore, fill this void that exists in academic literature.

Thirdly, whilst many researchers have focused on e-procurement influencing supply chain performance, research on e-procurement functions (e-sourcing, e-informing, e-negotiation, e-design and e-evaluation) on supplier integration and supply chain performance has remained scant in developing countries. This study is one of the few endeavours to investigate the influence of these five aforementioned constructs on supplier integration and supply chain performance. To the extent that this thesis has contributed new literature and empirical findings of these five constructs in the SMEs retailing sector context, it is likely to be useful source of reference material for future academic research.

Fourth, this study also makes a significant contribution to the SMEs performance literature by systematically exploring the impact of e-procurement functions on supplier integration and supply chain performance in the context of the South African SME retail sector. In particular, the current study's findings provide tentative support to the proposition that supplier integration should be recognised as a significant antecedent and tool to foster information sharing through technology platforms and firm performance in the SME retail sector. This research also enriches the growing discussion of supply chain management, e-business and supply chain integration by sharing empirical findings from the retail SMEs in South Africa.

Fifthly, the study may also assist in confirming theoretical assumptions on the relationship between e-procurement, supplier integration and supply chain performance in SMEs. The results presented provide useful information about the relationship between e-procurement, supplier integration and supply chain performance in SMEs, with implications for supply chain

professionals in SMEs and other relevant stakeholders. Furthermore, an understanding of the relationships within the context of the path model in this study offered further insight on how study constructs influence one another. These results contribute more to the expanding of the body of knowledge and further exacerbate debates among researchers in this field.

This study also suggests a conceptual model shown in Figure 7.1

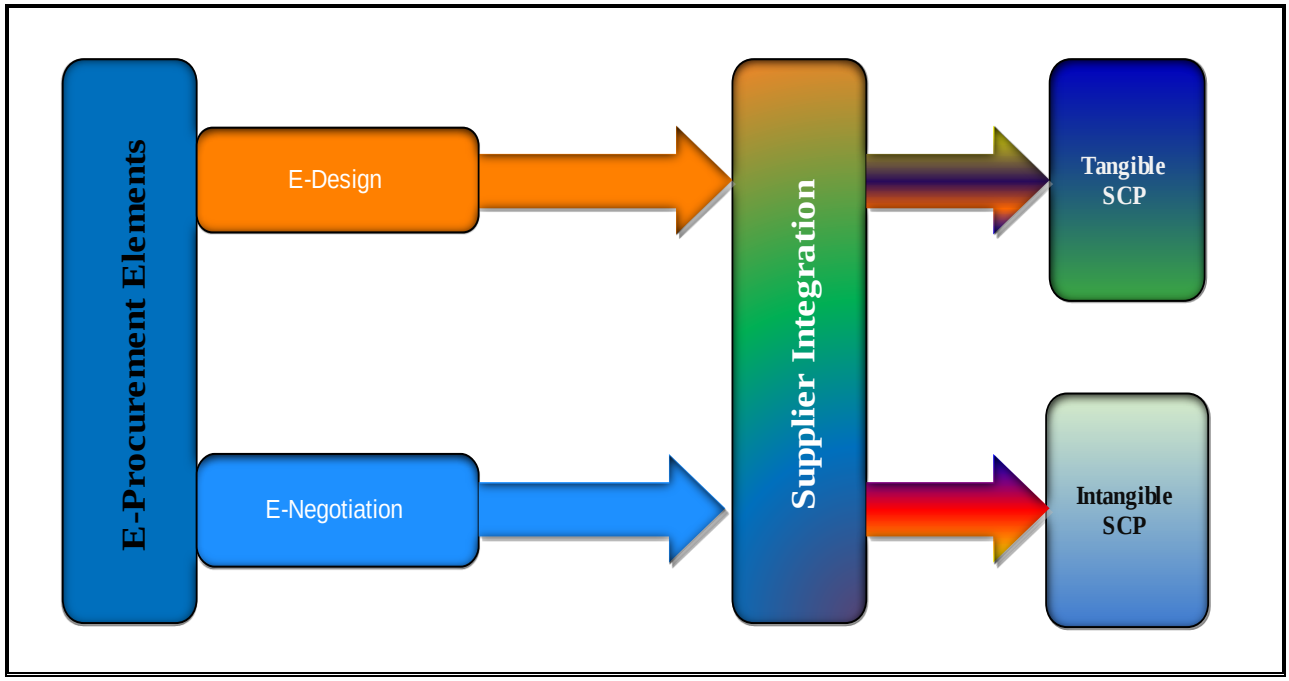


Figure 7.1: Proposed conceptual model

Figure 7.1 shows the proposed conceptual model suggested in this study. Drawing from the proposed conceptual model, a final contribution is the need for cooperation and collaboration among suppliers and other business stakeholders as this was shown to have the greatest significant influence on SME performance.

7.6.2 Practical value

This study added practical value in the following ways:

The study developed an integrative model (Figure 7.1), which might be used by SME practitioners in South Africa, thus contributing to the existing literature. Since the model paid attention to e-procurement (particularly e-design and e-negotiation) and supplier integration, possible strategies such as investing in supplier collaboration through e-procurement, could be derived from the model. Thus, SME

owners and managers will be in a better position to increase the levels of supply chain performance within their firms. Overall, these findings lend credence to the notion that by investing in supply integration tools and by using e-procurements functions such as e-design and e-negotiation, SMEs can improve their own performance.The findings of this study are also important to other SMEs in South Africa. They may use these findings as a benchmark for the best practices in SCM and e-procurement practices.

This study has assisted SMEs by providing current owners and managers' perceptions of e-procurement, supplier integration and supply chain performance. The results of this nature can be used for organisational planning and possibly policy making. The results of this study are also likely to benefit owners and managers in the SME retail sector, SME employee's represantives or trade unions and the government of South Africa at large.

The research study also enables owners and managers of the supply chain collaborating firms to gain a better understanding of the benefits of e-procurement functions such as e-sourcing, e-design, e-negotiation amongst others as well as gaining advantages of supplier integration inorder to achieve better supply chain performance.

Compared to all other e-procurement functions, supplier integration has greater influence on both tangible and intangible supply chain performance as depicted by the proposed conceptual model and/results of the study. Therefore, this study suggests that a joint-learning practice can be implemented for properly managing supply chains. Joint-learning strategy reflects the strategy underlying the concept of supply chain integration and focuses on know-how collaboration and mutual competency creation (Walters 2008:64). Following this strategy, an enterprise's know-how could be documented and collaborated with partners through an e-procurement system. For instance, know-how and cooperation with regard to new product designs could be incorporated into the e-procurement system, thus

enhancing supply chain performance, such as the "electronic visibility" system in Timken Company (Bylinsky 2018:87).

7.7 LIMITATIONS OF THE STUDY

Like any other scientific research, certain limitations were encountered. These include the following:

The data collected for this research was from only one province, namely, Gauteng. However, the results of this study could have been more informative if data from SMEs in all nine provinces were included in this study. This was not practical because of budget issues and time constraints.

The small (n=283) and non-probability sample (convenience sampling technique) helps to avoid the generalisation of the results beyond responses (Miguel & Brito 2011:66). Caution must be taken when generalising these results because of the limitation of data collection and the convenience sampling method used in this study.

The use of only SME owners and managers as chief informants in the survey could be a limitation.

7.8 POSSIBILITIES FOR FURTHER RESEARCH

Since this study is considered as the first attempt to investigate the relationship between e-procurement, supplier integration and supply chain performance in Gauteng, South Africa, directions for further research are suggested:

Future research should examine the relationship between these same constructs in SMREs versus non-SMREs firms.

In this study, supply chain performance was measured by tangible and intangible dimensions. Further research could apply different supply chain performance dimensions such as the SCOR, output resources and flexibility, amongst others.

Data were only collected from SME owners and managers, future research could broaden the scope to include customers, manufacturers (suppliers) and low-level subordinates.

Although this research provided some interesting findings regarding the relationships between e-procurement, supplier integration and supply chain performance in Gauteng, it is not clear whether these relationships would be the same in other provinces of South Africa. Therefore, future research should examine the differences and similarities in the relationship between e-procurement, supplier integration and supply chain performance. "Cross-cultural investigations of

supplier integration and how it influences supply chain performance may reveal interesting findings" (Huang *et al.* 2002:150).

Also, interesting future studies could compare the relationship of these constructs (in the study) between developed and developing economies.

Another area of research is analysing the factors that influence the degree of supplier integration on supply chain performance such as trust, national culture, organisational commitment and top management support as well as shared vision and objectives, among others.

Future research is needed in examining the relationship between supplier integration, schedule attainment and competitive performance.

E-procurement is a multi-dimensional concept and the study only investigated five important dimensions, namely, e-sourcing, e-negotiation, e-informing, e-design and e-evaluation. There are many other e-procurement functions, such as e-payment, e-catalogue, e-tendering, e-tailing, e-purchasing and e-transportation, among others. Future research should investigate the relationship between other e-procurement functions, supplier integration and supply chain performance.

Empirical studies on the direct relationship between supplier integration and customer satisfaction are somewhat rare. A study on this is also recommended.

Since this study only adopted the quantitative approach, another study involving a qualitative approach, or a mixed method approach is recommended as this will provide an in-depth analysis.

This study used only one dimension of supply chain integration, which is supplier integration; other dimensions such as internal or external integration, customer integration, design process integration, downstream integration, operational and measurement integration and other types of supply chain integration might enhance organisational performance and generate interesting results.

For this study, e-procurement was used as one of the several applications of e-business. Therefore, a research study focusing on other e-business applications such as Enterprise Content Management Systems (ECMS) and E-biz is recommended.

One problem that is clear in the literature (Chapter 5) is the lack of consistency regarding the model fit indices scale. Therefore, future research is needed in this area to strengthen the scale development efforts.

7.9 FINAL REMARKS

This final chapter showed how the final objectives were achieved and provided the research study's conclusion. The structural model was tested, and four out of seven postulated hypotheses were supported. The four accepted hypotheses are H1, H3, H6 and H7. Contrary to expectations, e-negotiation did not positively influence supplier integration in the SME sector (H2), e-evaluation did not positively influence supplier integration in the SME sector (H4) and e-informing did not positively influence supplier integration in the SME sector (H5). Hence, those hypotheses were rejected. In this thesis, the researcher studied the relationship between e-procurement, supplier integration and supply chain performance in SMEs and maintains that SMEs and even large enterprises (not studied in this thesis) need greater supplier integration to achieve excellence in overall supply chain performance. This is because supplier integration has shown strong positive and significant influence on both supply chain performance dimensions. Finally, the researcher encourages more studies to be conducted involving SMEs in this area as literature is still lacking and contradictory in some cases.

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APPENDIX A

COVER LETTER FOR QUESTIONNAIRE

Vaal University of Technology
Private Bag X021
Vanderbijlpark
1900
South Africa

Date: 23 March 2017

Dear participant,

I am a postgraduate student at the Vaal University of Technology, studying towards a Doctoris Technologiae: Business degree. The title of my research project is **"E-procurement, supplier integration and supply chain performance in small and medium enterprises"**.

You are invited to participate in this research study by completing the attached survey questionnaire. This questionnaire consists of four sections. Before you complete the enclosed questionnaire, I wish to confirm that:

- Your employer has given me permission for this research to be carried out.
- Your participation in this study is voluntary and you are free to withdraw at any time.
- Your anonymity will be maintained, and no comments will be ascribed to you by name in any written document or verbal presentation. Nor will any data be used from the questionnaire that might identify you to a third party. Please do not write your name anywhere on the questionnaire.
- On completion of the research, a copy of the completed research report will be made available to you upon request.
- Completion of the questionnaire will take approximately 15 minutes.

If you have any query concerning the nature of this research or are unclear about any question, please feel free to contact me at jeremiahm@vut.ac.za or 0847430200.

Your response and time are greatly appreciated. Thank you!

Yours sincerely,

_____

Mr J. Madzimure

APPENDIX B

SURVEY QUESTIONNAIRE

Section A: Demographic Information

In this section we would like to find out a little more about yourself and the profile of your company. Please place a cross (x) in the appropriate block.

A0	Is your company currently using e-procurement?	(1) Yes	(2) No

A1	Gender	(1) Male	(2) Female

A2	Age	(1) Under 30 years	(2) 30-39 years	(3)40-49 years	(4)50-59 years	(5)60 years and above

A3	Highest qualification	(1) Below Matric	(2) Matric	(3) Certificate	(4) Diploma/ Bachelor's degree	(5) BTech/ Honours degree	(6) Master's degree	(7) Doctorate/ PhD

A4	Race	(1) African	(2) White	(3) Indian/Asian	(4) Other ……(specify)

A5	Number of employees at this company	(1) Less than 50	(2) 51 to 100	(3)101 to 150	(4)151 to 200

A6	Experience in e-procurement	(1) Less than 1 year	(2) Between 1 to 5 years	(3) Between 6 to 10 years	(4) Between 11 to 15 years	(5) Over 15 years

A7	Turnover per annum (millions)	(1) Less than R 10m	(2) Between 11m to 20 m	(3) Between 21 to 30 m	(4) Between 31 to 40 m	(5) Between 41 to 50 m

SECTION B: E-procurement

We would like to find out a little more about your perceptions of E-procurement in SMEs. Please indicate the extent to which you agree or disagree by encircling the corresponding number between 1 (Strongly disagree) and 5 (Strongly agree). A rating of 3, point towards neutral acceptance of the statement. The electronic (technology-based) procurement system consists of five functions, namely: e-design, e-sourcing, e-negotiation, e-evaluation and e-informing.

E-PROCUREMENT		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
E-design						
ED1	Each department within the company shares the same network platform for procurement requests.	1	2	3	4	5
ED2	Each department within the company requests purchases from one specific department unit.	1	2	3	4	5
ED3	There is a design of the purchase requirement.	1	2	3	4	5
ED4	The design of the purchase requirement or the standardised purchasing norm between the organisation and supplier will be communicated or negotiated via internet.	1	2	3	4	5
ED5	Our company designs the format of marketing demands using the information system.	1	2	3	4	5
E-sourcing						
ES1	Our company selects the most appropriate supplier through its online information system.	1	2	3	4	5
ES2	Our company gathers the demand proposals about procurement information or related information through the online information system.	1	2	3	4	5
ES3	Our company releases the company requirements or rules through the online information system.	1	2	3	4	5
ES4	Our company notifies the supplier on the arrival of an authorised procurement contract through the online information system.	1	2	3	4	5
E-negotiation						
EN1	Our company negotiates the general procedures of purchasing with the supplier through the internet.	1	2	3	4	5
EN2	The use of the internet for negotiations results in significant savings for this company.	1	2	3	4	5
EN3	The use of the internet for negotiations results in lower purchase costs.	1	2	3	4	5
E-evaluation						
EE1	Our company documents past purchasing information in an electronic form.	1	2	3	4	5
EE2	Our company has a supplier database and utilises it in the purchasing process.	1	2	3	4	5
EE3	The evaluation of supplier performance is done using an online information system.	1	2	3	4	5

E-PROCUREMENT		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
EE4	Our company uses an online information system to collect extensive information about suppliers.	1	2	3	4	5
EE5	Our company evaluates suppliers on a regular basis via the internet.	1	2	3	4	5
E-informing						
EI 1	The use of e-informing has enhanced performance of the company.	1	2	3	4	5
EI 2	The use of e-informing has facilitated effective communication within our company.	1	2	3	4	5
EI 3	The use of e-informing has enabled the company to centralise strategic procurement processes.	1	2	3	4	5
EI4	The use of e-informing has enabled the company to decentralise operational procurement processes.	1	2	3	4	5
EI5	The use of e-informing has facilitated the dissemination of purchasing information to both internal and external partners.	1	2	3	4	5

SECTION C: Supplier Integration

We would like to find out a little more about your perceptions towards supplier integration. Please indicate whether you agree with the statements by encircling the corresponding number between 1 and 5. A value of 3 points towards neutral acceptance of the statement.

SUPPLIER INTEGRATION		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
SI 1	There is extensive participation with our major supplier in the design stage	1	2	3	4	5
SI2	Our major suppliers share their production schedule with our company	1	2	3	4	5
SI3	Our major suppliers share their production capacity with our company	1	2	3	4	5
SI4	Our major suppliers share available inventory with our company	1	2	3	4	5
SI5	Our company shares production plans with its major suppliers	1	2	3	4	5
SI6	Our company shares demand forecasts with its major suppliers	1	2	3	4	5
SI7	Our company shares inventory levels with its major suppliers	1	2	3	4	5
SI8	Our company helps its major suppliers to improve their processes to better meet the needs of our company	1	2	3	4	5

SECTION D: Supply Chain Performance.

We would like to find out a little more about your perceptions regarding supply chain performance. Please indicate whether you agree with the statements by encircling the corresponding number between 1 and 5. A value of 3 points towards neutral acceptance of the statement.

	SUPPLY CHAIN PERFORMANCE	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
						Tangible dimension
TD1	Our company manages its supply chain costs effectively.	1	2	3	4	5
TD2	Our company manages its profit effectively.	1	2	3	4	5
TD3	Our company manages cash turnover effectively.	1	2	3	4	5
TD4	Our company manages returns on sales effectively.	1	2	3	4	5
						Intangible dimension
ID1	Our company utilises its capacity effectively.	1	2	3	4	5
ID2	Our company manages inventory turnover effectively.	1	2	3	4	5
ID3	Our company has sufficient material availability.	1	2	3	4	5
ID4	Our customers are satisfied.	1	2	3	4	5
ID5	Our company manages lead times effectively.	1	2	3	4	5
ID6	Our company manages the deadlines for products/services effectively.	1	2	3	4	5

Thank you for taking time to complete this. Your views are much appreciated.

APPENDIX C
MODIFIED MODEL FIT STATISTICS FOR CONFIRMATORY FACTOR ANALYSIS

Model Fit Summary CFA

CMIN

Model	CMIN	DF	P	CMIN/DF
Default model	1046.592	702	.000	1.491
Saturated model	.000	0		
Independence model	4673.540	780	.000	5.992

Baseline Comparisons

Model	IFI Delta2	TLI rho2	CFI
Default model	.913	.902	.911
Saturated model	1.000		1.000
Independence model	.000	.000	.000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.042	.036	.047	.996
Independence model	.133	.129	.137	.000

Estimates (Group number 1 - Default model)

Scalar estimates (Group number 1 - Default model)

Maximum likelihood estimates

Regression weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
ED7	<---	DES	1.000				
ED6	<---	DES	1.073	.153	6.999	***	
ED4	<---	DES	.871	.132	6.590	***	
ED3	<---	DES	.916	.154	5.942	***	
ED2	<---	DES	1.060	.156	6.813	***	
ES4	<---	SOU	1.000				
ES3	<---	SOU	1.117	.128	8.709	***	
ES2	<---	SOU	1.297	.143	9.060	***	
ES1	<---	SOU	.829	.103	8.032	***	
EN5	<---	NEG	1.000				
EN4	<---	NEG	1.159	.122	9.526	***	
EN3	<---	NEG	.564	.065	8.612	***	
EE5	<---	EVA	1.000				
EE4	<---	EVA	.939	.121	7.763	***	
EE3	<---	EVA	1.333	.157	8.498	***	
EE2	<---	EVA	1.282	.150	8.538	***	
EE1	<---	EVA	.655	.101	6.495	***	
EI5	<---	INF	1.000				
EI4	<---	INF	1.100	.191	5.765	***	
EI3	<---	INF	1.294	.209	6.191	***	
EI2	<---	INF	1.109	.182	6.094	***	
EI1	<---	INF	1.305	.215	6.067	***	
SI16	<---	INT	1.000				
S115	<---	INT	1.094	.088	12.422	***	
SI14	<---	INT	1.182	.112	10.582	***	
SI13	<---	INT	1.258	.110	11.387	***	
SI12	<---	INT	1.339	.118	11.390	***	
SI11	<---	INT	1.091	.111	9.859	***	
SI10	<---	INT	1.107	.115	9.625	***	
SI8	<---	INT	.911	.109	8.336	***	
TD4	<---	TAN	1.000				
TD3	<---	TAN	.973	.084	11.630	***	
TD2	<---	TAN	.626	.070	8.989	***	
TD1	<---	TAN	.567	.064	8.905	***	
ID7	<---	ITA	1.000				
ID6	<---	ITA	1.083	.109	9.931	***	
ID5	<---	ITA	.834	.084	9.920	***	
ID4	<---	ITA	.562	.087	6.454	***	
ID3	<---	ITA	.814	.093	8.734	***	
ID2	<---	ITA	.766	.101	7.546	***	

Standardised regression weights: (Group number 1 - Default model)

			Estimate
ED7	<---	DES	.576
ED6	<---	DES	.592
ED4	<---	DES	.540
ED3	<---	DES	.476
ED2	<---	DES	.572
ES4	<---	SOU	.608
ES3	<---	SOU	.690
ES2	<---	SOU	.737
ES1	<---	SOU	.613
EN5	<---	NEG	.682
EN4	<---	NEG	.791
EN3	<---	NEG	.629
EE5	<---	EVA	.578
EE4	<---	EVA	.492
EE3	<---	EVA	.756
EE2	<---	EVA	.767
EE1	<---	EVA	.493
EI5	<---	INF	.481
EI4	<---	INF	.549
EI3	<---	INF	.647
EI2	<---	INF	.620
EI1	<---	INF	.613
SI16	<---	INT	.678
S115	<---	INT	.678
SI14	<---	INT	.722
SI13	<---	INT	.789
SI12	<---	INT	.790
SI11	<---	INT	.673
SI10	<---	INT	.648
SI8	<---	INT	.552
TD4	<---	TAN	.776
TD3	<---	TAN	.819
TD2	<---	TAN	.582
TD1	<---	TAN	.568
ID7	<---	ITA	.731
ID6	<---	ITA	.694
ID5	<---	ITA	.693
ID4	<---	ITA	.447
ID3	<---	ITA	.597
ID2	<---	ITA	.510

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
DES	<-->	ITA	.042	.010	4.324	***	
DES	<-->	TAN	.058	.016	3.611	***	
DES	<-->	INT	.060	.014	4.457	***	
DES	<-->	INF	.007	.011	.688	.492	
DES	<-->	EVA	.041	.009	4.546	***	
DES	<-->	NEG	.060	.014	4.460	***	
DES	<-->	SOU	.077	.015	5.288	***	
SOU	<-->	ITA	.043	.010	4.540	***	
SOU	<-->	TAN	.048	.015	3.165	.002	
SOU	<-->	INT	.071	.014	5.084	***	
SOU	<-->	INF	.000	.010	-.026	.979	
SOU	<-->	EVA	.045	.009	4.930	***	
SOU	<-->	NEG	.081	.015	5.536	***	
NEG	<-->	ITA	.031	.011	2.802	.005	
NEG	<-->	TAN	.058	.019	3.007	.003	
NEG	<-->	INT	.069	.016	4.257	***	
NEG	<-->	INF	.013	.013	.980	.327	
NEG	<-->	EVA	.051	.011	4.665	***	
EVA	<-->	ITA	.027	.007	3.700	***	
EVA	<-->	TAN	.030	.012	2.529	.011	
EVA	<-->	INT	.032	.010	3.247	.001	
EVA	<-->	INF	.006	.008	.736	.462	
INF	<-->	ITA	.003	.010	.312	.755	
INF	<-->	TAN	-.019	.017	-1.089	.276	
INF	<-->	INT	.003	.013	.254	.800	
INT	<-->	ITA	.056	.012	4.630	***	
INT	<-->	TAN	.096	.021	4.603	***	
TAN	<-->	ITA	.057	.015	3.855	***	
e28	<-->	e29	.144	.023	6.206	***	
e24	<-->	e25	.113	.020	5.720	***	
e23	<-->	e24	.094	.018	5.372	***	
e13	<-->	e14	.051	.012	4.186	***	
e4	<-->	e5	.088	.019	4.551	***	
e38	<-->	e39	.045	.009	5.247	***	
e37	<-->	e38	.031	.007	4.389	***	
e1	<-->	e6	.051	.014	3.784	***	
e27	<-->	e28	.066	.018	3.666	***	
e10	<-->	e34	.055	.015	3.647	***	

Correlations: (Group number 1 - Default model)

			Estimate
DES	<-->	ITA	.413
DES	<-->	TAN	.320

			Estimate
DES	<-->	INT	.420
DES	<-->	INF	.059
DES	<-->	EVA	.484
DES	<-->	NEG	.450
DES	<-->	SOU	.743
SOU	<-->	ITA	.406
SOU	<-->	TAN	.254
SOU	<-->	INT	.468
SOU	<-->	INF	-.002
SOU	<-->	EVA	.508
SOU	<-->	NEG	.581
NEG	<-->	ITA	.224
NEG	<-->	TAN	.240
NEG	<-->	INT	.355
NEG	<-->	INF	.079
NEG	<-->	EVA	.448
EVA	<-->	ITA	.312
EVA	<-->	TAN	.197
EVA	<-->	INT	.257
EVA	<-->	INF	.058
INF	<-->	ITA	.024
INF	<-->	TAN	-.085
INF	<-->	INT	.019
INT	<-->	ITA	.380
INT	<-->	TAN	.369
TAN	<-->	ITA	.306
e28	<-->	e29	.440
e24	<-->	e25	.404
e23	<-->	e24	.352
e13	<-->	e14	.299
e4	<-->	e5	.344
e38	<-->	e39	.350
e37	<-->	e38	.302
e1	<-->	e6	.267
e27	<-->	e28	.252
e10	<-->	e34	.258

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
DES	.099	.022	4.579	***	
SOU	.109	.021	5.144	***	
NEG	.181	.031	5.780	***	
EVA	.073	.015	4.741	***	
INF	.153	.042	3.639	***	
INT	.209	.034	6.110	***	
TAN	.326	.047	6.918	***	
ITA	.105	.016	6.390	***	
e1	.199	.020	9.882	***	
e2	.211	.022	9.685	***	
e3	.183	.018	10.225	***	
e4	.283	.027	10.572	***	
e5	.229	.023	9.836	***	
e6	.186	.018	10.287	***	
e7	.150	.016	9.382	***	
e8	.154	.018	8.590	***	
e9	.124	.012	10.237	***	
e10	.208	.024	8.808	***	
e11	.145	.023	6.220	***	
e12	.088	.009	9.649	***	
e13	.146	.014	10.335	***	
e14	.201	.019	10.855	***	
e15	.097	.013	7.744	***	
e16	.084	.011	7.457	***	
e17	.098	.009	10.934	***	
e18	.510	.048	10.528	***	
e19	.431	.043	9.932	***	
e20	.357	.042	8.592	***	
e21	.302	.033	9.035	***	
e22	.433	.047	9.135	***	
e23	.245	.024	10.377	***	
e24	.293	.028	10.646	***	
e25	.268	.027	9.953	***	
e26	.200	.022	8.959	***	
e27	.225	.025	8.917	***	
e28	.301	.029	10.465	***	
e29	.354	.033	10.604	***	
e30	.395	.036	11.113	***	
e31	.215	.028	7.602	***	
e32	.151	.024	6.351	***	
e33	.249	.024	10.554	***	
e34	.220	.021	10.653	***	
e35	.092	.011	8.531	***	
e36	.133	.015	9.178	***	

	Estimate	S.E.	C.R.	P	Label
e37	.079	.009	9.189	***	
e38	.134	.012	11.187	***	
e39	.126	.012	10.278	***	
e40	.175	.016	10.868	***	

SEM model fit summary

CMIN

Model	CMIN	DF	P	CMIN/DF
Default model	1038.614	714	.000	1.455
Saturated model	.000	0		
Independence model	4673.540	780	.000	5.992

Model	IFI Delta2	TLI rho2	CFI
Default model	.918	.909	.917
Saturated model	1.000		1.000
Independence model	.000	.000	.000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.040	.035	.045	.999
Independence model	.133	.129	.137	.000

Estimates (Group number 1 - Default model)

Scalar estimates (Group number 1 - Default model)

Maximum likelihood estimates

Regression weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
INT	<---	DES	.325	.153	2.126	.033	
INT	<---	SOU	.308	.204	1.512	.131	
INT	<---	NEG	.175	.103	1.969	.089	
INT	<---	EVA	-.018	.143	-.123	.902	
INT	<---	INF	-.002	.079	-.023	.982	
TAN	<---	INT	.287	.057	5.000	***	
ITA	<---	INT	.222	.046	4.810	***	
ED7	<---	DES	1.000				
ED6	<---	DES	.962	.121	7.955	***	
ED4	<---	DES	.735	.104	7.058	***	
ED3	<---	DES	.780	.123	6.363	***	
ED2	<---	DES	.903	.122	7.428	***	
ES4	<---	SOU	1.000				
ES3	<---	SOU	1.237	.153	8.069	***	
ES2	<---	SOU	1.418	.172	8.262	***	
ES1	<---	SOU	.891	.120	7.450	***	
EN5	<---	NEG	1.000				
EN4	<---	NEG	1.172	.126	9.328	***	
EN3	<---	NEG	.592	.068	8.655	***	
EE5	<---	EVA	1.000				
EE4	<---	EVA	.932	.121	7.717	***	
EE3	<---	EVA	1.327	.157	8.465	***	
EE2	<---	EVA	1.291	.151	8.535	***	
EE1	<---	EVA	.663	.101	6.537	***	
EI5	<---	INF	1.000				
EI4	<---	INF	1.108	.195	5.687	***	
EI3	<---	INF	1.293	.212	6.086	***	
EI2	<---	INF	1.133	.188	6.042	***	
EI1	<---	INF	1.348	.223	6.042	***	
SI16	<---	INT	1.000				
S115	<---	INT	1.097	.088	12.474	***	
SI14	<---	INT	1.167	.111	10.524	***	
SI13	<---	INT	1.240	.110	11.321	***	
SI12	<---	INT	1.333	.117	11.418	***	
SI11	<---	INT	1.100	.110	9.978	***	
SI10	<---	INT	1.115	.115	9.734	***	
SI8	<---	INT	.919	.108	8.490	***	
TD1	<---	TAN	1.000				
TD2	<---	TAN	1.073	.143	7.487	***	

			Estimate	S.E.	C.R.	P	Label
TD3	<---	TAN	1.668	.183	9.112	***	
TD4	<---	TAN	1.743	.193	9.030	***	
ID2	<---	ITA	1.000				
ID3	<---	ITA	1.082	.159	6.807	***	
ID4	<---	ITA	.710	.132	5.361	***	
ID5	<---	ITA	1.079	.149	7.236	***	
ID6	<---	ITA	1.440	.196	7.329	***	
ID7	<---	ITA	1.319	.177	7.461	***	

Standardised regression weights: (Group number 1 - Default model)

			Estimate
INT	<---	DES	.255
INT	<---	SOU	.206
INT	<---	NEG	.158
INT	<---	EVA	-.010
INT	<---	INF	-.002
TAN	<---	INT	.401
ITA	<---	INT	.412
ED7	<---	DES	.652
ED6	<---	DES	.607
ED4	<---	DES	.520
ED3	<---	DES	.462
ED2	<---	DES	.557
ES4	<---	SOU	.565
ES3	<---	SOU	.706
ES2	<---	SOU	.745
ES1	<---	SOU	.613
EN5	<---	NEG	.666
EN4	<---	NEG	.784
EN3	<---	NEG	.645
EE5	<---	EVA	.577
EE4	<---	EVA	.488
EE3	<---	EVA	.751
EE2	<---	EVA	.772
EE1	<---	EVA	.498
EI5	<---	INF	.475
EI4	<---	INF	.546
EI3	<---	INF	.638
EI2	<---	INF	.625
EI1	<---	INF	.625
SI16	<---	INT	.679
S115	<---	INT	.681
SI14	<---	INT	.714
SI13	<---	INT	.779
SI12	<---	INT	.788

			Estimate
SI11	<---	INT	.679
SI10	<---	INT	.653
SI8	<---	INT	.557
TD1	<---	TAN	.575
TD2	<---	TAN	.572
TD3	<---	TAN	.811
TD4	<---	TAN	.776
ID2	<---	ITA	.507
ID3	<---	ITA	.603
ID4	<---	ITA	.428
ID5	<---	ITA	.681
ID6	<---	ITA	.701
ID7	<---	ITA	.733

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
e41	<-->	e42	.075	.015	5.119	***	
e43	<-->	e44	.050	.011	4.617	***	
e42	<-->	e43	.073	.014	5.282	***	
e42	<-->	e44	.042	.009	4.789	***	
e41	<-->	e44	.046	.010	4.745	***	
e41	<-->	e43	.060	.014	4.357	***	
e28	<-->	e29	.140	.023	6.110	***	
e24	<-->	e25	.114	.020	5.763	***	
e23	<-->	e24	.092	.017	5.296	***	
e4	<-->	e5	.093	.019	4.975	***	
e13	<-->	e14	.052	.012	4.228	***	
e36	<-->	e37	.047	.009	5.384	***	
e37	<-->	e38	.034	.007	4.684	***	
e10	<-->	e31	.057	.015	3.729	***	
e1	<-->	e9	-.034	.010	-3.276	.001	
e4	<-->	e11	.053	.015	3.590	***	
e27	<-->	e28	.065	.018	3.626	***	
e6	<-->	e41	.048	.012	3.944	***	
e30	<-->	e33	-.061	.019	-3.230	.001	

Correlations: (Group number 1 - Default model)

			Estimate
e41	<-->	e42	.684
e43	<-->	e44	.444
e42	<-->	e43	.575
e42	<-->	e44	.507
e41	<-->	e44	.472
e41	<-->	e43	.404

			Estimate
e28	<-->	e29	.433
e24	<-->	e25	.405
e23	<-->	e24	.346
e4	<-->	e5	.355
e13	<-->	e14	.301
e36	<-->	e37	.359
e37	<-->	e38	.319
e10	<-->	e31	.261
e1	<-->	e9	-.234
e4	<-->	e11	.256
e27	<-->	e28	.249
e6	<-->	e41	.298
e30	<-->	e33	-.249

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
e41	.130	.024	5.390	***	
e42	.093	.020	4.610	***	
e43	.172	.031	5.628	***	
e44	.073	.015	4.732	***	
e45	.149	.042	3.582	***	
e46	.153	.026	5.922	***	
e47	.090	.019	4.847	***	
e48	.050	.012	4.041	***	
e1	.175	.019	9.230	***	
e2	.206	.021	9.871	***	
e3	.188	.018	10.615	***	
e4	.291	.027	10.957	***	
e5	.235	.023	10.295	***	
e6	.198	.019	10.408	***	
e7	.143	.016	8.941	***	
e8	.150	.018	8.169	***	
e9	.123	.012	10.079	***	
e10	.216	.024	9.072	***	
e11	.148	.023	6.343	***	
e12	.085	.009	9.425	***	
e13	.146	.014	10.339	***	
e14	.202	.019	10.874	***	
e15	.099	.013	7.834	***	
e16	.082	.011	7.316	***	
e17	.097	.009	10.906	***	
e18	.514	.049	10.566	***	
e19	.433	.043	9.953	***	

	Estimate	S.E.	C.R.	P	Label
e20	.364	.042	8.728	***	
e21	.299	.033	8.933	***	
e22	.423	.047	8.932	***	
e23	.245	.024	10.403	***	
e24	.291	.027	10.655	***	
e25	.275	.027	10.084	***	
e26	.209	.023	9.226	***	
e27	.228	.025	9.035	***	
e28	.297	.028	10.445	***	
e29	.349	.033	10.594	***	
e30	.392	.035	11.104	***	
e31	.216	.020	10.594	***	
e32	.253	.024	10.615	***	
e33	.155	.024	6.456	***	
e34	.215	.029	7.553	***	
e35	.176	.016	10.858	***	
e36	.124	.012	10.172	***	
e37	.136	.012	11.278	***	
e38	.082	.009	9.273	***	
e39	.131	.015	8.977	***	
e40	.091	.011	8.382	***	

APPENDIX D

DECLARATION FOR LANGUAGE EDITING

Dr. Andrea Garnett
English language editing services
SATI membership number: 1001674
Tel: 083 662 1728
E-mail: andreagarnett@yahoo.com

03 July 2018

To whom it may concern

This is to confirm that I, the undersigned, have language edited the completed research of Jeremiah Madzimure for the Doctoris Technologiae degree in Business and the thesis entitled: ***E-PROCUREMENT, SUPPLIER INTEGRATION AND SUPPLY CHAIN PERFORMANCE IN SMALL AND MEDIUM ENTERPRISES IN GAUTENG PROVINCE.***

The responsibility of implementing the recommended language changes rests with the author of the thesis.

Yours truly,

Andrea Garnett