THE RELATIONSHIP BETWEEN SUPPLY CHAIN RISK, FLEXIBILITY AND PERFORMANCE IN THE SOUTH AFRICAN PUBLIC SECTOR

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ABSTRACT

The expectation by South Africans is that the public sector must contribute positively to the economy. However, the general perception is that the public sector is failing to fulfil its mandate due to systemic problems in the entire public sector. Its supply chain in South Africa is both volatile and imperfect. This is demonstrated by the level of service delivery protests, which emanate from the feeling that the public is not receiving the quantity or quality service that they need. This study aimed to assess the relationship between supply chain risks, supply chain flexibility and supply chain performance in the South African public sector. A conceptual framework was developed, which included six supply chain risk factors, namely, government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process efficiency, which feed into supply chain flexibility, which in turn leads to supply chain performance. Seven hypotheses underlying these relationships were put forward for testing.

A quantitative approach using the cross-sectional survey design was adopted in which a questionnaire was distributed to 306 conveniently selected supply chain professionals who were based in Gauteng province. Items used in the survey questionnaire were adapted from previously validated scales. A confirmatory factor analysis was conducted to test the psychometric properties of the measurement instrument. Descriptive statistics were used to analyse the perceptions of respondents towards the factors under consideration in the study. Hypotheses were tested using the structural equation modelling approach.

The results of the study show that the threat from supply chain risks in the South African public sector remains high, and that flexibility and performance of the supply chain remains unsatisfactory. Hypotheses tests showed that all six supply chain risks significantly predicted supply chain performance. While the other supply chain risks were positively related to supply chain flexibility, the relationship between the flexibility and supply complexity was negative. Amongst the supply chain risks considered in this study, availability of skills emerged as the strongest predictor of supply chain flexibility. The study further showed that supply chain flexibility significantly and positively predicts supply chain performance.

Theoretically, the study provides a specific conceptualisation of the relationship between supply chain risks, supply chain flexibility and supply chain performance within the South African public sector, where no such study has been conducted before. Practically, it provides information to supply chain professionals in the South African public sector regarding the

improvement of supply chain performance. The study underscores that the performance public supply chain in South Africa can be improved by managing the six risks considered in this study, and their contribution to supply chain flexibility.

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INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

Today's supply chains are characterised by intense competitive pressures as well as high levels of turbulence and uncertainty (Braunsheidel & Suresh 2009:119). In spite of these pressures, authorities in most public organisations in many countries feel confident that they operate in efficient supply chains (Nyaga, Whipple & Lynch 2010:101). However, when most public organisations are subjected to tests with disruptions, they do not survive (Eyaa & Oluka 2011:36). For instance, in South Africa, Mafini and Pooe (2013:2) observed that public organisations face immense pressure to excel in their performance since they operate in a highly unstable and competitive environment. Consequently, the supply chain performance of most public organisations in the country remains unsatisfactory, with obvious negative implications for the South African economy (Narasimhan & Talluri 2009:114). This presents the need for public sector organisations to explore ways towards improving their respective operational supply chains.

According to Stuart, Verville and Taskin (2012:394), a supply chain is a network or a web of processes and activities that produce values in the form of products and services to meet the needs of the ultimate customer. A supply chain links or connects various autonomous organisations with the objective of creating value in products or services that will eventually end up in the hands of final consumers (Yuan, Zhongfeng & Yi 2010:302). In the public sector, the supply chain may be inbound into the public sector – an operational requirement for internal customers, for example, or it may be outbound from the public sector – in place to deliver broader organisational objectives to provide services for delivery to citizens, or a combination of both (Pauw 2011:13). The government spends a lot of resources on various payments to many suppliers who provide multiple products and services (Public Service Commission 2011:6). In the case of South Africa, supply chain management has become a critical component of government activities, as demonstrated through the appointment of the Office of the Chief Procurement Officer who oversees all public supply chain management activities in the country (Watermeyer 2011:15). This being the case, the management of supply chains and the risks involved in doing so have become critical.

Generally, supply chains are exposed to inertia risks, that is, a general lack of responsiveness to changing environmental conditions and market signals (Juttner, Peck & Christopher 2003:12). Inertia risks are critical since they exercise an impact on the ability of supply chains to flexibly adjust to fluctuating demands and environment, more so in today's current reality that is characterised by increasing global complexity (Blome, Schoenherr & Eckstein 2014:307). Ebaid (2011:108) proclaims that it is difficult for organisations to avoid risk, hence they have to identify and manage them as they get exposed. According to Juttner, Peck and Christopher (2003:3), organisations have for some time been aware of the need for risk management and contingency planning, which is a requirement for superior and sustainable supply chain performance. As such, successful supply chains are those that can continue performing and still be efficient and effective in predictable or unpredictable circumstances driven by continuously changing market conditions.

In these modern times, many organisations endeavour to improve their overall performance by implementing various supply chain initiatives. These are intended to increase revenue, reduce cost, reduce assets and enhance the provision of services or production of goods, and can be useful in a stable environment (Tang & Tomlin 2008:12). However, since supply chains exist in uncertain situations, they must be flexible enough to improve their general performance (Agus 2011:136). Grigore (2009:66) defines supply chain flexibility as the organisation's ability to meet an increasing variety of customer expectations without excessive costs, time, organisational disruptions or performance losses. Braunsheidel and Suresh (2009:119) state that organisations require flexibility in their supply chains to provide superior value as well as to manage disruption risks and ensure uninterrupted service to customers, which are enduring characteristics of excellent supply chain performance. Thus, supply chain flexibility remains one of the primary ingredients for improving supply chain performance through managing supply chain risks.

The purpose of the proposed study is to investigate the relationship between supply chain risks, supply chain flexibility and supply chain performance in the South African public sector. Apart from discussing the background of the study, it also deliberates on the theoretical framework, the problem statement, research objectives, summary of hypotheses, the research methodology, ethical considerations and the chapter classification.

1.2 THEORETICAL FRAMEWORK

1.2.1 Research Theory

The theoretical rationale underpinning this study is the Enterprise Risk Management Theory (Hopkin 2012:15). According to Fraser, Schoening-Thiessen, Simkins and Fraser (2010:399) organisations typically use two different approaches to manage risks. The first approach is to control each separate risk, one at a time, on a primarily compartmentalised and decentralised basis. The second approach is to view all risks together within a coordinated and strategic framework, a concept known as Enterprise Risk Management (ERM). It is acknowledged by Hoyt and Liebenberg (2011:797) that organisations that succeed in creating an active ERM tend to enjoy a long-run competitive advantage as opposed to those that manage and monitor risks individually. Mikes and Kaplan (2013:4) posit that an organisation can strengthen its capacity to implement their strategic plan when they measure and manage risks consistently and systematically, and by ensuring that their business managers have the necessary information and incentives to enhance the trade-offs that exist between risk and return.

1.2.2 Supply Chain Risks

Supply chain risks pertain to the probability or threat of damage, injury, liability, loss or any other adverse occurrence that is caused by external or internal vulnerabilities within the supply chain and that may be avoided through pre-emptive action (Grose & Richardson 2014:19). According to the Chartered Institute of Purchasing and Supply (CIPS), the six dominant universal supply chain risks include government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process efficiency. As suggested by Colyvas (2014:1), supply chain management operates within a regulatory framework set by the national government and extended by provinces and local government bodies to specific policies, legislation and regulations.

Supply complexity is characterised by a dynamic supply market, unreliable suppliers and an unreasonably high number of suppliers with whom business is conducted, as determined by various factors that include political, economic, technological and social factors, among others (Blome *et al.,* 2014:308). The skills shortage is defined as circumstances where employers are unable to fill or have considerable difficulty in filling vacancies for an occupation, or specialised skill needed within that occupation at current levels of remuneration and conditions of employment, and reasonably accessible location (Cappelli 2015:252). Supplier performance monitoring involves measuring, analysing and managing a supplier's ability to comply with, and preferably exceed their contractual obligation (Lysons & Farrington 2012:7). Information

security is the preservation of confidentiality, integrity and availability of information (Spears 2006:1). Process efficiency is meant to ensure that more outputs are achieved using fewer resources in all sets of steps or tasks that the organisation repeatedly employs to create a product or service, reach a specific goal or provide value to a customer or supplier (Dohmen & Moormann 2010:121). These individual risks, in different ways, affect the public sector's day to day supply chain business.

1.2.3 Supply Chain Flexibility

Supply chain flexibility may be perceived as the ability to respond to short-term changes in demand or supply situations of other external disruptions, coupled with the adjustment to strategic and structural shifts in the environment of the supply chain (Grigore 2009:66). It is concerned with the organisation's ability to effectively manage or react to changes with little penalty in time, cost or quality of performance (Agus 2011:136). Supply chain flexibility can be considered to be a solution for avoiding most of the common business disruptions by the timely and responsive reaction to changes in the supply chain environment (Tang & Tomlin 2008:14). The cultivation of flexibility is viewed as a risk management initiative that enables the firm to respond rapidly to marketplace changes, as well as to potential and actual disruptions, resulting in performance improvements throughout the supply chain (Braunsheidel & Suresh 2009:120). Accordingly, flexibility is of value for both risk mitigation, response and supply chain performance enhancements.

1.2.4 Supply Chain Performance

Supply chain performance is a monitoring process undertaking a retrospective analysis to determine whether the proper procedures have been followed and whether the desired objectives have been achieved within the supply chain (Migiro & Ambe 2008:233). One of the fundamental goals of supply chain management is to increase total supply chain performance, which is referred to as supply chain effectiveness (Supply chain service level) and efficiency (Supply chain cost) (Christopher 2012). According to Hult, Ketchen and Slater (2004:241), supply chain management is not a support function for implementing business strategy but is specifically meant to drive an organisation's performance and become a vital element of the overall strategy for the entire chain. Supply chain performance and effective management of a supply chain have increasingly been recognised as critical factors in enhancing earning performances (Agus 2011:134).

1.3 PROBLEM STATEMENT

The expectation by South Africans is that the public sector must contribute to the economy. However, the general perception is that the public sector is failing to fulfil its mandate due to systemic problems in the entire public sector. The public sector supply chain in South Africa is both volatile and imperfect, as demonstrated by the level of service delivery protests, which emanate from the feeling that people are not receiving the quantity or quality service that they need (National Treasury 2015:6). According to Khoza and Adam (2005:15), the public sector has a significant impact on the economy, particularly the larger public companies that operate in critical sectors of the economy, such as energy, telecommunications and transport. As suggested by Naudé and Badenhorst-Weiss (2011:279), delivering the right service in the right place at the right time for the right price is the best formula for supply chain success in the South African public sector. The South African public sector supply chain is supposed to focus on effective procurement, which is in line with the Public Financial Management Act (PFMA) and facilitates the measurement of how well the taxpayers' money is spent (Richardson & Snaddon, 2011:157). If the South African public sector is well managed and efficient, it will be able to make a positive contribution to the economy, although getting the South African public sector to perform optimally depends on a host of factors (Khoza & Adam 2005:16). Such factors include the involvement of government (through government policies); risk of supply; supply chain disruptions; lack of suitable or available suppliers; product performance and internal business processes, among others. These issues provide fertile ground for further scientific research to find relevant solutions.

It is notable that despite the availability of extensive literature on supply chain risks, supply chain flexibility (for example, Hoffman, Schiele & Krabbendam 2013; Stevenson & Spring 2009; Thome, Scavarda, Pires, Ceryno & Klingebiel 2014*)* and supply chain performance (Sánchez & Pérez 2005; Ganga & Carpinetti 2011), most studies have not focused on the relationship between supply chain risk and supply chain flexibility to enhance supply chain performance. Additionally, there is limited evidence that a study assessing such dimensions has previously been conducted in the South African public sector. This study was intended to address these existent research gaps. It focused on supply chain flexibility as a means to respond to supply chain risks and to assess whether supply chain flexibility contributes to supply chain performance. Therefore, this study aimed to establish the relationship between supply chain risks, supply chain flexibility and supply chain performance in the South African public sector. The study is important in that it generated information that can be used by supply

chain practitioners in the South African sector to manage various risks that the sector is exposed to as a way of attaining superior supply chain performance. This can be a solution to the service delivery challenges currently facing the country.

1.4 OBJECTIVES OF THE STUDY

In this study, the objectives have been classified into three categories, namely, the primary objective, theoretical objectives and empirical objectives.

1.4.1 Primary Objective

The primary objective of this study was to assess the relationship between supply chain risks, supply chain flexibility and supply chain performance in the South African public sector. More specifically, the objectives of the study were classified as theoretical and empirical objectives:

1.4.2 Theoretical Objectives

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

- to analyse literature on the South African public sector's supply chain;
- to explore literature on supply chain risks;
- to explore literature on supply chain flexibility; and
- to conduct a literature review on supply chain performance.

1.4.3 Empirical Objectives

The study addressed the following empirical objectives:

- to explore the perceptions of supply management practitioners towards supply chain risk management, supply chain flexibility and supply chain performance in the South African public sector;
- to determine the influence of supply chain risks on supply chain flexibility in the South African public sector; and
- to assess the influence of supply chain flexibility on supply chain performance in the public sector in South Africa.

1.5 THE CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

The conceptual framework presented in Figure 1 was developed, which highlights the presupposed relationships between the constructs under investigation in this study.
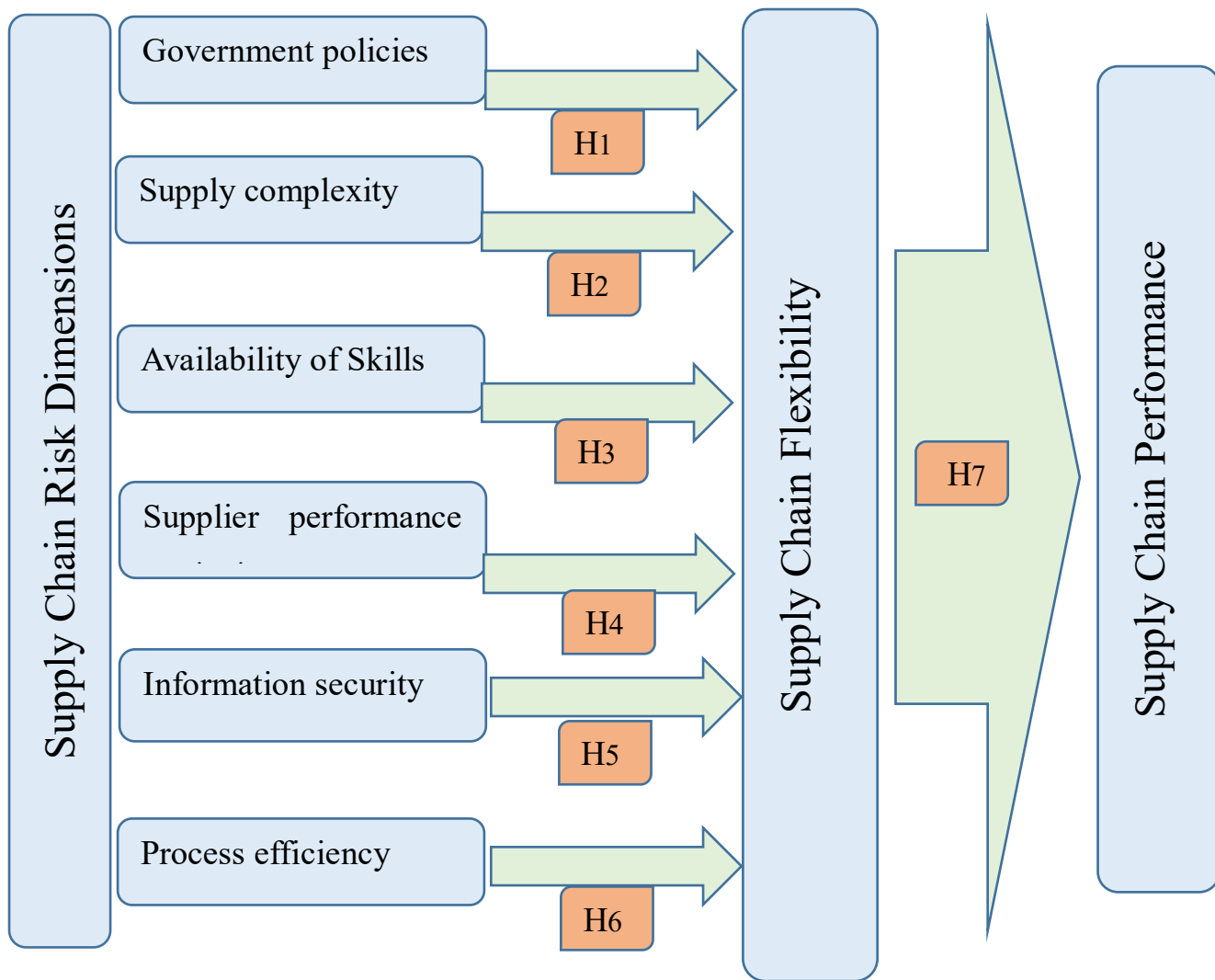
Figure 0.1: Conceptual Framework

Based on the conceptualised research framework, the following hypotheses were tested:

- H1: Effective government policies lead to increased flexibility of the public supply chain

- H2: Increased supply complexity leads to decreased flexibility of the public supply chain

- H3: Availability of skills leads to increased flexibility of the public supply chain

- H4: Monitoring of supplier performance leads to increased flexibility of the public supply chain

- H5: Effective information security leads to increased flexibility of the public supply chain

- H6: Process efficiency leads to increased flexibility of the public supply chain

- H7: Supply chain flexibility leads to the increased performance of the public sector supply chain.

1.6 RESEARCH METHODOLOGY AND DESIGN

1.6.1 Research Design

The design of a research study begins with the selection of a topic and a paradigm. A paradigm is a whole framework of beliefs, values and methods within which research takes place. Gerring (2011:626) points out that the purpose of a research design is to test a hypothesis. In view of this, the study adopted a quantitative paradigm. According to Creswell (2013:4), quantitative research is an approach for the testing of scientific theories through the examination of the relationships amongst variables. These variables can be measured, typically through the use of instruments, so that numbered data can be analysed using statistical procedures (Moutinho & Hutcheson 2011:5). The final written report in a quantitative study has a set structure that consists of the introduction, literature and theory, methods, results and discussion (Khan 2014:34). The quantitative design was selected since this study was intended to use hypotheses in testing the relationship between different variables. The survey method was used for the empirical part of the study since it uses questionnaires to obtain data from a sample of respondents selected from the population (Chai & Xiao 2012:21).

1.6.2 Sampling Design

Creswell (2009:145) defines a sampling design as a provision of a plan for a quantitative or numeric description of trends, attitude or opinion of a population by studying a sample of that population. Sampling design is made of elements that include the target population, sampling frame, sample size and sampling method.

1.6.2.1 Target population

A population refers to a set of individual units which the research question seeks to explore (Neil 2015:3). The research was conducted among supply chain professionals in the South African public sector. The South African public sector consists of state-owned companies, municipalities, government departments and constitutional entities. According to The Chartered Institute of Purchasing and Supply (2015:3), the South African government employs approximately 1,200 supply chain professionals.

1.6.2.2 Sampling Frame

The study primarily focuses on supply chain professionals who operate within the public sector in Gauteng Province. Gauteng province was deemed as appropriate because it houses the head

offices of most national departments and constitutional entities of South Africa, and the majority of state-owned companies have head offices there as well.

1.6.2.3 Sample size

Quantitative research aims to apply the relationship obtained amongst variables to the general population. Hence the selection of a representative sample is essential (Delice, 2010:2002). The size of the sample was based on the supply chain professionals employed and consultants working in the public sector in Gauteng province. According to Altunisik, Coskun, Bayraktaroglu and Yildirim (2004:125), sample sizes between 30 and 500 at 5% confidence level are generally sufficient for many studies. Based on this prescription, the sample size was pegged at n=500 respondents for this study.

1.6.2.4 Sampling approach and technique

Sampling involves selecting individual units to measure from a large population (González, 2011:65). In this study, sampling elements were chosen through the use of the non-probability sampling approach, using the convenience sampling technique. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher (Quinlan 2011:221).

1.6.2.5 Measurement instrument

In this study, data were gathered through a structured questionnaire. It was broken down into four sections. Section A contained questions on the demographic characteristics of respondents. Section B included items on supply chain risks, namely, government policies, supply complexity, skills shortage, supplier performance monitoring, information security and process inefficiency. Section C contained questions regarding supply chain flexibility while section D included questions regarding supply chain performance. Measurement scales in sections B, C and D were adapted from previously validated scales and were measured on five-point Likert-type scales.

1.6.3 Data Collection Method and Procedure

The data collection method relates to how relevant information to the study will be gathered and collected. Data were collected through the use of a self-administered questionnaire, which was distributed in person by the researcher. The cross-sectional survey approach was preferred, in which data were collected from the same respondents once within three weeks.

1.7 STATISTICAL ANALYSIS

Data were analysed using descriptive statistics. A combination of Statistical Package for the Social Sciences (SPSS version 24.0) and the Analysis of Moment Structures (AMOS version 24.0) was used. Respondents' demographic information was analysed using descriptive statistics. A confirmatory factor analysis (CFA) was conducted to test the psychometric properties of the measurement scales. Hypotheses or relationships between variables were tested using structural equation modelling.

1.8 RELIABILITY

The reliability of research is closely related to its repeatability (Delice 2010:2002). McNeil and Chapman (2005:9) confirm that one of the most critical indicators of quality in any research study is its reliability. Reliability is defined as the extent to which a measure is free from random error components (Cook & Campbell 1979:37). In this study, reliability was ascertained through the use of the Cronbach's Alpha coefficient and Composite Reliability. For the Cronbach's Alpha and the Composite Reliability, 0.7 was regarded as the minimum acceptable value (Fraering & Minor 2006:284).

In addition to the testing of reliability, the suitability of the proposed conceptual model was assessed through an assessment of the model fit. It is essential that the study examines the "fit" of an estimated model to determine how well it models the data (Anderson & Gerbing 1988:411). In this study, model fit was ascertained by using the following indices: Chi-square, Comparative fit index (CFI), Goodness of fit index (GFI), Incremental fit index (IFI), Normed fit index (NFI), Tucker-Lewis index (TLI), and Random measure of standard error approximation (RMSEA).

1.9 ETHICAL CONSIDERATIONS

Ethics refer to a body of moral principles or values that are particular to specific cultures and groups (Weinberg & Schneider 2007:218). According to Erikson and Kovalainen (2008:68), normative guidelines and codes of ethics and rules are needed to govern the integrity of scientific activities and to create ways of handling mistakes of an academic institution and organisation. This study was conducted after permission was granted to collect data, which has been obtained from relevant authorities in the South African public sector. Respondents were made aware that their participation in this study is on a voluntary basis and confidentiality was exercised in treating any information they provided. Furthermore, anonymity regarding the identities of respondents was exercised, and respondents were protected from any physical or psychological harm.

1.10 CHAPTER CLASSIFICATION

The proposed research study was presented in a comprehensive thesis document, of which the chapters were classified as follows:

CHAPTER 1: Introduction and background to the study

This chapter discusses the framework, context and scope of the study. The problem statement and primary objective were stated while the theoretical and empirical objectives were also addressed.

CHAPTER 2: Supply chain management in the public sector

This chapter provides the overview of literature focusing on supply chain management in the public sector. The South African public sector and public sectors in other countries around the world also receive theoretical emphasis.

CHAPTER 3: Supply chain risk

This chapter analyses literature that provides the overview of supply chain risks. In particular, the various supply chain risks under consideration in this study, namely, government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency were discussed.

CHAPTER 4: Supply chain flexibility and supply chain performance

This chapter provides an in-depth description of supply chain performance and supply chain flexibility. Benefits and challenges of supply chain flexibility were also discussed.

CHAPTER 5: Research methodology

This chapter articulates the research methodology that was used in the study. It outlines the research approach and design, the sampling design, and data collection method, data analysis and statistical techniques, ethical considerations and analysis of the psychometric properties of the instrument.

CHAPTER 6: Data presentation, interpretation, and analysis

Findings from the empirical study were presented and analysed in this chapter. The chapter also highlights interpretation and evaluation of the research findings.

CHAPTER 7: Conclusions and recommendations

This chapter provides a summary of the entire study and gives recommendations based on the literature review, the primary data as well as secondary data gathered throughout the study. The chapter reflects the study and states if the objectives of the research have been achieved.

CHAPTER 2
SUPPLY CHAIN MANAGEMENT IN THE PUBLIC SECTOR

2.1 INTRODUCTION

The responsibility of any government as a base is to ensure that its citizens are safe and have quality life through the supply of essential resources such as food, water and shelter. To provide the above, the government has to put in place policies, regulations and monitoring systems while ensuring that there is capacity from competent personnel to execute the activities involved.

This chapter discusses literature on supply chain management in the public sector. First, it focuses on literature on supply chain management in general. Issues that receive attention include a review of supply chain management, lists of procurement practices, objectives of supply chain management in the public sector and the implementation of supply chain management in that sector. Second, it moves on to supply chain management in the public sector from a global perspective. Other issues that receive attention are the procurement steps in the public sector, public sector institutions around the world and in South Africa, supply chain management regulations governing the public sector and the supply chain management challenges in the public sector. These discussions are necessary because the study is aimed at streamlining supply chain management activities in the public sector. Therefore, it is logical that attention was directed to these issues in this chapter.

2.2 THE CONCEPT OF SUPPLY CHAIN MANAGEMENT IN THE PUBLIC SECTOR

This section focuses on the concept of supply chain management in the public sector. The issues that receive attention in the section include an overview of supply chain management, a list of procurement practices, and the objectives of supply chain management in the public sector. The section concludes by discussing the implementation of supply chain management in public sector.

2.2.1 Supply Chain Management Overview

The cause of problems plaguing government and the people at large may emanate from lack of understanding regarding the concept of supply chain management and its complicated link to long-term quality service delivery, human capital development and associated socio-economic growth (Boateng 2016:1). According to National Treasury (2015:71), supply chain management is defined as the design, planning, execution, control and monitoring of supply chain activities in the delivery of goods or services with the objective of creating net value and

providing oversight and co-ordination of information and finances within the supply chain. Moreover, the Council of Supply Chain Management Professionals (CSCMP 2010:1) describes supply chain management as follows:

Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers and customers. In essence, supply chain management integrates supply and demand management within and across companies.

Aelkera, Bauernhans and Ehmc (2013:81) suggest that supply chain management includes the coordination of many elements that can take over different states and be connected via different relations. As such, sourcing and procurement forms part of supply chain management. Strategic sourcing is an organised and collaborative approach, which takes advantage of the size and nature of government spending to obtain the best possible service and value from selected suppliers (National Treasury 2015:44). Procurement is a strategic, systematic process of ensuring that maximum value is delivered to the organisation, through identification and selection of suitable and competent suppliers, negotiating, contracting, conducting supply market, fostering supplier measurement and system development (Handfield, Monczka, Guinipero & Patterson 2011:8).

According to Tutuka and Saruchera (2015:154), supply chain management consists of procurement incorporate purchasing, renting, leasing or acquisition of any product and service. It includes all functions that pertain to the process of acquisition, selection and solicitation of supply sources, preparation and award of contracts and all stages of supplier contract administration. Hanks, Davies and Perera (2008:1) emphasise that procurement can also be viewed as the combined functions of purchasing, inventory control, transportation, receiving, inspection, storekeeping, and salvage and disposal operations. As such, the procurement best practices emerged as purchasing advanced from being a tactical function to a strategic level of supply chain management (Dlamini & Ambe 2012:279). Components of procurement best practices have been developed over time by different scholars, which Table 2.1 shows.

Table 2.1: List of Procurement Practices

Bailey, *et al*. 2008:32	Nelson, et al. (2005: 28)	Smock, et al. (2007:7)
. Identify and work with key suppliers. . Develop openness and transparency. . Align system with strategic initiatives. . Articulate mutual goals. Forge partnerships where appropriate. . Use complementary competencies. . Employ dedicated complementary assets. . Employ appropriate technology. . Use appropriate e-technology/systems. . Share competencies and resources. . Establish common language. . Emphasise mutual benefits. . Implement kaizer. . Remove decoupling points. . Empower individuals. . Empower suppliers. . Focus on customer needs. . Pursue and eliminate waste. . Consider core/non-core questions. . Build knowledge base. . Be positive, and ready to change	. Cost management. . Supplier development. Values analysis/value engineering. . Non-traditional purchasing. . Supplier quality circles. . Training . Supplier information sharing. . Supplier conferencing. . Supplier performance reporting. . Supplier's surveys. . Delivery improvement. . Tool and technical assistance centres. . Supplier support. . Loaned executive. . Early supplier involvement . New model development group. . Written strategy for every supplier/ every part/ commodity. . Strategic planning and administration. . Career path training and academic outreach programmes. . Purchasing systems	. Strategic sourcing. . Negotiations management. . All spend categories in scope. Risk management. . Partnership with suppliers. . Supplier recognition. Collaboration with suppliers. Contract management and supplier- centric strategies. . Cost reduction planning/tracking. . Budget adjustment to preserve cost reductions. . Consortium buying. . Low cost country sourcing. . Asset recovery. . Selective outsourcing.

Source: Dlamini and Ambe (2012:279)

According to Mahmood (2010:103), the procurement of best practice is increasingly being recognised as significant drivers for successful management of public resources, where some countries have become more aware of its importance. Organisations that have improved from transactional purchasing to supply chain management level have adopted procurement best practices (Dlamini & Ambe 2012:279). Procurement best practices encompass a set of

approaches and practices that effectively integrate with suppliers, manufacturing, distribution and customers to improve the long-term organisational performance and their supply chain (Sukati, Hamid, Baharun & Yusoff 2012:227). Mofokeng and Luke (2014:1) add that procurement activity should be directly linked to organisational goals, management plans and stakeholders' expectations.

2.2.2 The objectives of supply chain management in public sector

Active governments are concerned about improving the standard of living of its citizens through ensuring access to essential services, such as health, education, water and sanitation, electricity and transport. Amann, Roehrich, Ebig and Harland (2014:352) agree that the public sector is responsible for providing a vast diversity of products and services which directly influence sustainable and socially responsible issues. Bolton (2006:2) further confirms that a government can use its procurement power to promote social and policy objectives by promoting the development of historically disadvantaged people. According to Ambe and Badenhorst-Weiss (2012:244), public procurement was established to fulfil the government's responsibility of ensuring that the public's needs are realised through the delivery of goods and infrastructure, such as roads, harbours, services, health care and education to the population of a country, or a specific geographic region, city or town.

Public procurement is essential to the delivery of public services, and as such it must be used as a strategic tool to enhance performance and the quality of services (Dzuke & Naude 2015:2). Monczka et al. (2008:109) state that the main objective of public procurement is to use public funds efficiently and provide service delivery through the use of competition. Arlbjørn and Freytag (2012: 204) assert that public sector's objective includes the effective delivery of essential services to the public. Bergman and Lundberg (2013:75) add that the ultimate goal of public procurement is to obtain an optimal combination of high quality and low prices through competitive bidding, low transaction costs and an absence of corruption and favouritism. As such, supply chain management in the public sector is about ensuring that goods and services are procured at the best possible cost, benefits are realised from private sector specialist expertise while promoting transparency, protecting public funds and ensuring that corrupt activities are dealt with effectively.

Arrowsmith (2010:4) posits that the objectives of public procurement are realised through various ways as attention has turned to ways in which it can be used as a tool for achieving a range of goals, including sustainability, promoting innovation and regional economic growth

(Amann *et al.,* 2014:353). According to the United Nations Development Programme (UNDP) (2006:1), public procurement plays a critical role in measuring government's performance, which is measured through service delivery. Service delivery success is achieved through effective public procurement.

Procurement systems in South Africa promote government objectives, which are secondary to the primary aim of procurement such as using it to support social, industrial or environmental policies (Dlamini & Ambe 2012:278). Section 217 of the Constitution of the Republic of South Africa Act No 108 of 1996n stipulates the primary and broad secondary procurement objectives, as indicated in Table1. In South Africa, there are a number of State Owned Enterprises (SOE's) to address government objectives. SOEs are critical to the growth of the economy and the development of the country's strategic sectors, especially energy, transport, telecommunications and manufacturing (Fourie 2014:30). The following table sets out the public procurement objectives as stated in the constitution:

Table 2.2: Public procurement objectives in South Africa as set out in the Constitution

Objective	Description	Reference
Primary	Procurement system to be fair, equitable, transparent, competitive and cost effective	Section 217(1)
Secondary	Procurement policy may provide for: 1. categories of preference in the allocation of contracts and 2. the protection or advancement of persons, or categories of persons, disadvantaged by unfair discrimination	Section 217(2)

Sources: Pauw and Wolvaardt (2009:67); Watermeyer (2011:3)

Section 217(3) of the Constitution requires that national legislation prescribes a framework within which the preferential procurement policy must be implemented. The PFMA 76[4] permits the National Treasury to make regulations or issue instructions applicable to all institutions to which the Act applies concerning "the determination of a framework for an appropriate procurement and provisioning system which is fair, equitable, transparent, competitive and cost-effective" (Watermeyer 2011:3).

2.2.3 The implementation of supply chain management in public sector

Public sector supply chain management is a concept that offers a reference framework for the composition of public sector supply chains and multilevel networks (Migiro & Ambe 2008:231). Public procurement refers to the government activity of purchasing the goods and services needed to perform its functions (Arrowsmith, 2010:1; Moeti 2014:141). Hommen and Rolfstam (2009) add that public procurement is "the acquisition (through buying or purchasing)

of goods and services by government or public organisations." Public sector supply chain comprises some activities which support the service delivery of government entities, with basic needs at the forefront followed by the need for improved infrastructure. According to Ambe and Badenhorst-Weiss (2012:244), public procurement is broadly defined as the purchasing, hiring or obtaining by any contractual means, goods, construction works and services by the public sector. It involves the purchase of commodities and contracting of construction works and services if such acquisition is effected with resources from state budgets, local authority budgets, state foundation funds, domestic loans or foreign loans guaranteed by the state, foreign aid and revenue received from the economic activity of the state. To deliver the activities within the public sector supply chain, several stakeholders are involved. Migiro and Ambe (2008:231) confirm that there are different stakeholders involved in the public sector supply chain. These actors comprise (1) private firms which receive orders from public sector agents, (2) accounting officers, and (3) policy-makers.

Developing and sustaining procurement best practice is not an easy task for organisations due to the time needed, which also entails breaking down barriers in internal resistance, demands a new approach to suppliers and considerable investment in ethical leadership, people, training, analysis, measurable and technology (Booth 2010:70). In 2001, the National Treasury completed a joint Country Assessment Review (CPAR) with the World Bank to assess procurement practices throughout the public sector (National Treasury 2005). Reforms in public procurement in South Africa were initiated to promote the principles of good governance. The reform processes were established as a result of inconsistency in policy application, lack of accountability and support structures as well as a huge concern that the procedures are fragmented (Ambe & Badenhorst-Weiss 2012:242).

In the public sector, government institutions have implemented different supply chain management practices. In the health sector, for example, the focus may be more on logistics and the effective movement of goods and services in and out of hospitals, whereas supply chain management in the education sector may focus on streamlining the chain to ensure that students and teachers receive study materials (Migiro & Ambe 2008:231). In South Africa, the democratic government in 1994 inherited a model of procurement, which was centralised in that the Department of State Expenditure managed the tendering process. The disadvantage with the centralised tendering process is that there was an administrative delay, which is a cumbersome process (Moeti 2014:143).

The CPAR identified specific deficiencies in current practices relating to governance, interpretation and implementation of the PPPFA and its associated regulations (Ambe & Badenhorst-Weiss 2012:245). The shortfalls compelled the authorities to robustly establish practices that are efficient and effective (Dlamini & Ambe 2012:282). According to Mkhize 2004) and Migiro and Ambe (2008:231), the deficiencies led the provincial treasuries, in conjunction with the National Treasury, to vigorously embark on a reform initiative to introduce best procurement practices that are efficient and effective. Based on this, supply chain management was introduced in the South African public sector. In 2003, a supply chain management document entitled "Supply Chain Management: a guide for accounting officers/authorities" was developed. (National Treasury 2005:5). The adoption of a supply chain management document entitled "Policy to guide uniformity in procurement reform processes in government" was to replace the outdated procurement and provisional practices in municipalities. The Supply chain management: a guide for accounting officers of municipalities and municipal entities was also compiled to provide guidelines on the adoption of the integrated supply chain management function and its related managerial responsibilities assigned to accounting officers in terms of sections 62 and 95 of the MFMA (Ambe & Badenhorst-Weiss 2012:246).

The procurement reform processes are embedded in section 76(4) (C) of the Public Finance Management Act (PFMA) and the Preferential Procurement Policy Framework Act (Act No 5 of 2000) (PPPFA) (SAMDI 2005). The Regulations in terms of the PFMA (PFMA Regulations) have been promulgated and the Supply Chain Management Regulations (PFMA supply Chain Management Regulations), in particular, make provision for the implementation of supply chain management systems by organs of state (falling within the Regulations) for the acquisition of goods and services and the disposal and letting of government assets. The Regulations provide that supply chain management systems implemented by organs of state must comply with the principles of fairness, equity, transparency, competitiveness and cost-effectiveness. The procurement of goods and services must further take place either by way of quotations or through a bidding process and must be in accordance with the threshold values as determined by the National Treasury (Bolton 2006:5).

This section analysed literature on supply chain management in the public sector in general. Issues that were outstanding in the segment include (1) supply chain management definition and background, (2) government responsibility towards its citizens, (3) objectives of supply chain management in the public sector, and (4) stakeholders within supply chain management

in the public sector. It is therefore clear that supply chain management is an essential function in the public sector.

2.3 SUPPLY CHAIN MANAGEMENT IN THE GLOBAL PUBLIC SECTOR

This section gives an overview of supply chain management in the global public sector by discussing its overall view, outlining the general steps of the procurement process and the legislative framework applicable to its supply chain. The section then concludes by addressing the challenges associated with public sector supply chain management globally.

2.3.1 Global public sector overview

A public sector that is not functioning well affects the overall economic performance through its direct contribution to the goods and services (Stevens 2006:65). Since the 1970s, public sector organisations throughout the world have been undergoing a series of progressive transformations. In other countries, these transformations have taken place at both the state and federal levels. The majority of reforms at both levels have been aimed at opening up the public sector, increasing effectiveness and efficiency, and reinforcing the concept of merit in recruitment and promotion (Dann 1996:28). According to the UN's World Economic Situation and Prospects 2013 mid-year update report released in May 2013 (UNDESA & UNCTAD 2013), global economic growth is likely to remain below potential for some time (Fourie 2014:31). Global economic growth is linked to the continuing situation of scarce employment opportunities. Dzuke and Naude (2015:2), define public services as services that are funded with public money and are delivered by or on behalf of the government. According to Fourie (2014:30), the public sector worldwide needs to respond to a changing environment to meet the demands resulting from globalisation, growing consumer expectations and increased physical demands.

The public sector consists of government departments and public entities, such as roads and transport services, communication systems and health services. These entities provide goods or services to the public (Institute of Internal Auditors 2011) and are provided through public procurement. In Australia, the public sector covers a variety of government-owned and controlled organisations, which include the public or civil service, statutory corporations such as government-owned financial institutions and other non-statutory government bodies, which are controlled by other government institutions. As stated by Dann (1996:28), the Australian public sector does not include any privately owned or run organisations, even if they are government subsidised or partially government controlled, such as charitable organisations.

Dzuke and Naude (2015:3) confirm that the Zimbabwe public sector organisations are made up of ministries, departments or other divisions of government or statutory bodies, and local (both urban and rural) authorities, which is in line with the Procurement Act (Chapter 22:14) (Act No. 2 of 1999) Section 2 (b) (c). In the UK public sector, public procurement is divided between a central government, which reports to cabinet ministers, and local government, which comprises some 375 councils in England and Wales, reporting to around 21,000 elected councillors (Waterman & McCue 2012:512), whereas in the EU public sector, the European Union and central government can have different priorities than local authorities. Local governments are caught between responsibilities to voters, who live and vote in their region or community, as well as duties for regional development. According to Lindskog, Breger and Brehmer (2013:40), the EU public sector must also comply with EU and central government policies that do not always correspond to specific local community interests.

2.3.2 Supply chain management in the public sector around the world

The procurement function has been conventionally referred to as an administrative function, often subordinated to the finance department by the public sectors (Baily, Farmer, Crocker, Jessop & Jones 2008:5). As part of the efforts to adopt a long-term and strategic view of country's procurement needs and management, most countries have resorted to using their annual procurement plans as a possible problem solver (Mahmood 2010:103). According to Mofokeng and Luke (2014.1), proper procurement management practices in public entities lead to better public service delivery and reduction in fruitless and wasteful expenditure.

The composition of the public sector differs from country to country, but generally, it is composed of such services as the provision of education, healthcare services, communication and postal services, power generation and distribution, and water and sanitation, amongst others (Dzuke & Naude 2015:2). The public supply chain division is increasingly recognised as an essential department that plays a vital role in the successful management of public resources. One primary goal of public procurement through competitive tendering is to increase public sector (cost) efficiency, reducing costs while keeping quality constant or getting higher-quality service at the same cost as before (Hansson & Holmgren 2011:368). Figure 2.1 shows the general approach to procurement adopted by countries around the world.
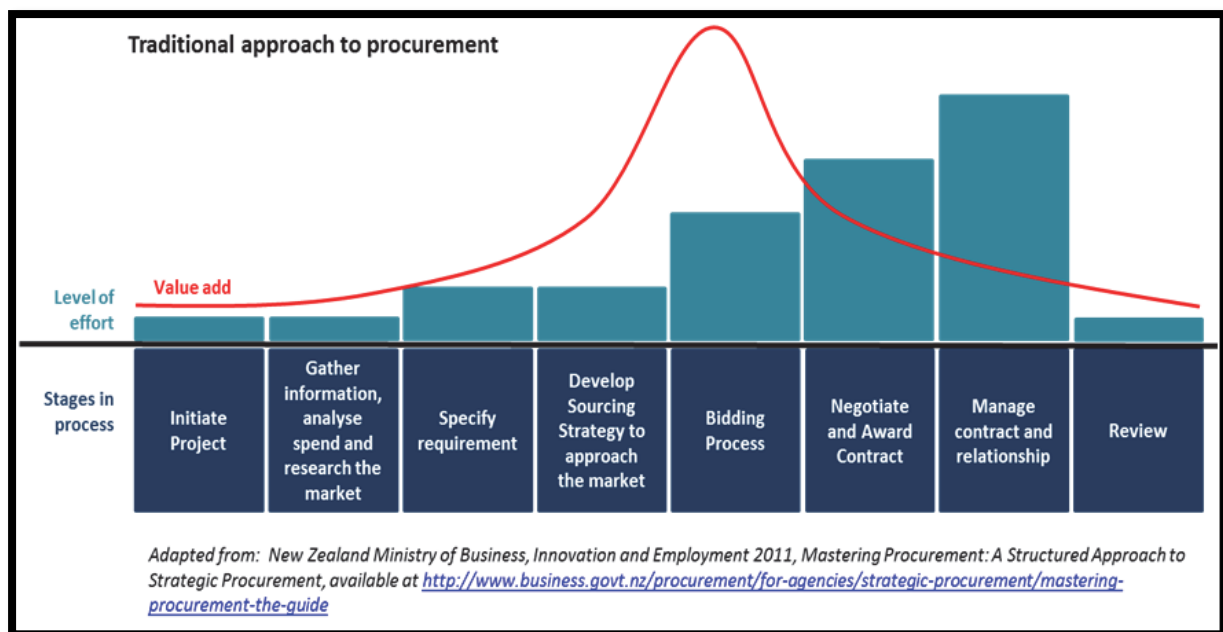
Figure 2.1: Procurement steps

Source: National Treasury (2015:37)

Open, transparent and non-discriminatory procurement is generally considered to be the best tool to achieve "value for money" as it creates competition among suppliers (Waterman & McCue 2012:507). As a result, the public procurement process has generally been intended as an inflexible process narrowly aimed at non-discrimination, cost efficiency and the achievement of transparency goals. But according to Amann *et al.* (2014:353), public procurement has the potential to influence markets regarding production and consumption trends considering its economic significance to the public sector. Bergman and Lundberg (2013:74) declare that public procurement is a process with some steps that start with the identification of needs via the design of the tender process, choice of supplier selection methods and a scoring rule for evaluating tenders and contracts design, post tender and contracting. Dzuke and Naude (2015:1) explain public procurement as the process by which public sector organisations, ministries, parastatals and local authorities acquire goods and services. Such goods and services include standard items such as stationery; standard to more complex expenditures such as the construction of roads; and critical services to citizens such as education. As such, some countries have become increasingly aware of the significance of procurement as an area vulnerable to mismanagement and corruption and have thus made an effort to integrate procurement into a more strategic view of government efforts (Munzhedzi

2013:282). With the realised importance of public procurement, the public procurement process in most countries is becoming aligned with the rest of its functions although the process is slow.

Public procurement has important economic and political implications. Therefore it is crucial to ensure that the process is economical and efficient. This requires in part that the whole procurement process should be well understood by all stakeholders: government, the procuring entities and the business community/suppliers and other stakeholders, including professional associations, academic bodies and the general public (Ambe & Badenhorst-Weiss 2012:245). Following Lindskog *et al.* (2013:36), the primary stakeholders in public procurements are:

- **Politicians.** Politicians are elected by citizens and responsible to them for their decisions and initiatives. Their voters evaluate politicians' achievements in the next election.

Their political decisions depend on their party's current policy.

- **Central government.** They formulate visions and take overall responsibility for the whole country. The execution of policy is delegated to authorities.
- **Local government.** They are responsible for a local authority, community or region.

Additionally, they are responsible for a geographically bounded area including support for local companies that employ their voters, who make up the tax base for local governments, which in their turn deliver services to citizens and local businesses.

- **Public agency.** The authority's overall goal is to deliver the best possible service at the lowest cost.
- **Public agency management.** Management is responsible for the running and administration of an agency and its decision making.
- **Procurement department.** The procurement department is responsible for the purchasing activities of an agency.
- **End-users/employees.** End-users are employees that will use the specific function, service or equipment that is procured.
- **Citizens and businesses.** The general public, citizens and businesses are the agencies' "customers".
- **Companies participating in the tendering process.** Companies that respond to the Request for Proposals and prepare offers.

The United Nations view public procurement as an overall process of acquiring goods, civil works and services, which includes all functions from the identification of needs, selection and solicitation of sources, preparation and award of contract and all phases of contract administration through the end of services contract or the useful life of an asset (Tabish & Jha 2011:261). The public sector provides services to the benefit of the overall society and normally provide such services to the public or its citizens regardless of an individual's ability to pay for the services (Dzuke & Naude 2015:2). According to Lindskog *et al.* (2013:36), public procurement meets not only purely serviceable and economic goals but also political goals that can involve societal, environmental or other political issues. Examples of such goals are new EU directives that impose a procuring organisation to specify and take into consideration environmental and social requirements that are harsher than the national law which private companies follow.

Dlamini and Ambe (2012:277) assert that procurement plays a key role in contributing to the bottom line of any organisation because it involves monetary resources. A considerable proportion of all purchasing activities on any national market is due to public procurement and has great importance for the economy of any country (Lindskog *et al.,* 2013:35). Public procurement is of significant importance in the economic development of any country, especially for countries that are still developing, particularly in respect of projects involving infrastructure and telecommunication (Bolton 2006:1). A study by the Center for International Trade, Harvard University (2011) estimates that government procurement typically represents about 15 percent of country's GDP. According to Waterman and McCue (2012:506), if the 15 percent of the world's GDP is approximately USD65 trillion, then the government across the globe spent around USD10 trillion in 2011.

2.3.3 Legislative framework applicable to public sector supply chain management around the world

The sovereignty of a state's economy and economic development is governed by various international laws, agreements and practices (Fourie 2014:31). The public procurement process is represented by a set of rules, policies and procedures that specify how government procurement activities are supposed to run. Public procurement is one of the most frequent types of transactions between organisations, in this case between public and private ones. All sorts of transactions follow specific laws that regulate the rights and obligations of all parties involved. All parties involved in public procurement have to adhere set rules and regulations applicable to their particular country (Lindskog *et al.,* 2013:36).

Increasingly, organisations are required to operate within strict guidelines. This has been so especially regarding their supply chain management through a call for improvement in adhering to ethical principles and driving out any potential malpractices (Chartered Institute of Purchasing and Supply [CIPS] 2014:1). Due to the increasing levels of corruption, a clear and comprehensive regulatory framework for the conduct of public procurement is a vital requirement for reducing corruption or other maladministration in public procurement (Tabish & Jha 2011:263). The laws and regulations in the public sector procurement around the world revolve around the objective of government, which is to accomplish increased efficiency (Hansson & Holmgren 2011:368).

A study by Dzuke and Naude (2015:2) state that many countries have improved procurement laws and regulations to enhance transparency and accountability. Tabish and Jha (2011:263) affirm that a legal framework based on publicity, transparency and a supervisory mechanism for awards of public contracts will contribute to preventing corrupt practices in public procurement. The introduction of proper ethical conduct such as the International Code of Ethics and Purchasing Practices and the King Code of Corporate Practice and Conduct is to ensure that procurement professionals act ethically in the procurement processes and there is accountability for all actions. Tukuta and Saruchera (2015:158) confirm that the International Code of Ethics and Purchasing Practices applies to many countries. Koma (2009:453) also proclaims that the King Code of Corporate Practices and Conduct applies to all companies with securities listed on the JSE, bank, financial and insurance entities, as well as public sector entities.

According to Waterman and McCue (2012:512), public procurement operates in an environment that tends to be highly regulated. The Government Procurement Agreement proclaimed by the World Trade Organization (WTO) applies to public authorities across the world. However, the differences in the legal framework in different countries affect the implementation and results of the public procurement process and service delivery. For example, the application of a separate legal framework in Zimbabwe, South Africa and EU affect service delivery in different ways. In Zimbabwe, public procurement is centralised at the State Procurement Board (SPB). According to the Procurement Act (chapter 22:14) Section 5(1)(2) (Zimbabwe Government 1999), the mandate of the SPB is to regulate and manage the public procurement process in all government ministries, public entities and local authorities in line with public procurement law (Dzuke & Naude 2015:1). In South Africa, public procurement has been granted constitutional status and is recognised as a means of addressing

past discriminatory policies and practices (Munzhedzi 2013:282). Public procurement in the EU countries is based on the principles from the Treaty of Rome regarding the free market within the EU and has to follow five fundamental principles (Lindsko *et al.,* 2013:37).

- **Non-discrimination** – all discrimination based on nationality or by giving preferences to local companies is prohibited.
- **Equal treatment** – all suppliers involved in a procurement procedure must be treated equally.
- **Transparency –** the procurement process must be characterised by predictability and openness.
- **Proportionality** – the means of assessing offers must have a natural relation to the supplies, services or works that are being procured.
- **Mutual recognition** – the documents and certificates issued by the appropriate authority in a member state must be accepted in the other member states

2.3.4 Supply chain management challenges associated with public sector around the world

The ability of government to deliver public services is a key determinant of quality of life and problems for all countries. Improving and maintaining public service delivery is one of the most significant challenges for all countries. The problem is predominantly in Africa, where historically the quality of service provision has been poor, and the needs of the poor continuously increase. However, globally, the public sector is facing pressure to deliver more effective and efficient public services to citizens despite a multitude of socio-economic and global challenges that governments are facing (Dzuke & Naude 2015:2). According to Fourie (2014:30), the problem for every government is to build a growing economy consisting of suitable infrastructure and logistics, competitive input prices, skills, technology and innovation and partnerships, efficient regulation and useful government offerings.

Although new policy initiatives in several major economies have reduced systemic risks and have assisted in stabilising the consumer, business and investor confidence since late 2012, these initiatives have contributed only marginally to economic growth (Fourie 2014:31). Prajogo and Sohal (2013:1533) identify five significant trends in supply chain management that contribute to the success of an effective supply chain management to be:

1. strategic relationship management with suppliers;
2. strategic cost reduction;
3. integrated systems and collaboration;

4. greater focus on total cost in supplier selection; and
5. strategic versus tactical purchasing orientation.

According to Chiboiwa, Samuel and Chipunza (2010:2912), lack of good corporate governance leads to high labour turnover; this is spread over all sectors of the economy, thereby negatively affecting national economic growth and stability. According to the National Treasury (2015:53), public supply chain management performance is weakened by institutional practices which include the following:

- Poor alignment between strategy, demand management and supply chain management planning.

- Poor decision-making about sourcing strategies.

- Lack of aggregation of procurement transactions.

- Poor bid specifications.

- Improper bid evaluation and adjudication.

- Poor contract management.

- Insufficient supplier performance management.

The World Bank has identified corruption as among the greatest hindrances to economic and social development. Corruption undermines development by distorting the rule of law and weakening the institutional foundation on which economic growth depends. While organisations have internal controls that seek to produce a kind of stability and certainty by binding individuals within a system of governance, individuals can always subvert such systems for personal gain (Sikka & Lehman 2015:63). Internal controls are viewed as ways to prevent and detect corrupt procurement practices (Neu, Everett & Rahaman 2015:51). Thornhill (2012:140) defines corruption as:

> offering or granting, directly or indirectly to a public official or any other person, of any goods of monetary value, or other benefit, such as a gift, favour, promise or advantage for himself or herself or for any other person or entity, in exchange for any acts or omission in the performance of his/her public functions.

Corruption sabotages policies and programmes that aim to deliver services to the poor, which in turn will reduce poverty (Tabish & Jha 2011:262). Bolton (2006:2) mentions that corruption further undermines the attainment of value for money in government contracting, the fair treatment of contractors and the use of procurement as a policy tool. Tabish and Jha (2011:262) add that corruption can increase as much as 25% cost to the total cost of ownership in public

procurement, unavoidable generating waste in public resources, missed development opportunities, an unstable environment for businesses, and therefore increasing poverty. De Lange (2011:1) agrees that significant monies are wasted each year as a result of poor management of public procurement policies.

Lindskog *et al.* (2013:38) state that the most important source of conflict in the public procurement arena arises from following policies and promoting political goals rather than minimising the total cost of ownership of goods and services sourced. Typical examples of these political goals include environmental and social requirements, as well as support for disadvantaged social groups, such as minorities or disabled persons. Despite a strong economic policy framework, in many countries, including South Africa, job creation and productivity growth remain too low to underpin the rapid and sustained GDP per capita growth that is required (Fourie 2014:30).

Public procurement is prone to corruption, and as such, there is a growing need for procurement systems to be able to fight corruption and improve the effectiveness, efficiency, fairness and transparency of public procurement (Tabish & Jha 2011:261). Some efforts have been made in the past by different institutions to reduce corruption and bring fair practices into public projects at various levels. According to Sikka and Lehman (2015:63), almost all countries prohibit the use of corrupt practice to secure government contracts, and considerable efforts have been made to regulate public procurement activities. Despite the attempts made to fight corruption, it has reached the highest level and is regarded as the leading challenge for management thought and practice in the 21st century (Pearce *et al.* 2008).

This section analyses literature on supply chain management in the public sector around the world and gives an overview of supply chain management in the public sector from a global perspective. The section further gives an in-depth analysis on (1) the different supply chain management processes adopted by different sectors within the public sector around the world, (2) procurement steps, and (3) applicable legislation in the public procurement around the world, Corruption, which is identified as a global challenge is also analysed. The highlighted issues analysed in this section confirm that different countries have their policies, laws, administration and regulations, but face similar challenges.

2.4 SUPPLY CHAIN MANAGEMENT IN THE SOUTH AFRICAN PUBLIC SECTOR

This section analyses literature on supply chain management in the South African public sector. Issues that are discussed include an overview of South Africa public sector, supply chain management in the South African public sector, legislative framework applicable to the South African public sector, and conclude by outlining procurement challenges associated with the South African public sector.

2.4.1 Overview of the South African Public Sector

South Africa's economy like any other economy has been under significant pressure because of external demand conditions and domestic challenges that have been through drastic changes over the years. According to the Public Service Commission report "The rationalisation of public administration in the Republic of South Africa, 1994-1996", the public sector was structured differently to what it is today. The report further highlighted the different challenges with the structure, which demanded change. Before 1994, South Africa was structured as per the table below.

Table 2.3: The list of administration and departments prior to rationalisation

Administration	Departments	Total
Republic of South Africa		53
1. Central administration	37	
2. Provincial administration	16	
Independent (TBVC) states		80
1. Transkei	20	
2. Bophuthatswana	26	
3. Venda	16	
4. Ciskei	18	
Self-governing states		62
1. Gazankulu	9	
2.KaNgwane	10	
3. kwaNdebele	10	
4. KwaZulu	13	
5. Lebowa	10	
6. Qwaqwa	10	
Total		195

Source: Public Service Commission Report "The Rationalisation of Public Administration in the Republic of South Africa. 1994-1996.

Today, the country has a population of approximately 51 million. The country's nominal GDP is estimated at R814 billion, according to figures released for the first quarter of 2013. This is nearly R1 billion less than the fourth quarter of 2012 (Fourie 2014:31). The country is divided into nine provinces, namely, Gauteng Province, Limpopo Province, Free State Province, Kwazulu Natal Province, Northern Cape Province, Eastern Cape Province, Western Cape

Province, Mpumalanga, and North West Province. The South African public sector is also divided into three spheres as stated in the constitution, which is, the National Government, the Provincial Government and the Local Government (Department of Public Services and Administration 2003:14-15).

The PFMA lists approximately 300 public organisations consisting of nine (9) constitutional institutions, twenty one (21) major public entities, hundred and fifty three (153) national public entities, twenty six (26) national government business enterprises, seventy two (72) provincial public entities, and eighteen (18) provincial government business enterprises. Constitutional institutions are listed as Schedule 1 organisations, major public bodies as Schedule 2 organisations, and the remainder as Schedule 3 organisations (Fourie 2014:33).

2.4.2 Supply chain management in the South African public sector

In South Africa, the public sector provides services that benefit the society at large (Dube & Danescu 2011:1). In 2013/14, the South African public sector spent R500 billion on goods and services and construction works (National Treasury 2015:3). These supported and enabled the delivery of services to the country's residents. Public sector procurement is estimated to amount to approximately 14% of gross domestic product (GDP) (Bolton 2006:1). Before the birth of democracy in 1994, unfair and discriminatory public procurement policies in South Africa preferred large and established businesses to small businesses (Dlamini & Naude 2012: 282). Immediately on taking office in 1994, the government initiated a series of budgetary and financial reforms (National Treasury (2004:1). Since then, there has been significant progress in the implementation of such transformations.

According to Hansson and Holmgren (2011:368), public procurement in South Africa is done through a tendering process, where the use of private contractors engaged through procurement is common in most public sector areas. The public supply chain management cycle has three key stages: pre-tender, tendering, and post-tender. The pre-tender stage includes needs assessment, planning and budgeting, development of specifications and selection of the most suitable procurement strategy. The tendering stage consists of the invitation to tender, evaluation and adjudication of bids. Post-tender includes contract management, ordering and payment (National Treasury 2015:16). Figure 2.2 presents the essential elements of the public sector supply chain management system and shows how policies, procedures and systems support supply chain management processes.
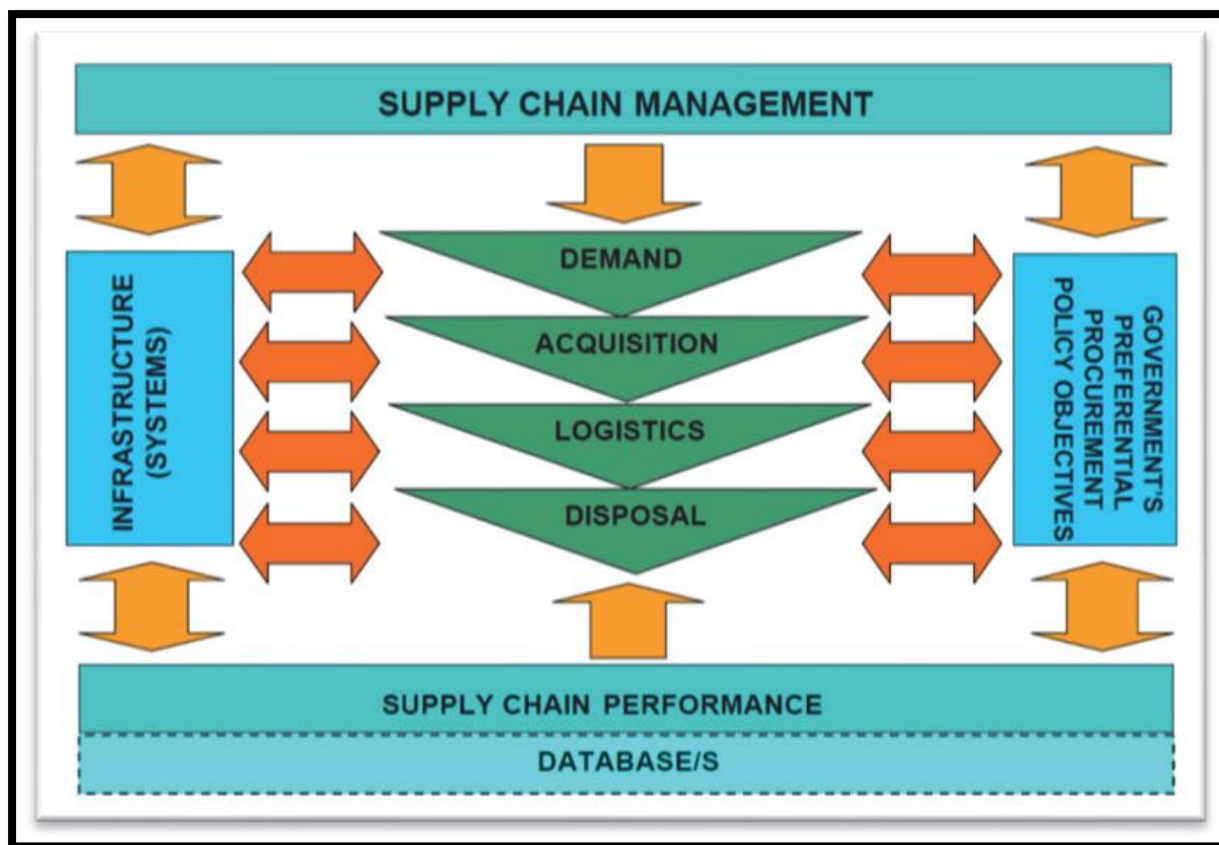
Figure 2.2: The generic elements of supply chain management
Source: National Treasury (2012)

Government is investing in large-scale projects related to water, transport, electricity, telecommunications and infrastructure at an estimated cost of approximately R3,2 trillion by 2020 (DPE 2012:3). According to Ismail, Mabuza, Pillay and Xolo (2014:570), public infrastructure spending started in the early 1980s. However, from the mid-1990s, the government began to increase capital spending, with a sharp rise after 2003 as the South African government's fiscus allowed it to do so. Infrastructure development and management are crucial for efficient development within a society and are the cornerstone of socio-economic development (Mutheiwana 2014:1).

Public procurement is made possible through the spending of public funds via the budget as allocated by the minister of finance. Public funds are collected through taxes and must be spent in a transparent and accountable manner. Ismail *et al.* (2014:570) emphasised that expenditure mostly emanates from non-financial public enterprises such as state-owned enterprises (SOEs) (with Eskom and Transnet accounting for the most substantial proportion), followed by the

provincial and local government. Figure 2.3 presents the South African public procurement spend on infrastructure for the financial year 2011/2012.
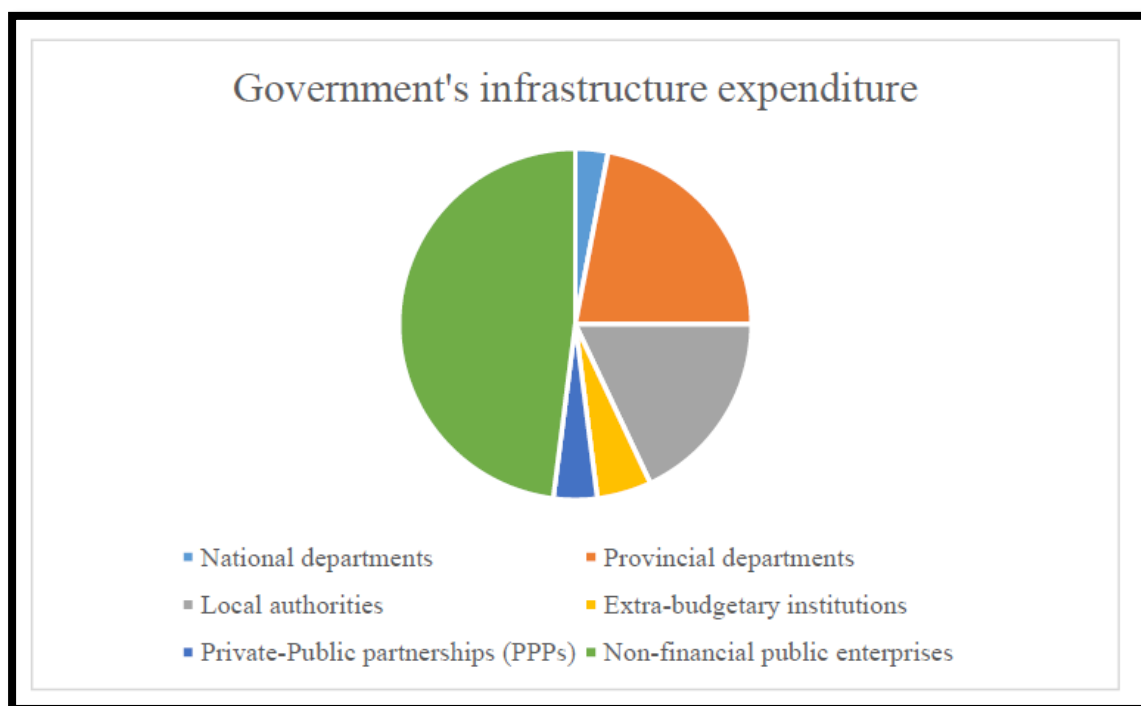
Figure 2.3: Government's infrastructure spending (2011/12 fiscal year)

Source: National Treasury (2012)

The Department of Economic Development (2010:3) confirms that investment in infrastructure is made through the budgetary power of the government as demonstrated through the New Growth Path. "Infrastructure refers to all basic inputs into and requirements for the proper functioning of the economy". Examples of infrastructure include telecommunication, bridges, schools, roads, transport, ports, electricity, piped water supply and sanitation (Mutheiwana 2014:1). According to Fourie (2014:34), government investment in infrastructure can contribute effectively to increased investment by users of that infrastructure, to opportunities for infrastructure equipment suppliers and benefits supporting peripheral economic initiatives and developmental opportunities, such as the increased use of railway infrastructure as opposed to road transport networks.

2.4.3 Legislative framework applicable to the South African public sector

Policies are important for any organisation as they provide principles and procedures or guidelines that should be followed when carrying out certain activities (Monczka, Handfield, Giunipero, Patterson & Waters 2010:136). Policies provide uniformity on how specific

processes are managed. The South African legislative framework underpinning public sector procurement is aimed at empowering the previously disadvantaged and allows flexibility to individual public institutions to facilitate efficient service delivery (Ababio, Vyas-Doorgapersad & Mzini 2008:3). Procurement is deemed to be of particular significance in the public sector in that it has been used as a policy tool to address the discriminatory and unfair practices during apartheid (Munzhedzi 2013:282).

In terms of section 217 of the Constitution of the Republic of South Africa, when government contracts for goods and services it must do so in a way which is fair, equitable, transparent, competitive and cost-effective. Also, the supply chain management system must provide for the advancement of persons or categories of persons disadvantaged by unfair discrimination. These are the cornerstones of South Africa's public sector procurement system (National Treasury 2012:3). Unlike other countries, South Africa's public procurement system is embedded in the South African Constitution. However, organs of state (national and provincial departments, municipalities, constitutional entities and public entities) may implement procurement policies that provide for categories of preference in the allocation of contracts and the protection or advancement of persons or categories of persons disadvantaged by unfair discrimination (Bolton 2008:782). Other pieces of legislation also govern procurement which is executed by the different organs of state.

According to Munzhedzi (2013:285), all the legislative measures, including the legislative framework, incorporate five core principles of behaviour or Five Pillars of Procurement upon which the entire supply chain management policy of effective and efficient municipal and government procurement is based, are:

• **Value-for-money**: refers to cost-effectiveness in the procurement system by providing value-for-money services, for example, the avoidance of unnecessary costs and delays for a department or its suppliers, as well as the monitoring of contracts, to make sure they provide the anticipated benefits.

• **Open and effective competition:** refers to the transparent, standardised and easily available laws, policies, practices and procedures that came into place. The practice must be open to public scrutiny.

• **Ethics and fair dealings**: refers to honest dealings with all suppliers, abolition of prejudices, the elimination of fraud and corruption, as well as the non-acceptance of gifts or hospitality that could compromise the good standing of a municipality or the state.

• **Accountability and reporting** refer to the accountability of all concerned through openness and transparency. Everybody including politicians and administrative officials must be held accountable.

• **Equity** refers to the advancement of persons or categories of persons previously disadvantaged by unfair discrimination. The Preferential Procurement Policy Framework Act, 2000 (Act 5 of 2000) seeks to ensure the government's commitment to preferential procurement, economic growth by supporting industry. More specifically it seeks to ensure that small, medium and micro enterprises (SMMEs); historically disadvantaged individuals (HDIs); the creation of opportunities for women and the physically disabled, as well as support for procuring local products (Horn & Raga, 2012:78).

Procurement transformations in South Africa started after 1994 and were directed at two broad focus areas, namely, the promotion of principles of good governance and the introduction of a preference system to address specific socio-economic objectives. According to Bolton (2008:783), National Treasury is empowered to issue guidelines and instructions in the form of practice notes or circulars to all institutions under the public sector on various issues relating to procurement to ensure uniform minimum norms and standards within the Government. National legislation, in the form of the Preferential Procurement Policy Framework Act (Procurement Act), and has been enacted to provide a framework for the implementation of such policies. Table 3 summarises the Acts and their functions in procurement practices in South Africa.

Table 2.4: Primary Acts that regulate procurement

Act	What it does in respect of procurement
Public Finance Management Act 1 of 1999	Establishes a regulatory framework for supply chain management, which includes procurement in national and provincial departments and state-owned enterprises.
Promotion of Administrative Justice Act 3 of 2000	Establishes fair administrative procedures, permits those affected by unfair administrative action to request reasons for such administrative action and requires administrators to respond to such requests. (Administrative actions are presumed to have been taken without good cause where an administrator fails to respond within the prescribed period). Provides for procedures for the judicial review of administrative actions and remedies in proceedings for judicial review, including the prohibition of an administrator from acting in a particular manner, setting aside the administrative action, correcting the defective action and ordering the administrator to pay compensation.
The Promotion of Equality and the Prevention of Unfair Discrimination Act 4 of 2000	Prohibits the state or any person from discriminating unfairly against any person on the grounds of race or gender through the denial of access to contractual opportunities for rendering services or by failing to take steps to reasonably accommodate the needs of such persons.
Preferential Procurement Policy Framework Act 5of 2000	Establishes the manner in which preferential procurement policies are to be implemented.
Construction Industry Development Board Act 38 of 2000	Establishes the means by which the Board can promote and implement policies, programmes and projects, including those aimed at procurement reform, standardisation and uniformity in procurement documentation, practices and procedures within the framework of the procurement policy of government, through the establishment of: 1. a national register of contractors (and if required, consultants and suppliers) to manage public sector procurement risk and facilitate public procurement; 2. a register of projects above a financial value with data relating to contracts awarded and completed and a best practice project assessment scheme; 3. best practices establishes a code of conduct for the parties engaged in construction procurement.
Broad-based Black Economic Empowerment Act 53 of 2003	Establishes a code of good practice to inform the: • development of qualification criteria for the issuing of licences or concessions, the sale of state-owned enterprises and for entering into partnerships with the private sector; and • development and implementation of a preferential procurement policy.
Local government: Municipal Finance Management Act 56 of 2003	Establishes a regulatory framework for supply chain management which includes procurement in municipalities and municipal entities.
Prevention and Combating of Corrupt Activities Act 12 of 2004	Makes corruption and related activities an offence; establishes a Register in order to place certain restrictions on persons and enterprises convicted of corrupt activities relating to tenders and contracts; and places a duty on certain persons holding a position of authority to report certain corrupt transactions.

Source: Watermeyer (2011:3)

Law prescribes procurement processes. While this promotes uniformity in the public sector procurement practices, it does not necessarily guarantee excellence or even success (Mofokeng & Luke 2014:2). Public tender processes are regarded as administrative processes, but once the tender is awarded the parties conclude a contract, which will govern their relationship going forward. The South African constitution also provides that the public administration must be governed by the principles enshrined in it including, amongst others, the principle of accountability (Roos & Harpe 2008:9). Bolton (2008:783) adds that the courts have held that the solicitation, evaluation, and award of public tenders amount to "administrative action" within the meaning of the constitution.

As the years evolve, there is a tendency to include more and more political goals into public procurements, such as environmental and societal considerations (Linskog, Breger & Brehmer 2013:35). Following Arrowsmith (2010:1), there are two main ways to approach policies of realising political goals through public procurement:

- policies can be limited to securing compliance with legal requirements, and those that go beyond; and
- policies applied only to the contract awarded and those that go beyond.

2.4.4 Supply chain management challenges associated with the South African public sector

Public procurement operates in an environment of increasingly intense scrutiny driven by technology, programme reviews, and public and political expectations for service improvements (Eyaa & Oluka 2011:35). O'Regan (2012:1) highlights that South Africans do not trust the procurement processes in the public sector. The Auditor General's report (2008:2) indicates that there is a doubt that public sector processes will achieve the constitutional procurement goals (Mofokeng & Luke 2014:1). Supply chain management across South Africa is highly fragmented, which is evident in the different approaches by public and private sectors. It is difficult for the government to obtain maximum value when buying and making use of goods and services (National Treasury 2012: 3). Public procurement space (materials, equipment and services) is to a large extent decentralised to departments, provinces and municipalities. The number of cases of tender fraud and lack of services on all levels of government raises the question as to whether the parties have the knowledge and intention to get the best value for tax-payers money (Ambe & Badenhorst-Weiss 2012:253).

The Constitution (Republic of South Africa 1996) and the General Procurement Guidelines (National Treasury 2003b), permit institutions in the public sector to give preference in the allocation of contracts to previously disadvantaged persons. It further allows all service providers that do not qualify for preferential points to partner with qualifying service providers, which should result in the development of previously disadvantaged service providers. This process is aimed at promoting fairness and balance in the appointment of service provider although it involves some challenges. According to Hansson and Holmgren (2011:368), to fulfil the unique condition as prescribed in the Constitution, public officials are tempted to give preferential treatment to special interests. Bolton (2006:2) further adds that both contractors and public officials may resort to corrupt practices for either personal or political reasons. Linskog *et al.* (2013:36) also point out that deregulation of former monopolies has a considerable effect on public procurements.

According to Medzi (2013:282), fraud and corruption activities cost South African taxpayers hundreds of millions of rand each year as fruitless and wasteful expenditure. To give context to this, the South African government spent over R26.4 billion in 2010 in ways that contravened laws and regulations including corruption (Smart Procurement 2011). Many countries have transformed procurement laws and regulations to improve transparency and accountability (Lisa 2010). Roos and Harpe (2008:4) state that public institutions' failure is the cause of weak economic performance. The National Treasury (2015:57) affirms that a well-performing supply chain management function is critical to achieving the strategic objectives and goals of any government institution.

Thornton (2012:107) points out that the lack of availability of a skilled workforce is one of the critical constraints to the expansion of business operations in South Africa. A study by Heyns and Luke (2012:107) confirms that the shortage of skills in South Africa is frequently cited as one of the key features inhibiting growth in the country's economy. These, according to Sharp 2011:1), pose a significant limitation on the country's long-term economic growth potential. Due to a lack of needed skills, including managerial, professional and technical skills, viable economic opportunities cannot be productively tapped.

Policy is also at the centre of challenges in the South African public sector. The National Treasury (2015:11) highlights the unclear legal status of the different regulatory instruments for general and specific procurement practices, such as the supply chain management instruction on norms and standards for general public procurement. Also, industry-specific

standards such as the defence industry's armament procurement instruction standards, and SITA's procurement instruction standards, codes and guidelines for ICT procurement also pose challenges in the South Africa public sector. This splintered legal framework creates uncertainty about which of these diverse instruments takes legal precedence in regulatory interpretation when public procurement cases are disputed in court.

This section analyses literature on supply chain management in the South African public sector and gives an overview of it in the public sector from a South African perspective. The section further provides an in-depth analysis on (1) the number of civic organisations in South Africa, (2) the significance of SOE's in infrastructure, (3) South African expenditure on public procurement, and (4) policies and regulations applicable to the South African public procurement. It is therefore clear that public procurement plays an essential role in the South African public sector.

2.5 CONCLUSION

This chapter aimed to review the literature on supply chain management in the public sector. Several themes emerged. First, the review of the existing literature revealed that there is a general agreement between academics, practitioners and politicians regarding the description and characteristics of the public sector and public sector supply chain management. The literature further revealed that the sovereignty of a state's economy and economic development is governed by various international laws, agreements and practices, which have a direct influence on supply chain management activities in the public sector. Furthermore, the literature indicated that the employment of procurement best practices has important economic and political implications for the public sector. However, despite this importance, public procurement is vulnerable to corruption, maladministration and mismanagement, which is a common trend throughout the world. It also emerged from the literature that although South Africa has not performed well in addressing fraud, corruption and financial misconduct over the years, its government has established the office of the chief procurement officer at the National Treasury to among other things address challenges associated with government procurement activities. The chapter further highlights corruption to be the key element in the incompetence of poor societies to take advantage of development opportunities as it hurts the poor the most. The next chapter discusses literature which focuses on supply chain risks.

CHAPTER 3
SUPPLY CHAIN RISKS

3.1 INTRODUCTION

This chapter discusses literature on supply chain risks. It focuses on literature on supply chain risks in general and in the public sector as well as noting certain characteristics of supply chain risks. It further discusses the selected sources of supply chain risks associated with public sector supply chain management, namely: government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency. Issues that receive attention include the supply chain policies proposed by the government, the relationship between policy and politics and the consequences of supply disruption in the public sector. Skills shortages, the importance of supplier performance management, limitations in forming building relationships with suppliers, the role of security in the supply chain and the flow of information in the public sector supply chain also receive attention in this study. These discussions are necessary because the study is aimed at categorising supply chain risks that affect the public sector.

3.2 OVERVIEW OF SUPPLY CHAIN RISKS

This section focuses on the nature of supply chain risks, characteristics of supply chain risks, and lastly the implementation of supply chain risk management. The section further discusses the different types of supply chain risk and also places emphases on the background and importance of supply chain risk management.

3.2.1 The nature of supply chain risks

Organisations used to operate in the context of a market that was prepared due to the scarcity of the available goods (Grigore 2009:70). However, the increase in market competition, rising costs, increased globalisation of manufacturing, supply and distribution contribute to the ever-increasing importance of effective supply chain management to reduce costs, maintain acceptable service levels and, most importantly, reduce and mitigate uncertainty. Today, the supply chain is the part of an organisation that is most severely affected by unknown changes (Prater, Biehl & Smith 2001:824). Highly complex supply chains, due to the vastness of data, decision variables, intricate interrelationships, system constraints, and performance trade-offs present many challenges for management in arriving at sound business decisions (Manuj & Sahin 2011:512). A study by Tang and Tomlin (2008:12) validates that long and complex global supply chains are usually slow to respond to changes. Hence, they are vulnerable to business

disruptions. Faster and cost-efficient supply chains have provided an operational environment vulnerable to disturbances that can rapidly escalate from localised events to significant disruptions (Cedillo-Campos, Perez-Salas, Bueno-Solano, Gonzalez-Ramirez & Jiminez-Sanchez 2014:685).

While there is an acknowledgement that today's supply chain is complex and vulnerable, Jutter, Peck and Christopher (2003:3) proclaim that the concept does not have a precise meaning. Uncertainty in the supply chain environment is one of the critical external driving forces instrumental in the development of supply chain management (Betts & Tadisina 2009:4). Its execution demands the control of information, material, and cash flows across multiple functional areas both within and among organisations (Lockamy III 2014:756). According to APICS (2016:1), supply chain management incorporates a wide range of very significant and inherent risks and opportunities. Heckmann, Comes and Nickel (2015:119) posit that as the number of supply chain uncertainty's increase, the importance and attention assigned to risk must also grow.

Supply chain risks relate to an occurrence of an event where the affected organisations are unable to cope with the consequences (Kull & Closs 2008:1158) and have a direct impact to the country's economy. According to Cedillo-Campos *et al.* (2014:685), supply chain risks can damage the country's economy and have the potential to affect other country supply chains involved in the chain. Current literature about supply chain risks describes several meanings of supply chain risks, and it is clear that there is not an explicit or unified description. Lockamy III (2014:757) define risks as the probability of variance in an expected outcome. Wu, Blackhurst and Chidambaram (2006:350) classified a broader set of supply chain risks as internal and external, as well as by the level of controllability, Hunter *et al.* (2004) classified risks based on their probability and importance, which is very similar to the classification based on probability and impact in Hallikas, Karvoenen, Tuominen, Pilkkinen and Virolainen (2004:47). Zeng and Berger (2005:143) divide risks based on their origins from capacity limitation, technology incompatibility, supply disruptions, currency fluctuations or disasters, while Tang (2006:451) divides risks into either operational and disruptions. A more general definition comes from Heckmann *et al.* (2015:122) who define supply chain risks as "anything that disrupts or hinders with the information, material or product flows from original suppliers to the delivery of the final product to the ultimate end- user". Revilla and Saenz (2014:1124) add that disruption is an unplanned and unanticipated situation in comparison with usual demand-supply coordination risks.

3.2.2 Characteristics of supply chain risks

In the past, supply chain risks were generalised as those in line with their impact to the business. According to Sindhuja and Kunnathur (2015:480), supply chains consisted of three subsystems, namely, internal supply chain management, customer relationship management, and supplier management. Internal supply chain is under the full control of the organisation, while customer relationship and supplier management require collaboration with partners upstream and downstream of the supply chain to avoid disruptions. However, Revilla and Saenz (2014:1125) insist that supply chain risks are derived from industrial (or the market), operational and environmental ones. Their study led to the common understanding that the most relevant drivers of supply chain risks are: the market, supply chain discontinuity, natural hazards, and the economic context. Another study done by Clemons and Slotnick (2016:171) caution the integrating of supply chain risk sources into four, as it may lead to confusion in identifying the correct reliable source. According to APICS (2016:1), organisations have become preoccupied with risks such as international terrorism, security, natural disaster, SARS and are overlooking at the more ordinary day to day supply chain risks sources which include:

- variety of supply interruption risks;
- demand and supply planning and integration risks;
- purchase price risks;
- inventory and obsolescence risks;
- regulatory and compliance risks;
- information privacy and security risks;
- customer satisfaction and service risks;
- contract compliance and legal risks;
- process inefficiency risks;
- employee and third-party fraud risks;
- product introduction and cycle time risks;
- human resource skills and qualifications risks;
- project management risks;
- corporate culture and change management risks; and
- information integrity and availability risks.

The nature of the relationship between an organisation and its environment is controlled by its external environment (Sindhuja & Kunnathur 2015:480). There is a general assumption that

supply chain risks are associated with the loss of monetary value. APICS (2016:1) affirm that supply chain risks apply to activities within the organisation as well as outside it - at suppliers, suppliers' suppliers and outward at its customers and their customers' customers. Heckmann *et al.* (2015:123) emphasise that supply chain risk should reflect the potential non-achievement of corporate goals due to ineffective or inefficient supply chain processes. The characteristics of supply chain risks beyond the monetary value are shown in Figure 3.1.
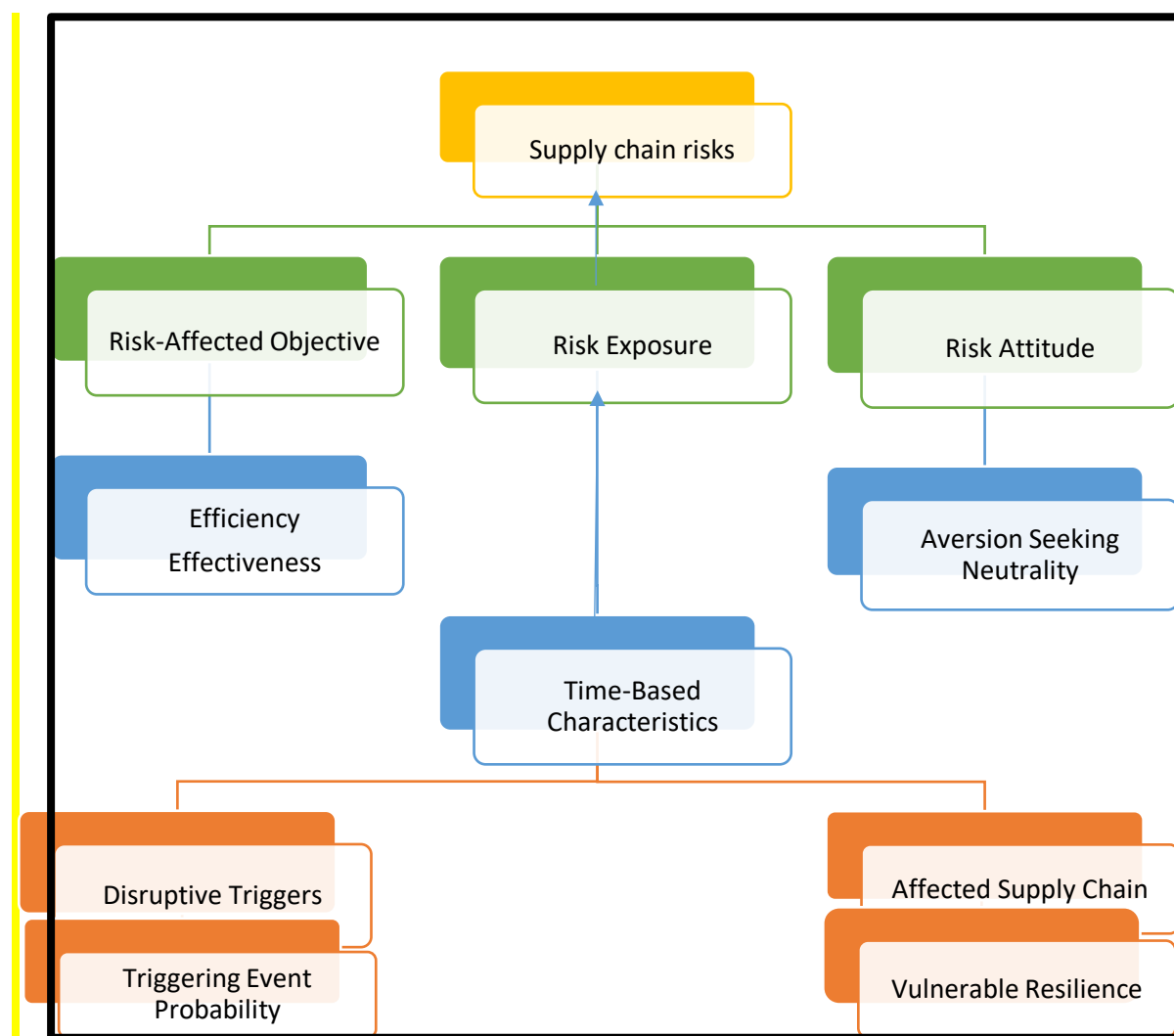
Figure 3.1: Core Characteristics of Supply Chain Risk

Source: Heckmann *et al.* (2015:121)

A recent study by APICS (2016:1) identifies the top three supply chain risk sources that are most likely to negatively affect the organisation as (1) supply interruption risk derived from supply complexity and lack of supplier performance monitoring; (2) lack of effective leadership

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by management and poor operations planning, which is a result of involvement of government policies and lack of process efficiency; (3) lack of timely and accurate information and spend analysis capability for strategic sourcing derived from availability of skills and information security.

3.2.3 The implementation of supply chain risks management

Public sector supply chain management must be able to respond quickly and effectively when faced with supply chain risks to meet customer needs (Cantor, Blackhurst, Pan & Crum 2014:208). Sindhuja and Kunnathur (2015:480) allude that the smooth functioning of the supply chain requires protection against disruptions at all levels of the supply chain such as among other things facilities' level, and information flow level or transportation of goods level (Sindhuja & Kunnathur 2015:480). To protect the smooth functioning of the supply chain, the public sector supply chain management must first identify the challenges applicable to their environment. Butner (2010:22) suggests that there are five top supply chain risks that apply to both public and private sector.

- cost containment – rapid, constant change is continually challenging supply-chain executives' ability to adapt;
- visibility – flooded with more information than ever, supply-chain executives still struggle to see and act on the right information;
- risk – risk-management ranks remarkably high on the supply-chain agenda;
- customer intimacy – despite recognising the need to be demand-driven, companies continue to be better connected to their suppliers than their customers; and
- globalisation – counterintuitively, globalisation has proven to be more about revenue growth than about cost savings.

Figure 3.2 shows the top five supply chain challenges and their impact to supply chain.
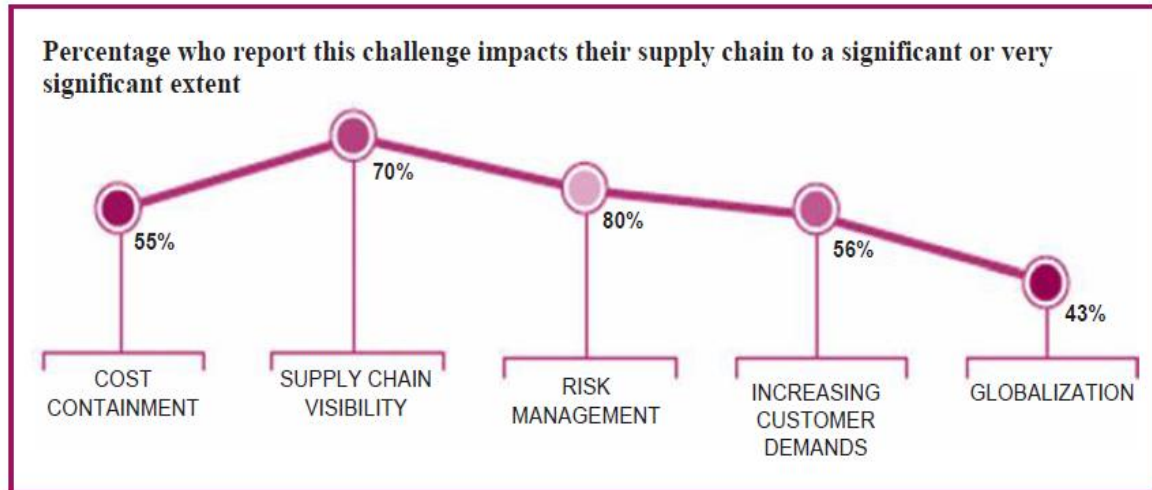
Figure 3.2: Supply chain challenges and Impact

Source: Butner (2010:22)

A firm is less likely to become vulnerable to supply chain risk so long as it has implemented management controls and capabilities to respond to risk events (Cantor *et al.,* 2014:208). However, Cedillo-Campos *et al.* (2014:686) allude that supply chain risk analysis should not focus on the specific nature of the disruption because decision-makers cannot foresee every potential threat, or neither determine how likely that threat could materialise, whereas Clemons and Slotnick (2016:170) assert that an organisation strategy to mitigate risks depends on its perception of risks. Whereas many organisations operating in both the private and public space have developed contingency plans to address potential points of vulnerability, it remains the organisation's supply chain employees who often, without much warning, must make decisions on how to best react, or not react to potential supply chain risks (Cantor *et al.,* 2014:159). Public sector regulators are responsible for ensuring that supply chain employees in the public sector supply chain management are empowered and equipped to make informed decisions on supply chain risks. Butner (2010:22) asserts that supply chain management executives are finding it increasingly difficult to respond to challenges in the supply chain, especially with conventional supply chain strategies and designs.

Senior managers are expected to reduce the firm's exposure to uncertainty through the deployment of effective risk management strategies (Lockamy III 2014:757). These mitigation activities provide the firm with a set of strategies and policies that can be used to eliminate or reduce the exposure to loss in the supply chain, whereas risk mitigation plans provide the firm with information that can be helpful to assess the current level of risk that exists with the firm's

supply base (Cantor *et al.,* 2014:207). According to Clemons and Slotnick (2016:171), there are five categories for dealing with supply chain risks, namely: proactive, coping, aligning, early warning, and survival strategies. He, Huang and Yuan (2015:296) further mention that the emergency procurement strategy and the optimal allocation procurement strategy are widely used for managing supply disruption risks. However, APICS (2016:7) indicate that many best practices in supply chain management and procurement are also best practices in risk management. Fenz, Heurix, Neubauer and Pechstein (2014:414) assert that there are specific tasks that the public sector needs to follow to mitigate supply chain risks. These tasks include the following:

- identifying the threat sources relevant to organisations;
- identifying the events that could be produced by those sources;
- identifying the vulnerabilities that could be exploited;
- determining the likelihood of occurrence of threat events and their success rate;
- determining the adverse impacts organisations need to face; and
- assessing the information security risks as the combination of the likelihood of threat exploitation of vulnerabilities and the impact of any uncertainties associated with the risk determination.

This section analyses literature on supply chain management risks in general. Issues that were outstanding in the section include (1) supply chain management risks overview; (2) the nature of supply chain management risks; (3) characteristics of supply chain management risks; and (4) the implementation of supply chain management risks management in the public sector. The section has identified several sources of supply chain risks and further aligned and consolidated them into six sources relevant to the public sector supply chain.

3.3 SOURCES OF SUPPLY CHAIN RISKS

This section discusses different sources of supply chain risks in depth. They are supply complexity, supplier performance monitoring, government policies and lack of process efficiency, availability of skills and information security. Attention is given to the characteristics of the sources and their drivers from a public sector point view.

3.3.1 Government Policies

Government procurement has constitutional status, as the procurement of goods and services are governed by section 217 of the constitution, which stipulates explicitly the manner in which the state must contract for products and services. Ambe and Badenhorst-Weiss (2012:246)

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confirm that supply chain management operates within a regulatory framework set by the national government and extended by provinces and local government bodies to specific policies, legislation and regulations. Kumar and Kumar-Tewary (2007:5) stated that it is a regulatory norm that government prescribes on how businesses operate. Such laws affect all public organisations. The Preferential Procurement Policy Framework Act (Act No 5 of 2000) (PPPFA) and its associated regulations dictate how public organisations must manage their supply chain. The PFMA (76[4] permits the National Treasury to make rules or issue instructions applicable to all institutions to which the Act applies concerning "the determination of a framework for an appropriate procurement and provisioning system which is fair, equitable, transparent, competitive and cost-effective" (Watermeyer 2011:3). However, National Treasury (2015:4) alludes that public sector supply chain management has the challenge to find the best balance between the two primary objectives of procurement. Section 217 (2) of the constitution and the Preferential Procurement Policy Framework Act (PPPFA) both provide for the use of public procurement as a means of development and transformation.

Practices of public procurement are never separate from the political field in which the business of government is embedded (Neu *et al.,* 2015:51). According to Braman (2011:4), the law comes from the government, and it is within this context that a conclusion can be made that policymaking is included in the politics of a country which is, in turn, the government. Mead (2013:392) points out that political analysis can provide a perspective on policy because goals that are sufficiently difficult to be realised politically may call for policy argument into question. Pastor and Veronesi (2012:1219) further emphasise that both economic and non-economic objectives motivate government's policy-making decision: it maximises investors' welfare, as a social planner would, but it also takes into account the political cost (or benefit) incurred by changing the policy. Government policies constitute a significant risk to public sector supply chain management as they are unpredictable, more often contradict supply chain management best practice and are often made to the benefit of the political party in power.

Public policy is the cornerstone of service delivery in the public sector. According to National Treasury (2015:4), policies and regulations are often confusing and cumbersome. Supply chain professionals are unable to interpret and apply some of them while suppliers also do not keep up with the ever-changing policies and procedures. Public procurement operates in an environment of increasingly intense scrutiny driven by technology, programme reviews, public and political expectations for service improvements (Eyaa & Oluka 2011:35). Therefore, it is of paramount importance that the government align their policy with service delivery

expectation. According to Pastor and Veronesi (2012:1219), there is a level of uncertainty about what the government is going to do, as well as uncertainty about what the effect of its action is going to be. Moen and Riis (2010:1261) affirm that history shows that unlikely parties usually undertake critical political reforms. Effective policy-making requires information on whether governments are doing things right and whether they achieve the results intended (Acevedo, Rivera, Lima & Hwang, 2010:80).

In a conference held by Smartprocurement, Estelle Setan in her address acknowledged that National Treasury is aware of the shortcomings of government's existing public procurement processes (Smartprocurement 2014:1). She alluded that the auditor general has identified supply chain management as one of six key risk areas in government. Compliance to supply chain policy is a significant factor as it results in irregular, a wasteful and fruitless expenditure that contribute to the challenges faced by public procurement. A report by Business Day (2011) alludes that procurement actors in government have spent millions of rand in ways that contravened laws and regulations. The national and provincial governments and their entities have notched irregular, unauthorised, fruitless and wasteful expenditures that violate laws and regulations (Ambe & Badenhorst-Weiss 2012:252). Compliance with public supply chain management rules, legislation, norms and standards are critical to ensure that government's policy objectives are attained. To reduce waste, eradicate corruption and improve public sector performance, ethics, integrity, transparency and accountability need to be strengthened (National Treasury 2015:15).

3.3.2 Supply complexity

Despite some appearances of sophistication, performance improvements and predictability, consistency, and agility, supply chains today are still extremely fragile and exposed to interruptions of all kinds (APICS 2016:21). Supply complexity is one of the major challenges for organisations. When supply and demand are not stable and balanced, it causes supply complexity. Blome *et al.* (2014:308) suggest that supply complexity is characterised by a dynamic supply market, unreliable suppliers, and an unreasonably high number of suppliers with whom business is conducted. Clemons and Slotnick (2016:170) define supply complexity an event where a supplier unexpectedly fails to deliver goods or services where the unexpected disruptions happen during normal activities as opposed to ongoing problems of coordinating supply and demand. Revilla and Saenz (2014:1125) also define supply complexity as the failure by the main supplier to deliver goods or services, whereas Jutter *et al.* (2003:7) refer to supply risks like the possibility and effect of a mismatch between supply and demand.

Goods not delivered on time and services that take time to complete is common in the public procurement hence the ever-increasing outcry of service delivery by citizens. Clemons and Slotnick (2016:169) point out that even with ample warning, public organisations cannot always prevent loss or disruption of services. Supply complexity can occur primarily as a result of the controlled and uncontrolled event. While controllable supply complexity is predictable, it remains high risk for public organisations. According to APICS (2016:21), controllable supply complexity includes supplier failures (Technical or financial), supply and demand fluctuations, power failure, labour disputes and so on, whereas, uncontrollable supply complexity refers to all unforeseen events such as natural disasters, climate change, and terrorist attacks (He *et al.,* 2015:296). More controllable and predictable supply interruption risks continue to challenge management, which includes supplier failures (technical or financial) that can occur at any point or level in the integrated supply chain. Other risks include demand and supply fluctuations that result in the allocation of supply and different outcomes and channels, or other supply line interruptions resulting from foreseeable labour disputes (APICS 2016:21).

Madadi, Kurz, Mason and Taaffe (2014:105) argue that supply complexity is costly and has tragic consequences in spite of their low probability of occurrence. Clemons and Slotnick 2016:170 also confirm that supply complexity is costly and the loss of goods or services can affect an entire supply chain. A study by He *et al.* (2015:296) indicates that numerous strategies have been introduced to mitigate supply complexity. An example of such a strategy includes dual-sourcing, emergency sourcing, backup supply, demand management. However, there is no consensus that the strategies are effective. Cantor *et al.* (2014:203) assert that an organisation can leverage its joint planning activities with the supply base to mitigate supply chain risk. Zhu (2015:191) supports the dual sourcing strategy where an organisation can have different supply sources that have different grades of reliability regarding the quantity and quality of orders delivered, but he raises the issue that multiple suppliers may come with various supply uncertainties. Tang and Tomlin (2008:13) adopted the strategy of reducing the number of suppliers and insist that managing a small number of suppliers is more efficient, although they also indicate that this can increase supply risks.

Supply complexity is a risk that originates from buying blindly and saving cost. Through a tender system, a public organisation awards a contract based on the tender response that meets the set criteria as per the tender document issued to the market. Clemons and Slotnick (2016:169) highlight that planning is the most effective strategy to mitigate or prevent a loss

of supply, but APICS (2016:21) argues that mitigating supply risks goes beyond planning and indicates that the best practice to address supply risks is to have contractual contingency plans and supply sources,

3.3.3 Availability of skills

Due to the ever-changing business environment, resources that have historically sustained an organisation's competitive advantage in business may no longer be practical (Moon, Yi & Ngai 2012:191). Skills shortages vary from country to country, but common threads appear in that many countries have failed to educate their indigenous workforce in a manner that produces the skills demanded by the production sectors in the countries concerned (Heyns & Luke 2012:108). South Africa, like many other developing countries, is faced with unemployment challenges but still experience skills shortage. The mismatch between the qualification and skills an individual possesses and the qualification and skills required to get and do the job right is a serious concern in the labour market. According to Zieminski (2009), employers are looking for more specific skills, which lead to a mismatch between supply and demand. Heyns and Luke (2012:107) proclaim that the lack of availability of a skilled workforce is cited as one of the key constraints to the expansion of business operations in South Africa. Prajogo and Sohal (2013:1534) further confirm that the availability of skilled resources is the most critical and more important than physical infrastructure, information and communication structure. In principle, a country that is not able to create employment for its people shouldn't at the same time have trouble in filling critical vacancies.

Skill is defined as the ability to carry out the tasks and duties of a job in a competent manner and the ability gained by practice or knowledge within the workplace (Tassabehji & Moorhouse 2008:57). However, Martinaitis (2014:200) asserts that skills are sometimes confused with two other terms, namely, "qualifications" and "competence". The confusion stems from the fact that skills are unmeasurable and also acquired through education (qualification) and on the job training (competency). However, Sutherland (2012:620) argues that qualifications constitute a measure of educational attainment and academic competence. Futcher, Schroder and Von Solms (2010:371) insist that competency is more than just knowledge and skills because it requires the ability to meet complex demands in a particular context. Hall, Sarkani and Mazzuchi (2011:156) further add that competency refers to differentiated knowledge, skill, ability, distinctive organisational processes, and other characteristics needed to perform a specific task. Martinaitis (2014:200) states that competence refers to motives, traits, self-concepts, attitudes or values, content knowledge or cognitive or behavioural skills and any

individual characteristics that can be shown to differentiate significantly between superior and average performers. OECD (2005) also points out that competency is when an individual contributes value to society and assists other individuals to meet demands in a wide variety of contexts.

Heyns and Luke (2012:109) declare that in South Africa a national skills list is produced periodically to determine the types of skills that identify areas that require interventions either regarding education and training drives or recruitment of scarce foreign skills. However, the competencies that individuals need to meet their goals have become more complex and require more than the mastery of specific narrowly defined skills (Futcher *et al.,* 2010:366). The department of education (DoE) is responsible for regulating education in South Africa (Futcher *et al.,* 2010:367). The availability of skilled resources, therefore, would be possible as soon as the DoE, through higher educational institutions, start developing a curriculum that meets the limited skills needed in the country. While the DoE plays a critical role in closing the gap of availability of skills, Baron (2011:31) alludes that organisations can assist by taking the responsibility to assess its human resource needs and set initiatives to ensure that skills are available to match strategy requirements.

Skills required for a specific job change over time due to new initiatives that get introduced such as new technology, policies and regulations. Supply chain practice as a profession has experienced rapid changes over the past two decades and evolved from tactical buyers to strategic supply chain managers (Wu, Steward & Hartley 2010:817). According to National Treasury (2015:52), supply chain management skills and knowledge in the public sector is lower than in the private sector due to some factors such as:

- there is competition for skilled supply chain management staff between the public and private sectors;
- the public sector does not sufficiently regard supply chain management as a strategic function;
- the negative image of public sector supply chain management makes it difficult to attract the right skills; and
- institutional cultures need to change to attract, develop and retain talent, and offer attractive and appropriate career paths.

A decade ago supply chain executives "rarely reported directly to the CEO and the function was somewhat removed from the concerns of top management" (Groysberg *et al*., 2011:66;

Roh, Krause & Swink 2016:48). However, Manuj and Sahin (2011:512) confirm that supply chain managers have found their roles to be evolving into managing more complex supply chains that are defined by rapidly changing, continuously expanding and often uncertain business environments. Supply chain management function plays an influential role in the creation of competitive advantage because it controls most of the resources, structures, and capabilities that either support or impede strategic initiatives and objectives (Roh *et al.,* 2016:49). As such, it is essential that supply chain professionals adjust and reconfigure themselves to achieve a balance between the responsiveness of their organisations and changes in the marketplace by increasing their flexibility in all operational activities (Moon *et al.,* 2012:191).

As supply chain management becomes strategically important, understanding the useful interpersonal skills becomes more important in recruiting, mentoring, and training supply chain managers (Wu *et al.,* 2010:817). In 2003, the government issued a policy strategy to guide uniformity in procurement reform, which included standard procurement objectives and procurement officers' expected behaviour (Mofokeng & Luke 2014:3). Tassabehji and Moorhouse (2008:59) identified and classified procurement skills into five groupings with the aim of addressing the gaps. The below figure lists their categorisation:
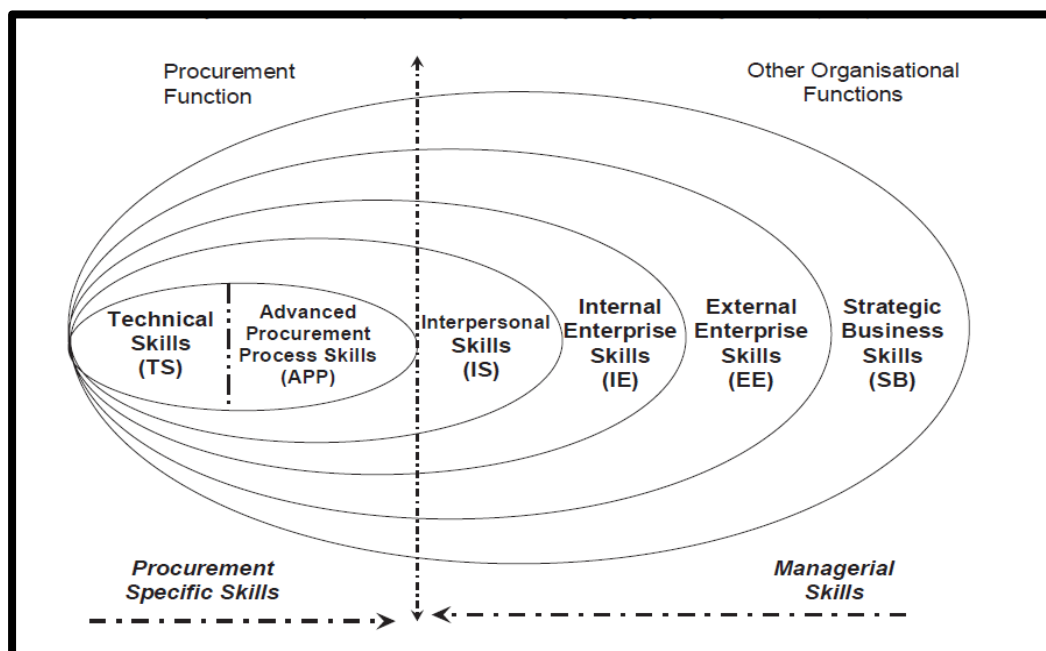
Figure 3.3: Categorisation of skills types required for procurement

Source: Tassabehji and Moorhouse (2008:60)

In 2015, the National Treasury (2015:5) confirmed that supply chain management practitioners frequently do not have the skills, knowledge and experience that they need to execute their duties in the public sector supply chain management. According to Heyns and Luke (2012:113), today's supply chain requires high levels of communications, teamwork and the ability to see the big picture; it is fast moving, which requires strong decision-making and changes management skills; it is cross-functional, which requires the ability to think outside the box and look at processes rather than functional silos; it is highly sophisticated, which requires all of these skills as well as high levels of integrity, problem-solving capabilities and leadership.

There are some issues that could be considered to enhance competency in the South African public sector supply chain management. It is critical that policy and decision-makers consider developing skills and knowledge through specialised training programmes, involve stakeholders in the bidding process and employ centralisation and decentralisation for different categories of goods and services. National Treasury (2015:5) suggests that for public sector supply chain management to perform, supply chain professionals must have the right skills, experience, social awareness, ethical standards and dedications; and a regulatory and organisational environment that supports and monitors their work in the public interest. Prajogo and Sohal (2013:1533) add that these supply chain professionals should be more flexible team workers with leadership abilities and possess excellent communications skills to be able to communicate across functions and organisations to promote and coordinate supply chain management, as well as manage the upward and downward communication within the organisation. Wu *et al.* (2010:819) also point out that active supply chain managers must not only perform a portfolio of roles, but they need to be able to navigate across different functions with ease and flexibility.

3.3.4 Supplier performance monitoring

Organisations have adopted new ways of doing business where they no longer use the strategy of pursuing cost and quality trade-offs to achieve the lowest possible price (Lockamy & McCormack 2004:272). The current environment in which organisations operate has changed drastically with the growth in collaboration between competitors, supply chain partners, outsourcing, integrated supply chain systems and advancement in technology and innovation (Agus 2011:134). According to Lockamy III (2014:755), when organisations increase their dependence on integrated supply chain networks, they become more vulnerable to their suppliers' disaster risk profiles as well as other risk categories linked to supply chains.

Organisations need to be aware of their supply chain capability and that of their partners so that necessary joint actions can be undertaken to address any discrepancies such as setting up appropriate policies to harmonise the capability differences for each sustainable practice (Kurnia, Mahbubur, Samson & Sigh 2014:2). While Dries, Gorton, Urutyan and White (2014:99) agree with integrated supply chain network, they also point out that supplier relationships may generate scope for opportunistic behaviour. Hence, Cantor *et al.* (2014:207) posit that organisations must continuously evaluate points of vulnerability in their supplier relationship and risk mitigation plans as a way to prevent supply chain disruptions from having a detrimental impact.

In the past, relationships with suppliers were regarded as insignificant in the overall performance of organisations. Buyers played suppliers off against one another and frequently switched suppliers (Naude, Ambe & Kling 2013:1). Suppliers perform a strategic role in an organisation of which influence the overall performance of supply chains, mainly in competitive business environments (Stouthuysen, Slabbinck & Roodhooft 2012:423). According to Wu *et al.* (2010:819), supplier performance is about how well a supplier can provide the required products to the buyer and is manifested as the operation's outcome regarding quality, delivery, responsiveness, cost, and technical support. Public sector supply chain management's success and profit realisation depend on the ability to monitor and manage their process performance as well as those of their suppliers. Supplier performance monitoring has become a necessity for public organisations to avoid the risk of fruitless and wasteful expenditure. The performance of an organisation, regarding cost, quality and delays, depends more and more strongly on its capacity to optimise its relationships with its partners and on its ability to collaborate and exchange sound information (Sakka & Botta-Genoulaz 2009:916). Effective sharing and using of information and knowledge in an integrated supply chain strengthen an organisation's capability to evaluate partners and react to disruptions (Cantorn *et al.*, 2014:203). According to Gullet *et al.* (2009:330), a relationship between a buyer and a supplier is inherently subject to conflicts and pressure, although it yields substantial benefits in the form of increased supplier responsiveness and better long-term financial performance. Supplier relationships have evolved from transactional processes based on an arm's length agreement to collaborative processes. Tukuta and Saruchera (2015:157) emphasise that supplier relationships are different from simple purchasing transactions because they require commitment from all parties. Table 3.1 presents the dimensions and characteristics required for a healthy buyer-supplier relationship.

Table 3.1: Dimensions and characteristics of the buyer-supplier relationship

Dimensions	Characteristics
Goals	Goals are shared, explicit, and clear at strategic and operational levels
Information sharing	Open and prompt two-way information sharing
Relationship structure	Multiple levels and functions are in contact. Clear communication channels. Inter-personal relationships
Coordination mechanisms	Formal as well as informal mechanisms govern the relationship
Locus of decision making	Clear decision-making process. Mandate from top management
Top management commitment	Top managers jointly support the relationship
Compatibility	Compatibility of organizational structure and management philosophy

Source: Gullet *et al.* (2009:330)

According to National Treasury (2015:5), the public sector frequently underestimates how important supplier performance monitoring is, and there is limited understanding about how public sector decisions and actions affect the overall business environment. On the other hand, suppliers often take advantage of the current weak public sector supply chain management environment. Supplier performance monitoring in the public sector supply chain management must take into account supplier performance management, supplier partnership and supplier relationship management to be successful. Mofokeng and Luke (2014:2) define performance management as a process to detect and alert performance that does not meet the standards set at strategic and operational planning stages, where supplier management is a series of coordinated activities to select suitable suppliers to enable the achievement of the public sector supply chain management goals. Performance management involves monitoring processes retrospectively to determine whether the objectives and goals have been achieved (Naude *et al.,* 2013:4). Supplier partnership requires cooperation efforts to improve supplier capabilities concerning technology, quality, delivery and cost (Al-Abdallah, Abdallah & Hamdan 2014:195).

Agus (2011:135) alludes that strategic supplier partnership is about developing trust and collaboration among supply chain partners as well as customers. Effective alliances characterised by mutual trust between organisations and their partners may facilitate more open communication, information sharing and conflict management, which are all essential for

organisational success (Mafini, Pooe & Loury-Okoumba 2016:263). Supply chain efforts involve major cultural changes such as the establishment of trust, a shift from adversarial relationships to collaboration and partnership among buyers and sellers in the supply chain (Braunsheidel & Suresh 2009:121). However, the process of developing trust between buyers and suppliers continues to be indefinable and reflects differing perspectives about ethical duties owed (Gullet *et al*., 2009:329). The public sector supply chain management's ability to trust and understand their suppliers will enable them to monitor their performance while improving supply chain performance. According to Sakka and Botta-Genoulaz (2009:914), mutual trust plays an essential role in building relationships. Trust between the buying firm and its suppliers improve cooperation, enhance satisfaction, reduce conflicts, facilitate information exchange, and lead to long-term relationships (Al-Abdallah *et al.,* 2014:194) and contributes to a reduction of opportunism from suppliers and their willingness to coordinate activities with their customers along the supply chain (Cantor *et al.,* 2014:203). Tang and Tomlin (2008:14) further emphasise that trust, and a long-term perspective are necessary for aligning interest among multiple parties within a supply chain.

Figure 3.4 shows factors that organisations and their suppliers need to assess when deciding to trust each other.
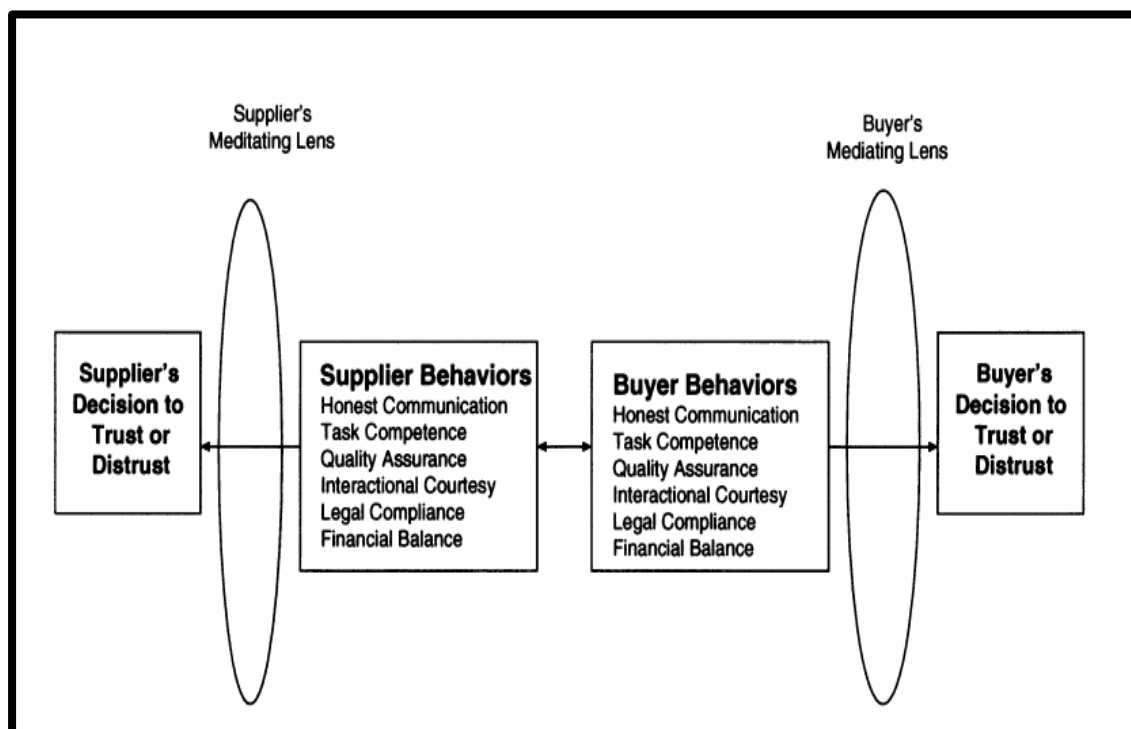
Figure 3.4: Model for buyer-supplier decision to trust or distrust

Source: Gullet *et al*. (2009:332)

Most organisations view their suppliers as partners and seek a stable relationship with comparatively few of them that can provide high-quality supplies, sustain delivery schedule and remain flexible in relations to changes in specification and delivery schedules (Naude e*t al.,* 2013:1). However, in public sector supply chain management, developing relationships with specific suppliers is frowned upon and in many instances forbidden outside a contractual relationship (Public Service Commission 2008:45). Public sector supply chain management still struggles with the risk of late or no deliveries and quality work by suppliers because there is no relationship. According to Cantor *et al.* (2014:203), these risks can be mitigated by improved teamwork, knowledge sharing and joint problem-solving. Al-Abdallah *et al.* (2014:195) support that information exchange and cooperation are pillars of supplier partnerships that lead to healthy, successful and long-term seller relationships, but argue that trust building is a costly, complicated, and time-consuming procedure.

3.3.5 Information security

Information is abundant, and connectivity is easier than ever (Butner 2010:24). Various types of information are increasingly being made available to management, investors, regulators, shareholders and other interested parties by business entities (Trites 2013:2). Public sector organisations take the lead in terms of making information available, which is in line with the public sector supply chain management requirement for transparency and high standards of ethics, for example: no suppliers must receive the same information at the same time prior or during the tender process (Public Service Commission 2008:45). In the procurement process, information for decision making (that is, management, measurement, and control information) is a fundamental capability. It is obvious that without the necessary information, even the most qualified and most skilful organisation will find it extremely difficult to manage and execute even the best-designed procurement processes successfully or to implement even the most comprehensive and aligned procurement-related strategic plans and policies (APICS 2016:16). According to National Treasury (2015:23), the public has a right to public sector supply chain management information, which must be made available in the most convenient way for accessibility. The information made available include supply chain management policy documents, government plans on supply chain management, updates on legislation through practice notes, etc. Trites (2013:2) further indicates that the information may include extracts from financial statements such as inventories or accounts receivable, data from the organisation records such as production volumes and critical performance indicators.

More and more organisations around the world regard information as a vital business asset critical to their success in today's globally connected and complex business environment (Hall *et al.,* 2011:156). The adequate flow of quality information in an organisation is of high importance as it represents a crucial value in the effectiveness of the firm's operations (Mafini *et al.,* 2016:262). Through communication and the sharing of information and ideas better outcomes are provided for stakeholders in the public sector supply chain management (Naude *et al.,* 2013:2). Stakeholders use data to make decisions, interpret and generally increase their knowledge about the subject matter (Trites 2013:3). However, the availability of information comes with risk if not managed properly. Butner (2010:24) further indicates that available information is not captured expertly, executed, analysed and made available to people who need it.

According to King III, it is the responsibility of the boards to ensure that information assets are managed effectively and should approve the organisation's information security strategy. Public sector boards are also responsible for delegating the implementation of information security and management needs to demonstrate their commitment and buy-in. According to Sindhuja and Kunnathur (2015:480), there are five top attributes for information security objectives, which are:

- confidentiality;
- integrity;
- non-repudiation;
- authentication; and
- availability.

Information security is critical for public sector supply chain management as unreliable or incomplete information can change the outcome of the process or counter the objectives of public sector supply chain management. Security is a critical issue for policymakers when designing the supply chain management process (Cedillo-Campos *et al*. 2014:684). Consequently, supply chain management processes that do not incorporate security are not likely to succeed. Sindhuja and Kunnathur (2015:481) affirm that communication networks and supply chain integration aid the proper functioning of a supply chain. Carr (2016:173) further confirms that communication in an organisation is critical for achieving a successful outcome.

Herath (2008:9) posits that information security cannot be achieved through technological tools only, and further suggests that effective organisational information security depends on three components, namely: people, processes, and technology. Coordination and collaboration among supply chain partners are brought about by a series of information-handling activities within and across organisations and largely depends on information systems to get the work done (Sindhuja & Kunnathur 2015:477). Therefore, to make sense of and function well in this world, individuals need to have the capability of working with changing technologies and be able to deal with large amounts of available information (Futcher *et al.,* 2010:366). As such, many public sector organisations have invested in Information Technology (IT) systems to record and secure information. According to Mofokeng and Luke (2014:2), an IT system provides an organisation with capabilities to capture, store and manipulate business data and serves as an internal communication tool. Jaarsveldt (2010:176) posits that IT enables the government to offer public services, provide information and execute policies more efficiently. An IT system also allows supply chain management efficiency due to reduced costs and effort by transforming procurement through automation, providing access to broader range of suppliers and helping to ensure fair and transparent competition (National Treasury 2015:63). Information technology enables six significant areas of supply chain management (Prajogo & Sohal, 2013:1535), which are:

(1) strategic planning;

(2) virtual enterprise;

(3) e-commerce;

(4) infrastructure;

(5) knowledge and IT management; and

(6) implementation.

A study by Hall *et al.* (2011:155) indicates that despite the increased investment in information security through IT, effective implementation of information security strategy remains one of the top challenges facing global organisations. According to Cantor *et al.* (2014:207), it has become critically important that organisations have access to useful real-time information to coordinate between supply chain partners. Trites (2013:4) indicates that for information to be useful, it must be prepared for a specific purpose, be accurate, relevant, complete, and available

on time; furthermore, users need to have confidence in the integrity of the information. Completeness of data needs to be confirmed to avoid risks.

The risks associated with the integrity of information are presented in Figure 3.5.
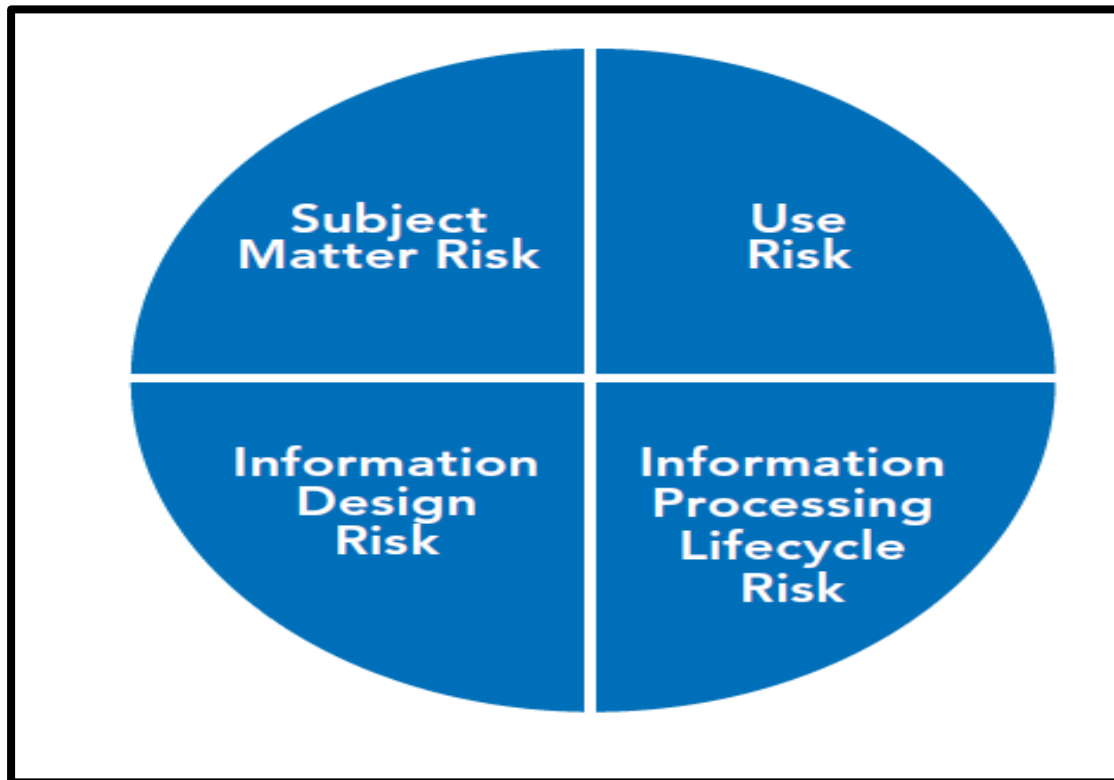
Figure 3.5: Information Integrity Risk

Source: Trites (2013:12)

According to Da Veiga (2016:140), organisations must have a written information security policy to manage information and minimise risk that comes with the availability of information. She also highlights that the policy must provide formal direction and intent of management for the protection of information in the organisation. Sindhuja and Kunnathur (2015:480) assert that information security policies of an organisation define the processes and procedures that the employee should adhere to protect the confidentiality, integrity and availability of information and other valuable assets. Da Veiga (2016:140) also adds that the information security policy directs the manner in which employees process information and establishes a baseline from which ethical decisions are made when dealing with organisational information; it influences the way in which employees interact with information assets and ultimately directs their behaviour to be compliant with legislative, regulatory and contractual requirements. An

organisation, therefore, can realise benefits from its ability to protect information and the environment in which it exists. Among these benefits are (Hall *et al.,* 2011:157):

- maintaining compliance with the law;
- preserving brand strength;
- company reputation;
- increasing customer trust; and
- Sustaining business resiliency;

3.3.6 Process inefficiency

Organisations conduct their operations through business processes designed to achieve their business goals (Ghattas, Soffer & Peleg 2014:93). A business process is commonly viewed as a set of related activities designed to produce a specific output, such as budget decision making, or procurement (Schober & Gebauer 2011:639). Processes operate in an environment of uncertainty where they must have an obligatory level of robustness to changing conditions (Wang, Mastragostino & Swartz 2016:400). Revilla and Saenz (2014:1124) indicate that organisational practice is adapted to the social context, and different practices are found across nations. In many organisations business processes are designed into the day to day operations and in other instances they go unnoticed (APICS 2016:33), although each process and decision in an organisation is prone to uncertainty (Heckmann *et al.,* 2015:119). Mofokeng and Luke (2014:2) define a process as a set of activities that when performed collectively will result in the achievement of business goals by converting specified input to the desired output. Processes include the policies, processes, procedures, methods and associated documentation which enable an organisation to achieve its objectives methodically and systematically (National Treasury 2015:30). Ghattas *et al.,* (2014:93) also indicate that business processes involve a variety of decisions, such as the selection of a route from several ones available, deciding on quantities, or assigning resources.

Processes provide the flow of information and decision points within an organisation (Mofokeng & Luke 2014:2). The managerial effort for effectively planning, implementing, and controlling the supply chain is known as supply chain decision-making complexity (Manuj & Sahin 2011:512). Decisions affect the outcome of the process and the success of achieving its goal (Ghattas *et al.,* 2014:93). Supply chain management seeks to improve the internal efficiency of the supply net of an organisation and its competitiveness concerning other enterprises through collaboration among firms for leveraging their strategic position and their

operational efficiency (Barad 2012:752). A fully coordinated supply chain management has all the supply chain decisions aligned to meet the ultimate supply chain objective, which is to provide value to the end consumers regarding products and services, and by doing so, each player acquires individual economic benefits (Sindhuja & Kunnathur 2015:477). Organisations have adopted a business process management method to structure activities carried out in their operations, analyse them for efficiency and effectiveness and also identify the potential for improvement (Schonig, Cabanillas, Jablonski & Mendling 2016:1). Process efficiency is about delivering set objectives at the best price, on time, without any form of waste while increasing profitability. A supply chain management goal can be achieved through efficiency or effectiveness. Tiwari, Tiwari and Samuel (2015:781) argue that efficiency requires bureaucracy, which can impede flexibility when an organisation is required to consider the trade-off between efficiency and flexibility. Heckmann *et al.* (2015:122) allude that effectively means that achieving a predefined goal can be guaranteed even if conditions are adverse, whereas efficiency refers to minimal pending of resources to reach this goal. It is in this context that Mofokeng and Luke (2014.2) state that procurement processes should be focused on delivering goods or services effectively.

Public sector supply chain management operates within the ambit of National Treasury. However, organisations are allowed to extend and develop their policies, systems and structures within National Treasury framework so that processes are standardised (Ambe & Badenhorst-Weiss 2012:247). According to National Treasury (2015:63), public sector supply chain management processes are weekly integrated and automated. A business process is based on four parameters, namely uncertainty, variability, time-criticality, and load (Schober & Gebauer 2011:639) as such inefficient processes pose a significant risk. Mofokeng and Luke (2014:2) allude that operations should focus on customer needs, and if public sector supply chain management processes do not meet customer needs, there is a risk to supply chain management. Supply chain management seeks to plan, monitor, and control a network of interdependent organisations that facilitate different types of flows between the original producer to the final customer with the objectives to maximise profitability through efficiencies as well as achieving customer satisfaction (Heckmann *et al.,* 2015:123). However, the National Treasury (2015:4) states that the organisational structures and systems within which public sector supply chain management takes place are in too many cases not ideal due to lack of suitable equipment, such as computers with dependable internet connections; or information, such as databases giving up-to-date details of available products and services. APICS (2016:18) further emphasise that

supply chain management function does not get the tools needed to most effectively leverage, manage, and control supply based expenditure and risks.

Supply chain inefficiencies and disruptions are common problems inhibiting the international competitiveness of emerging and transitional economies (Dries *et al.,* 2014:98). Manuj and Sahin (2011:511) allude that the key to successful supply chain management is accomplishing the effective integration of the business functions and channel members such that all processes are aligned to achieve the overall system objectives. Lockamy III (2014:756) further adds that a prerequisite to effective supply chain management is the coordination of functional and supply chain trading partner activities with organisational strategies that are aligned with its structures, core processes, management cultures, incentive systems, and human capital. According to Ghattas *et al.* (2014:93), process redesign initiatives have been proposed mainly for increasing the efficiency and providing clear and useful decision criteria. Clemons and Slotnick (2016:170) point out that many processes that improve the efficiency in the supply chain management also increase a firm's dependency on suppliers, which leaves it more vulnerable to supply disruption. Heckmann *et al.* (2015:123) also add that when efficiency is the sole objective of business processes, there is a little buffer to enable continuity or recovery in the event of a disruption. However, failing to address process risks may result in unnecessary cost and other instances reputational consequences, which will, in turn, affect the overall performance of an organisation.

This section analyses literature on supply chain management in the public sector in general. Issues outstanding in the section include: (1) the impact of government policies on public sector supply chain management; (2) the mismatch between demands and supply; (3) lack of required skills in public sector supply chain management; (4) challenges of supplier performance monitoring; (5) the role of information in public sector supply chain management; and (6) different processes adopted in the public sector supply chain. These issues are important in this study because they outline and emphasise the different risk sources that affect public sector supply chain management.

3.4 CONCLUSION

This chapter aimed to analyse literature on supply chain risk sources. The literature acknowledged that there are a lot of writings on supply chain risks. Supply chain risks are categorised into many forms based on their impact on the organisation's performance. The research also dwelt on the nature and characteristics of supply chain risks, which were

discussed in detail. Also highlighted was the role of the private sector in public sector supply chain management and the risks associated with building relationships and partnering. It emerged that in the public sector the lack of clarity about the roles and responsibilities of technical people and political appointments remains a topical issue. Hence there is interference, which ultimately affects the much-needed service delivery in South Africa. The literature further revealed that South Africa, like the rest of the world, lacks the required skills needed to competently manage the public sector supply chain management, while also dealing with the massive problem of unemployment. It also emerged that information is abundantly available, but it is risky if not properly managed and controlled. Lastly, the chapter revealed that information security is critical and mandatory to every organisation, and must be built into the day to day processes to deliver required goods and services to the public. The next chapter discusses literature that focuses on supply chain flexibility and supply chain performance.

CHAPTER 4
SUPPLY CHAIN FLEXIBILITY AND SUPPLY CHAIN PERFORMANCE

4.1 INTRODUCTION

A strong and effective supply chain management system is critical to the success of any public sector. To have an effective and efficient supply chain, the public sector must implement strategies that will work towards its improvement. This chapter discusses literature on supply chain flexibility and supply chain performance. The nature of supply chain flexibility and drivers of supply chain performance are discussed in detail. Specific attention is paid to factors influencing supply chain flexibility, the benefits and challenges of implementing its flexibility in the public sector, supply chain performance measurement, supply chain performance globally and within South Africa and the benefits of implementing supply chain performance management. These issues are discussed since the study aims at understanding the relationship between supply chain flexibility and supply chain performance in the public sector.

4.2 SUPPLY CHAIN FLEXIBILITY OVERVIEW

This section focuses on the concept of supply chain flexibility. The literature on different types of flexibility which affect the public sector is reviewed. The section further highlights various factors that drive the need for supply chain flexibility, with customer satisfaction being the centre. It concludes by discussing the benefits and challenges of implementing supply chain flexibility in the public sector.

4.2.1 The nature of supply chain flexibility

Uncertainty affects the entire organisation and as such organisations are continuously searching for initiatives to remain competitive. Wang *et al.* (2016:400) assert that the key properties that reflect the capacity to mitigate uncertainty are flexibility and responsiveness. Organisations require flexibility to be able to deal with unanticipated changes in supply chain or demand and to diminish their repercussion (Fischera, Pfeiffer, Hellingrath, Scavarda, Martins 2014:75). The concept of flexibility originated in the manufacturing sector in the early 1990s as a strategy for responding more effectively to a changing competitive landscape (DeGroote & Marx 2013:909) and to see how manufacturers could deal with unexpected changes in their production processes, such as equipment breakdowns, variable tasks times, queuing delays and re-workings (Moon *et al.,* 2012:192).

Tiwari *et al.* (2015:771) declare that a supply chain is said to be flexible if it can ensure smooth undisrupted supply of goods and services from supplier to the organisation under all risks and

uncertainties in their environment, with the least variation in the difference between the demand and supply at every demand-supply node, and without much penalty or impact on the supply chain resources and the costs incurred. According to Das (2011:172), a supply chain should have all types of flexibility, including extra capacity, extra inventory and the operational flexibility needed to assign a job to a different plant if one plant fails to obtain an improved lost sales performance.

Today, flexibility is seen as the core strategy for supply chain performance for many organisations and is defined to align with the organisational needs. Manuj and Mentzer (2008:203) define flexibility as "the ability to change or react with little penalty in time, effort, cost or performance". Fischera *et al.* (2014:76) also agree that supply chain flexibility has the ability of a supply chain to change its structures, processes, resources, and steering mechanisms in the bounds of a given scope of action. Wang *et al.* (2016:400) defined it as the ability to maintain feasible steady operation for all parameter values within a specific range. Gosling, Purvis and Naim (2010:12) view flexibility as an adaptive response to environmental uncertainty in that it reflects the ability of a system to change or react with little penalty in time, effort, cost or performance. Liu, Ke, Wei and Hua (2013:1453) further proclaim that supply chain flexibility is essential in ensuring the firm's competitiveness because it enables effective and efficient responses to operational changes, such as procurement, manufacturing, delivery, and market promotion.

Fischera *et al.* (2014:75) assert that the most important characteristics needed to best describe meaningful flexibility are a range, time and cost. Seebacher and Winkler (2016:177) further declared a highly flexible supply chain is characterised by high performing grouped supply chain processes that can maintain a stable performance, even when changing conditions lead to even greater flexibility requirements that must be met by the involved entities. Hence, flexibility must be seen as a proactive attribute that is built into a system, rather than a reactive behaviour that may, in fact, result in a detriment to time, effort, cost and performance (Gosling, Purvis & Naim 2010:12).

Supply chain flexibility was considered to have four types, namely, supply, manufacturing, distribution, and product development (Tachizawa & Thomsen 2007:1116). A recent study by (Elleuch, Dafaoui, Elmhamedi and Chabchoub (2016:1448) affirm that there are four components of flexibility: knowing what to do, what to look for, what to expect and what has

happened. Tiwari *et al.* (2015:771-1774) have classified and created a theoretical foundation for analysing supply chain flexibility components to include:

- **sourcing flexibility** – sourcing flexibility is associated with the availability of qualified materials and services and the ability to effectively purchase them in response to changing requirements (Moon *et al.,* 2012:193);
- **product development flexibility** - product development flexibility relates to the plant's ability to introduce substantially new discrete products into production (Malhotra & Mackelprang 2012:182);
- **manufacturing flexibility** – manufacturing flexibility is a vital tool in allowing an organisation to align its manufacturing strategies with the needs of the marketplace (Malhotra & Mackelprang 2012:182);
- **logistics flexibility** – logistics flexibility enhances internal new product development flexibilities and is significantly associated with modification and volume flexibilities (Malhotra & Mackelprang 2012:182); and
- **information technology flexibility** – information technology flexibility represents the ability of the organisation's information system to adapt to changing circumstances, especially in situations of unexpected disturbances (Moon *et al.,* 2012:193).

However, Tiwari *et al.* (2015:771-1774) acknowledge that the unified process based view that supply chain flexibility must include the core processes such as procurement, sourcing, distribution and logistics and further propose that all these different aspects of supply chain flexibility can be realised by integrating the vendor and sourcing flexibility into the purchasing considerations. This notion is also shared by Gosling, Purvis and Naim (2010:12) who alluded that supply chain flexibility is rationalised as comprising of two fundamental concepts, namely:

Vendor flexibility - vendor flexibility consists of flexibilities related to sourcing, warehousing and logistics; and

Sourcing flexibility - sourcing flexibility includes the capability of the focal company to reconfigure its supply chain, its ability to adapt to market changes and its ability to increase the supplier responsiveness.

A study by Tachizawa and Thomsen (2007:1119) show that flexibility influences the sourcing strategy of an organisation. According to Pereira, Christopher and Da Silva (2014:627), achieving flexibility along the supply chain requires effort from internal actions within the

business and the wider network. Liu *et al.* (2013:1453) further confirm that supply chain flexibility enables organisations to coordinate with channel partners and also acts as a rare, valuable, and imperfectly imitable operational capability, which is critical to improving firm performance. However, Tiwari *et al.* (2015:779) point out that different elements of uncertainty affect different types of flexibility differently.

4.2.2 Factors influencing flexibility in supply chain

Most supply chain risks are rooted in uncertainty (Das 2011:172). However, it is not possible to guarantee that reducing risk makes the supply chain less vulnerable or more resilient (Pereira *et al.,* 2014:628). Gosling, Purvis and Naim (2010:11) proclaim that flexibility has been proposed as a response to the high levels of complexity and uncertainty in modern markets. According to Tachizawa and Thomsen (2007:1118), flexibility drivers are related to uncertainty, as flexibility has often been seen as a reaction to environmental risk. Barad (2012:752) indicates that flexibility is a powerful ingredient that enables stable performance under changing conditions.

The need for flexibility applies to many corporate assets, including capital investments, employees, business partners, organisational structures, processes and information systems (Schober & Gebauer 2011:638). Hence, Wang *et al.* (2016:400) declare that flexibility is now considered a strategic capability. According to Tiwari *et al.* (2015:777), drivers of flexibility are factors or situations that forge the need for flexibility, while a source of flexibility is a set of specific actions that generate flexibility. Tanco, Jurburg and Escuder (2015:13) allude that factors or situations that forge the need for flexibility are factors that constitute difficulties in the supply chain. These include 1) changes in government policies; 2) workforce availability and productivity; 3) custom process and related paperwork; 4) supply side problems; 5) commitment of top management; 6) internal and external integration; and 6) information technology.

Satisfying customer needs and competitive advantage is the key to factors that influence flexibility in the supply chain. Fischera *et al.* (2014:76) also confirm that volatile customer demand is the leading cause for the need for flexibility and poses difficulties in choosing the right parameters for flexibility measures. However, other drivers include globalisation, technological change and market instability.

The ability to utilise resources flexibly plays an essential role in managerial decision making (Schober & Gebauer 2011:638). Supply chain managers are under pressure to instil flexibility

in supply chains to match the speed of change and the accelerating competition in markets (Brusset 2016:46). A study by Prajogo and Sohal (2013:1533) proclaim that flexibility is one of the competitive strategies and requires organisations to have competent supply chain professionals as well as useful supply chain technologies. Ngai *et al.* (2011), as well as Prajogo and Sohal (2013:1533), mention that the combination of management competencies, IT integration, and supply chain integration have a healthy and positive effect on supply chain flexibility. Ibrahim, Ahmad, Shahid and Asif (2015:36) assert that organisations cannot manage cost, provide high customer service, and become leaders in supply chain management without the incorporation of information technologies Gosling *et al.* (2010:11) also affirm that flexible supply chains are promoted as a route to competitive advantage. Das (2011:171) further emphasises that IT integration improves supply chain flexibility.

According to Tanco *et al.* (2015:13), changes in political environments affect the supply chain. Some of the relevant changes include unanticipated fiscal and monetary change, price controls, government regulations and labour incentives. An example of such changes is minimum wages and green initiatives.

4.2.3 The benefits of Supply Chain Flexibility in the Public Sector

Customers always pay the cost that they perceive is correct, and if they want to get something additional presented to the product, they prefer value added. Ibrahim *et al.* (2015:34) alludes that they are two factor which is significant when it comes to value added, and these factors are flexibility and quality. According to Manuj and Mentzer (2008:203), flexibility is vital in global supply chains because it plays a facilitating role in the coordination process and provides a unique ability to help firms manage the high levels of environmental and operating uncertainty inherent in global operations (Manuj & Mentzer 2008:203). DeGroote and Marx 2013:909 assert that flexible organisations are quick to sense market changes, and execute coordinated responses that can achieve critical first-mover and other competitive advantages over rivals. Flexibility positively impacts not only the firm's ability to extend its global reach but also its ability to enhance comparative performance relative to leading industry competitors (Manuj & Mentzer 2008:203)

4.2.4 The challenges associated with supply chain flexibility in the public sector

The public expects the government always to provide the best quality at very low cost. As such, public sector procurement is continuously looking for tools and strategies that will guide and help fulfil the requirement. It is for this reason that the public sector is consistently on the point

of massive transformation (Warn 2016:6). The public sector across the world is transforming to fulfil their mandate. According to Kudo (2008:93), transformation is stimulated by a shortage of financial resources; sometimes it is brought on by a change political power or may be forced by citizen demand, and at times it results as a response to corruption and scandal. However, in most cases, it is brought on by more than one of these aspects working together to push forward government reform. Organisations use process strategies to improve and enhance their performance and that such strategies need the identification of aims, formation of policies and assignation of available and required resources for the implementation plan (Ibrahim *et al.,* 2015:35). Warn (2016:8) declares that before the transformation process can start, organisations must ensure that critical stakeholders must understand why this change is necessary today, how the process will work and, most importantly, what the government and the taxpayers will gain from new investments in procurement teams, systems and tools.

It is a fact that the inclusion of effective flexibility measures can make a business more responsive, which will resolve most supply chain uncertainty issues in the public sector (Das 2011:170). However, the concept of supply chain flexibility reflects a complicated philosophy, which is not about rules and procedures which can be easily implemented or imitated (Liu *et al.,* 2013:1453). It involves the application of supply chain resources and requires organisations to develop cross-functional and cross-company strategies that eliminate bottlenecks and create a level of performance that allows such organisations to reinforce their competitive advantage in an uncertain market (Moon *et al.,* 2012:191). Fischera *et al.* (2014:76) allude that organisations must be able to select flexibility parameters that provide enough flexibility potential, even where the size of expected uncertainty is underestimated. As such, organisations cannot function effectively unless its leadership learns, understands and contributes to the organisation's top-level strategic deliberation and decision-making process (Roh *et al.,* 2016:50).

Chuah, Wong, Ramayah and Jantan (2010:724) allude that the organisation has to be responsive in providing prompt and reliable delivery of high-quality products and services at the least cost which is an essential cornerstone for organisations to develop a sustainable competitive advantage and remain at the forefront of excellence in the market. A study by Tiwari *et al.* (2015:781-783) has established that there is an opposed relation between cost and flexibility and therefore the implementation of supply chain demands enormous investments. However, Meehan, Ludbrook, and Mason (2016:161) argue that the concept of low-cost consideration must not override operational responsiveness and flexibility. Fischera *et al.* (2014:76) posit that

flexibility costs need to be practical and also be reasonable when compared to the expected benefits. This is further supported by Manuj and Mentzer (2008:203) who indicate that flexibility comes at a cost, and organisations should invest in flexibility that depends on their level of risk. Hence, Warn (2016:6) posits that the most successful organisations place high premiums on understanding how procurement transformation will affect their cultures as well as their supplier communities, and proactively address potential adoption and change management challenges.

This section analyses literature on supply chain flexibility. Issues that were outstanding in the section include: 1) the nature of supply chain flexibility; 2) the importance of decision making in the implementation of supply chain flexibility; 3) factors influencing supply chain flexibility in the public sector; 5) the benefits of implementing supply chin flexibility; and 6) the challenges of implementing supply chain flexibility. These issues are important in this study because they outline and emphasise the importance of supply chain flexibility and supply chain performance.

4.3 SUPPLY CHAIN PERFORMANCE OVERVIEW

This section focuses on the factors influencing supply chain performance and supply chain performance measurement. The section discusses the different types of supply chain performance measurement tools and their characteristics, and reviews supply chain performance in South Africa and also globally. Benefits of implementing supply chain performance within the public sector conclude this section.

4.3.1 Factors influencing performance in the supply chain

Public organisations operate in a dynamic environment, which is continually influenced by the need for change. This change is caused by factors such increased globalisation, technological advances, accessibility to complex computer programmes, increased demand by upper management, a shift towards outsourcing and a greater awareness of corporate social responsibility (Tassabehji & Moorhouse 2008:56). To face the intense pressures of the world competition, organisations are constantly in search of new ways to improve the performance of their supply chain to reduce costs, to improve quality and to increase productivity (Sakka & Botta-Genoulaz 2009:1). As a result, supply chain has become widely recognised as an important function, which is responsible for increasing an organisation's competitiveness within an unstable environment (Alinaghian *et al.*, 2011) and also contribute as equally as other functions within the organisation for business continuity (Pereira *et al.,* 2014:627).

Effective supply chain management has become a potentially valuable way of securing competitive advantage and improving organisational performance (Trkman, McCormack, de Oliveira & Bronzo 2010:318). Estampe, Lamouri, Paris and Brahim-Djelloul (2013:247) confirm that supply chain is a critical element of business competitiveness and most organisations view this function as the cornerstone of their differentiation strategy. According to Prajogo and Sohal (2013:1536), competitiveness of an organisation is no longer solely determined by their capability, but also significantly influenced by their supply chain network, which means that building integration within supply chain partners cannot be ignored. Chuah *et al*. (2010:726) also declare that business practices today no longer evaluate the performance of an organisation at a unit level, but rather on a value chain perspective, therefore organisations need to set, monitor and manage their supply chain performance and that of their partners. Shafiee, Lotfi and Saleh (2014:5094) further propose that organisations need to carry out efficiency measurement for different purposes such as: identifying success, identifying whether they are meeting customer requirements, helping them understand their processes, identifying where bottlenecks (such as waste, etc.) exist, where improvement is necessary, ensuring that decisions are objective rather than subjective, and showing if the improvement planned has actually happened.

Roh, Krause and Swink (2016:50) assert that the performance of an organisation depends on the degree to which its internal features are appropriately matched with the situational demands of its task environment. Zelbst, Green Jr, Sower and Reyes (2009:667) also state that the success of organisations depends heavily upon the success of the supply chain in which the organisation participates as a partner. Success, in this case, is defined as customer satisfaction. However, Estampe *et al.* (2013:247) argue that integration between supply chain partners no longer means that an organisation is performing well. According to Sakka and Botta-Genoulaz (2009:3), the global performance of the supply chain is a combination of various performances such as customer performance, supplier performance, financial performance, market performance, delivery performance, the performance of service providers, alliance performance, and organisational performance. The goal is generally to improve these performances.

Organisations make structural changes in efforts to maintain organisational alignment or "fit" with constantly changing environmental demands, and higher performance accrues to those firms achieving a higher degree of fit (Roh *et al.,* 2016:50). The development of an organisation's internal capabilities is strongly influenced by competing priorities such as cost,

quality, flexibility and delivery, which are at the heart of an organisation's operations strategy (Jankulović & Škorić 2013:176). A fundamental element of an operations strategy is the definition of the firm's competitive priorities. These may include the fundamental priorities such as cost, quality, delivery, and flexibility as well as additional ones such as innovation (Wagnera, Grosse-Ruykena & Erhun 2012:341).

While organisational managers are ultimately held accountable for the performance of their particular organisations, today's managers must both manage efficiently and effectively at an organisational level and also at the supply chain level. (Zelbst *et al.,* 2009:667). Supply chain management involves integrating all key operational processes at any level between the final users and original suppliers of the products, services and bits of information that offer added value to customers and other stakeholders' strategies (Estampe *et al.,* 2013:248). Prajogo and Sohal (2013:1533) proclaim that from a business point of view, the changes required by supply chain members are to move from a reactive mode to a planning mode, from risk avoidance to risk management, from hoarding information to sharing information, from transactional relationships to managerial relationships, from bureaucratic behaviour to creative behaviour, and team decision-making involving all supply chain members.

In this dynamic environment, identifying the difficulties which hinder SC performance should be a strong motivator for SC managers and scholars to develop strategies and solutions to cope with uncertainty, allowing businesses to achieve their goals (Tanco *et al.,* 2015:12).

Table 4.1: Antecedents to measure Supply Chain performance

Performance Measure Supply Chain Antecedent	Performance Measure Supply Chain Antecedent
Operational Performance	-Inventory Levels -Quality -Time -Customer Satisfaction
Economic Performance	-Cost -Environmental cost -Cash-to-cash Cycle
Environmental Performance	-Business waste

Source: Azfar, Khan and Gabriel (2014:807)

4.3.2 Supply chain performance measurement

The outputs of the public sector are peculiar; and affect the whole of society and its more vulnerable members in particular. The fact that the public sector provides the most critical services for the general society makes their management and the assessment of their performance problematic (Steven 2006:65). Public procurement activities are done through the

utilisation of money from taxpayers. Therefore, government departments are urged to implement and enforce a variety of managerial techniques and performance indicators, including procedures for risk assessment, training, sanctions, self-reviews and reports by internal and external auditors (Sikka & Lehman 2015:63). Kusrini, Subagyo and Masruroh (2014:1) assert that performance measurement can be used to assess the effectiveness of strategies in supply chain management and to identify success and opportunities for the future. Phusavat, Anussornnitisarn, Helo and Dwight (2009:647) underscore that performance measurement typically provides feedback to three fundamental questions that every organisation should be asking: how well an organisation is performing? Is the organisation achieving its objectives? How much has the organisation improved from the last period? Also, Cuthbertson and Piotrowicz (2011:587) allude that performance measurement can fully be understood when its factors are analysed. Factors influencing performance measurement are: supply chain model, industry, relationships, integration and differences between supply chain management members, supply chain strategy and strategic goals, structure, complexity and processes, stakeholders, demand and product characteristics, the degree of regulation, supply chain scope, globalisation and geographical coverage, the number of supply chain participants, technology, culture and attitude. Other factors include infrastructure, operating knowledge, corporate governance, social climate, innovation. Table 4.1 shows how different factors influence supply chain performance measurement:

Table 4.2: Performance measurement system

CONTEXT: Under what conditions does measurement take place?

Organisational factors	Supply chain factors
• Strategy	• Industry/sector/model
• Structure	• Relationships/integration
• History	• Number of participants
• Experience	• Maturity
• Culture	• Products
• Management methods and philosophy	• Strategic goals
	• Geographical coverage/ scope
• Company size	• Stakeholders

Supply Chain Performance Measurement

CONTENT:
What is measured?
• Metrics groups
• Metrics categories and sub-categories
• Metrics levels
• Individual measures
• Metrics importance

PROCESS:
How is the measurement carried out?
• Methods and tools
• System design
• Metrics selection
• Data capture and analysis
• Metrics usage

Source: Cuthbertson and Piotrowicz (2011:585)

The creation and use of performance measurement systems at the supply chain level is influenced by the organisation concerned, such as structure, culture, processes and company size (Cuthbertson & Piotrowicz 2011:588). Kusrini *et al.* (2014:1) declare that performance measurement plays a vital role in the improvement of an organisation, can determine its level of progress and also learn the necessary action needed for growth. Azfar *et al.* (2014:806) further stated measurement of supply chain performance should offer the business an outline of how their supply chains are economical and sustainable. However, Shafiee *et al.* (2014:5094) argue that organisations need to measure not only the final output but also the processes involved in reaching the final output to locate the problem which is causing the variance between the target and the actual specification of the final product.

Performance management is the process of quantifying action, with measurement as a process of quantification and engagement leads to performance (Jankulović & Škorić 2013:176). Phusavat *et al.* (2009:647) posit that performance measurement represents a system that consists of mechanisms, processes, and criteria or areas of performance, which must be aligned with organisational missions, policies, land objectives. According to Dzimbiri (2008:47), performance management can be defined as a strategic and integrated approach to delivering sustained success to organisations by improving the performance of the people who work in them and by developing the capabilities of teams and individual contributors. Avelar-Sosa, García-Alcaraz and Castrellón-Torres (2014:959) define it as a process of quantifying the efficiency and effectiveness of action. Ibrahim et al. (2015:34) assert that performance management composes of chain-wide information, planning, resource management and performance measurement. Jankulović and Škorić (2013:176) also define performance measurement as the set of metrics used to quantify both the efficiency and effectiveness of actions. A study by Kusrini *et al.* (2014:3) affirms the notion of acceptable criteria for supply chain management. This is presented in Table 3.3.

Table 4.3: Good criteria for supply chain measurement

Main Criteria	Sub Criteria	Sub Sub Criteria
EFFICIENT	Simple & Inexpensive	The amount of data is not too much and does not require complicated software / expert advice
		Low cost
		Metric and output are presented in a simple form (metric in ratio form, the output in the graphic)
EFFECTIVE	Clarity	Easy to understand and easy to use
		Clear in definition for metrics and formulas, data sources and a data collection
	Valid & Reliable	Precise and objective
		Metric does not contradict
		Measurements can provide feedback to take necessary actions
		Focus on the business unit or business process
		Balanced; Contains elements that accommodates the interests of all stakeholders and to measure the contribution of stakeholders
	Comprehensive	Conformity with the objectives of the organization (both horizontal and vertical as well as compliance with short-term goals, medium-and long-term goals of the organization)
		Incorporate financial and non-financial aspects
		Involving organizational and corporate culture
	Responsive & Dynamics	Responsive to change and there is a dynamic relationship (cause and effect) between the criteria

Source: Kusrini *et al.* (2014:3)

A typical early performance measurement system was based mainly on scientific management principles promoting the careful analysis of workers' effort, tasks, work arrangements, and output establishing work procedures according to a scientific logic and setting standards and

production controls to maximise efficiency (Heinrich & Marschke 2010:183). Shafiee *et al.* (2014:5094) also confirm that the early performance measures usually focused on cost, but acknowledged that extending these measures leads to providing a new framework for supply chain evaluation that measures the strategic, tactical and operational level of performance. Adcroft and Willis (2005:387) allude that central to pretty much all measures of organisational performance is an understanding of the relationship between economic inputs and outputs, which raises the question of what does the organisation get out for the investment put in? However, according to Kusrini *et al.* (2014:1), there are various approaches in supply chain management performance measurement, which can be grouped into three categories: context (supply chain conditions); content (what is measured); and process (how to measure), based on the supply chain maturity phase and on the number of elements measured. Shafiee *et al.* (2014:5093) confirm the most prominent performance measure to be: balanced scorecard [4]; the performance measurement matrix [5]; performance measurement questionnaire [6]; criteria for measurement system design [7]; and computer-aided manufacturing approaches. Kusrini *et al.* (2014:2) introduced two more supply chain performances to be, namely: financial (activity-based costing and economic value added), and non-financial. Charan (2012:69) further emphasised that organisations must use financial indicators used in conjunction with non-financial indicators so that the organisation doesn't suffer.

Supply chain management seeks improved performance through the practical use of resources and capabilities via the development of internal and external linkages, thus creating a seamlessly coordinated supply chain (Maestrini, Luzzini, Maccarrone & Caniato 2017:299). Performance measurement plays a more influential role in process management within a company as the database becomes more flexible and robust (Phusavat *et al.,* 2009:647). Charan (2012:69) proposed that a supply-chain measurement system should fulfil the following three requirements:

  i.   reflect the objectives of main interest groups such as customers, owners and personnel;
 ii.   combine operational and financial follow-up data; and
iii.   link operational objectives to critical success factors and goals.

Saldanha (2017:1) recently proposed that an effective performance management system in the public sector must typically include:

  i.   the performance framework - system of establishing clear goals and targets;
 ii.   the performance monitoring – monitoring progress against these targets; and

iii. performance reports and accountability - reporting results periodically.

According to Azfar *et al.* (2014:806), to improve the supply chain to be more effectual and operative, it is required to assess the performance of the supply chain. Trkman *et al.* (2010:319) confirm that improving supply chain performance has become a continuous process and requires an analytical performance measurement system. Monitoring and improving the performance of a supply chain has become an increasingly complex task and includes many management processes such as identifying measures, defining targets, planning, communication, monitoring, reporting and feedback. Thus, an approach which relies on conventional wisdom to make supply chain -connected decisions, the use of benchmark or best-practices etc. cannot be used to manage the supply chain. Avelar-Sosa et al. (2014:959) also point out that organisations, suppliers and customers should discuss how they would address the measurement and improvement of supply chain management performance.

Organisations fail in their performance measurement because they have measured performance at an organisational level rather than at inter-organisational level. Supply chain performance can be measured both regarding the customers' level of satisfaction since they remain the ultimate judges of how much value is being created at a logistics level and the costs incurred (Estampe *et al.,* 2013:247). A study by Hawkins, Gravier, Berkowitz and Muir (2015:81) shows that a supply management's competency at managing internal customer commitment as a process has a direct benefit on the performance outcomes as measured by service quality. For example, creating a well-developed supply risk management process appears to enhance performance outcomes more than focusing on individual risk monitoring and mitigation strategies. Azfar *et al.* (2014:806) declare that supply chain performance should be evaluated from a tactical level, strategic level and operational level as well as from a commercial and non-commercial perspective. Shafiee *et al.* (2014:5094) also emphasise that in the process of evaluating the performance of the supply chain, choosing performance measures is an essential task because the action of management and solution for improvement are derived from them. However, despite the reliable recognition of performance impacts on a management process, performance measurement, especially at the organisational and functional levels, sometimes has not received proper attention from top management (Phusavat *et al.,* 2009:647).

Although organisation executives are ultimately held accountable for organisational performance, organisational success first depends on the performance of the supply chain in which the organisation functions as a partner (Tanco *et al.,* 2015:12). It is the responsibility of

organisation executives to put in place measures that will allow them to assess and empower themselves with the necessary information to enable them to deliver their mandate. According to Phusavat *et al.,* (2009:647), performance measurement helps create feedback to managers on the effectiveness of improvement interventions as part of learning and development. Kusrini *et al.* (2014:1) also state that performance measurement has the role of providing feedback information, which is very useful for managers to monitor the progress of the organisation's performance as an initial step in the development of the company, to increase motivation and communication and to diagnose problems. Avelar-Sosa *et al.* (2014:959) further suggest that it is necessary for an organisation to know its performance measures and compare standards with competing chains.

Several methods have been introduced over the years to measure supply chain performance where some were successful while others needed enhancement. However, Haghighi, Torabi and Ghasemi (2016:580) posit that to regulate the supply chain performance, it is important to monitor the viability of strategies. They identify strategies to include: demand management, customer relationship management, supplier relationship management, capacity and resource management, service performance, information and technology management, and service supply chain finance, which were selected as the critical factors to assess service supply chains. Some of the most common measures introduced are:

1. Supply chain performance measurement system – this method enables the adoption performance metrics that span different firms and processes. Hence, SCPMSs represents a way to improve the supply chain governance by ensuring more value, adding conscious and timely decisions (Maestrini *et al.,* 2017:299).

2. Data envelopment analysis (DEA) - this method is highly flexible and can be integrated with other multi-criteria decision-making techniques (Haghighi *et al.,* 2016:580)

3. The balanced scorecard - BSC is one of the most ample performance measurement tools by which both financial and nonfinancial measures, along with long- and short-term strategies, are collectively considered for performance evaluation Haghighi *et al.,* 2016:580)**.** This method provides one possible solution to link performance to strategy. The balanced scorecard approach has four components (Charan 2012:70).

- Financial measures that provide an answer to the question "how do we look to stakeholders?" are retained from the traditional performance reporting approach.

- Customer perspective measures are developed to answer the question "how do customers see us?" sequential nature of supply chain dictates that you are a customer in one link and seller in other. Therefore, a partnership with chain members is essential to overcome mistrust.

- Internal business perspective measures provide an answer to the question "what must we excel at?"

- Innovation and learning perspective measures provide an answer to the question "can we continue to improve and create value?" Zhu *et al*. (2008) advocated that within resource-based framework organisational learning is a significant capability when coupled with an organisation emphasis on continuous improvement.

4. Supply Chain Operations References (SCOR) – this method integrates three main elements in the management of business process re-engineering, benchmarking, and process measurement into a cross-functional framework in the supply chain (Wibowoa & Nur Sholeha 2015:27). SCOR is regarded as the most balanced measurement system with multiple levels covering four core supply chain process (Plan, Source, Make, Deliver, and later Return was also added). Trkman *et al.* (2010:319) also confirm that SCOR provides common supply chain framework, standard terminology and metrics that can be used for evaluating, positioning and implementing supply chain process, which reflects supply chain analytics that includes planning, sourcing, making and delivery.

4.3.3 Supply chain performance in the global public sector

Governments have evolved from increasing its capacity to sustainable public management due to ever-changing environments. Government procurement involves the use of financial resources belonging to mostly invisible stakeholders (Neu *et al.,* 2015:50). The management of supply chain emphasises how to maximise the overall value of the organisation by better usage and deployment of resources across the whole organisation (Sukati *et al.,* 2012:226). Olander (2007:11) confirms that there are four objectives for the management of the public spend, namely: the control of aggregate expenditure of public resources in line with available resources; the effective allocation of resources to different areas of concern in pursuit of objectives; the efficient operational use of resources to ensure value for money; and the fiscal transparency through social control.

The continuous need to align the needs of society with limited resources require governments to put measures in place to ensure that limited resources are used for purposes intended

(Wagnera *et al.,* 2012:341). Meehan *et al.* (2016:161) also allude that achieving value for money is at the heart of the public sector, but they are of the view that value does not necessarily suggest the cheapest price, and define value for money as securing the best mix of quality and effectiveness for the least outlay over the period of use of the goods and services bought. Hence, the public sector has the burden of finding supply sources at the lowest price and acceptable quality (Falagario *et al*. 2012); Costantino, Dotoli, Falagario & Sciancalepore. 2012:189). Warn (2016:8) confirms that fuelling the local economy and reducing the problem on suppliers sits right next to transparency and cost containment at the top of most governments' priority lists. In achieving the notion, different countries follow different rules, procedures and policy. However, there is a common understanding of the basics regarding the process. According to Colyvas (2014:1), the strategic goals of a public sector entity are usually determined by that entity's "executive authority". Who that differs, depending on the nature of the entity, which is usually prescribed by legislation such as national, provincial and local. The executive authority is a politically appointed individual (the minister or MEC in the case of national and provincial departments and their entities), or the elected mayor (or mayoral council) in the case of local government. The executive authority of a national government department is the relevant cabinet minister who is accountable to the president of the country. As such, the supply chain performance of a nation cannot be separated from the politics of that country.

The tradition of public sectors in both developed and developing countries has been to focus on the 'budget' as the key instrument of public sector management. While this has some justification, the emphasis on the budget has generally skewed management focus in public sectors to financial processes and to the timely disbursements of funds for budgeted activities (Saldanha 2017:1). It is vital that public procurement follows consistent and transparent business models that optimise specific service objectives and considers the impact of such a procedure across the governmental organisation (Costantino *et al.,* 2012:189). According to Meehan *et al.* (2016:161), maintaining integrity in decision making is a fundamental pillar of public procurement and the primary goal of competitive bidding. Public procurement is an ample source of decision-making problems where they have to make decisions such as (Belenky 2013:1142):

1. choosing the type of a contract and the type of competitive bidding to maximise the chances of successfully implementing the agreement for procuring goods and services under various procurement risks and in line with the existing laws constitutes the first problem;

2. setting an initial price for the contract to hold the bidding; and

3. designing a set of new rules for determining the winning bid or with choosing such rules from among available ones to help eliminate or reduce undesirable effects capable of affecting the quality of public procurement such as dumping prices, collusions, forming corrupt ties.

Saldanha (2017:1) posits that the public sector needs an effective performance management system to ensure it is efficient, effective and accountable to its stakeholders. He further emphasises that this notion can only be realised when the public sector sets and links objectives with crucial performance reporting. Figure 4.2 presents the common key performance reporting mechanism in the public sector.

DIAGRAM 4 Key Performance Reporting Mechanisms
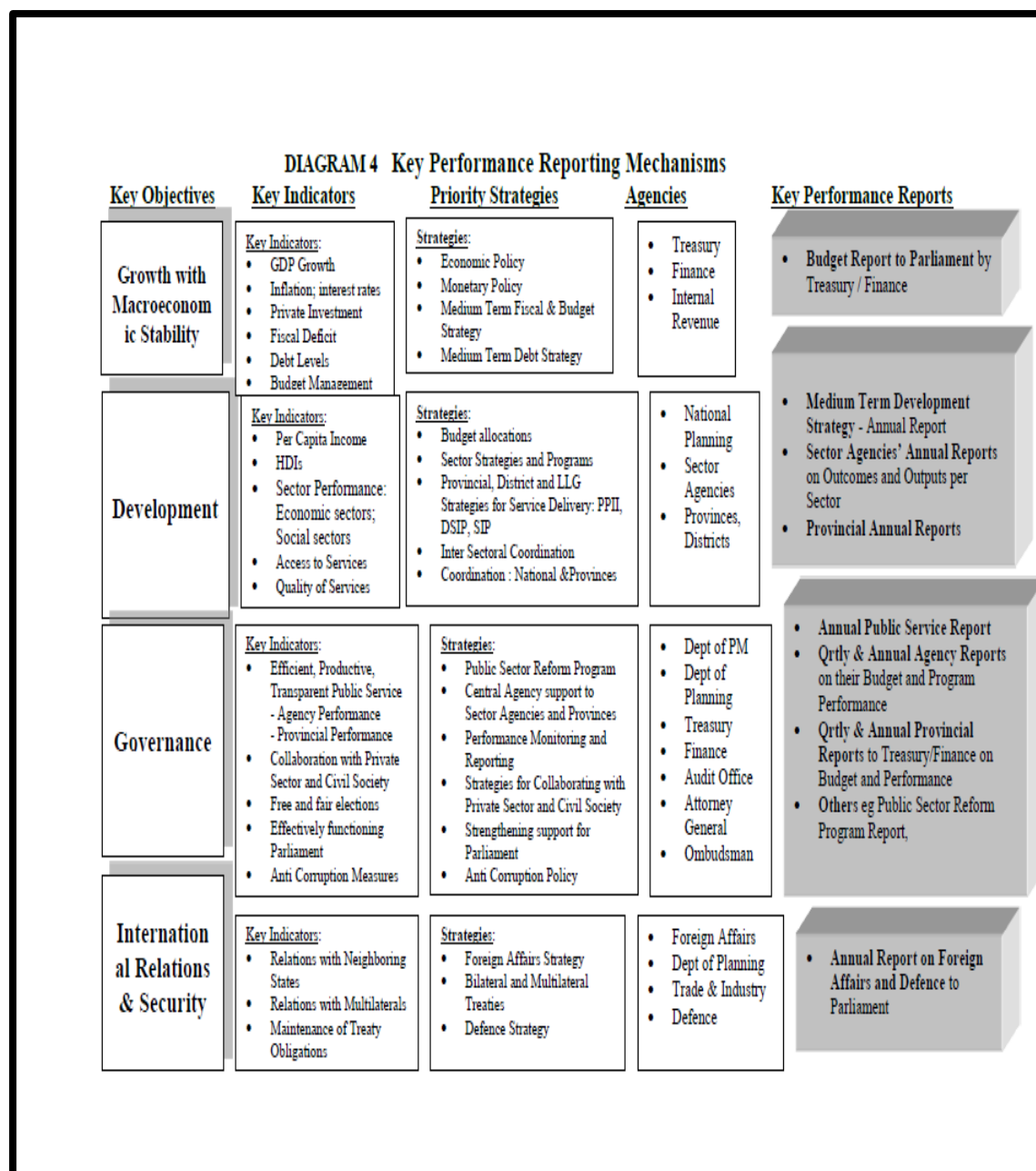
Figure 4.1: Key performance reporting mechanism in the public sector

Source: Meehan *et al.* (2016:161)

The centralisation of public procurement is a growing worldwide trend to achieve efficiencies (Meehan *et al.,* 2016:161). Centralisation means organisations devise ways that will integrate and ensure a smooth flow of information within the stakeholders. According to Sukati *et al.* (2012:226), to achieve effective supply chain integration, firms need to implement information technology. They suggested that by using information technology, organisations could manage the flow and impact of numerous supply chain dimensions, such as quality, cost, flexibility, delivery, and profit. Warn (2016:6) also points out that technology will enable the public

sector's procurement transformation, although he cautions that the success of any transformation is largely determined by people and processes working in concert with the technology.

A study by Jankulović and Škorić (2013:178) suggests that like any organisation, the public sector, especially in developing countries, needs to consider their performance regarding the quality of service, flexibility, customisation, innovation and rapid response. Many organisations in the public sector will agree, although they are unable to realise this notion due to several challenges. According to Costantino *et al.* (2012:189), the public sector is covered by a number of public procurement regulations, bringing legislative requirements into force, but Auriol, Straub and Flochel (2016:395) assert that it is one of the main areas at risk of corruption due to the fact that regulations and legal enforcement are weak. Sikka and Lehman (2015:63) confirm that the risk in the public sector is massive, to the extent that in pursuit of competitive advantage, some corporations and their executives have shown a willingness to subvert laws, international treaties and well-designed internal controls instituted in government procurement programmes to their advantage. Vanichchinchai (2014:126) points out that culture, investment, business relationship and management system maturity, which in turn are influenced by organisational characteristics such as company ownership, company size, tiers in the supply chain and management system certification. Dzimbiri (2008:45), however, blames mismanagement, nepotism, political patronage, large and rigid bureaucracy and widespread corruption.

4.3.4 Supply chain performance in the South African public sector

Any organisation, be it in the public or private sector, needs an effective performance management system to ensure it is efficient, effective and accountable to its stakeholders (Saldanha 2017:1). The performance of the public sector affects us all. There are at least three reasons why we should be interested in how well it functions: it is significant; its outputs are exceptional, and it is getting bigger (Stevens 2006:65). Post-1994 following the first democratic election, the South African public sector embarked on a remarkable transformation process. However, transformed South Africa brought about new challenges in political, economic, cultural, technological and physical environments. The transformation process has identified burning issues that were in the past overlooked such as basic economic participation, gender equality and participation of all in the economy. To address these issues, a white paper (Batho Pele white paper) was formed. According to Department of Public Service and

Administration (1997), the paper introduces eight (8) principles for the transformation of public services as follows:

- **Consultation:** citizens should be consulted about the level and quality of public services they receive and, whatever possible, should be given a choice about the services that are offered.
- **Service standards:** citizens should be told what level and quality of public services they would receive so that they are aware of what to expect.
- **Access:** all citizens should have equal access to services to which they are entitled.
- **Courtesy:** citizens should be treated with courtesy and consideration.
- **Information**: citizens should be given full, accurate information about the public service they are entitled to receive.
- **Openness and transparency:** citizens should be told how the national and provincial department is run, how much they cost, and who is in charge.
- **Redress:** if the promised standard of service is not delivered, citizens should be offered an apology, a full explanation and a speedy and effectual remedy; and when complaints are made, citizens should receive a sympathetic, positive response.
- **Value for money:** public services should be provided economically and efficiently to give citizens the best possible value for money.

However, the introduction of the "White Paper" did not resolve the fundamental issues. The South African public still complains about necessary service delivery, which reflects the failures for the implementation of it. While it is acknowledged that available resources are limited, the South African public trust the public sector to still deliver. To ensure the balance between service delivery and limited resources, South Africa is forced to measure and manage its supply chain performance continuously.

The South African government has introduced capital expenditure to stimulate the ailing economy. According to National Treasury (2004:1), the government is determined to modernise the management of the public sector and make it more people-friendly and sensitive to meeting the needs of the communities it serves.

The supply chain performance of South Africa's public sector is based on numerous performance indicators derived from its core responsibility, which must be in line with the much-praised constitution. According to Colyvas (2014:1), the only available performance indicators are those set by National Treasury. He asserts that this framework does not have

clear, definitive guidance and strict enforcement (in the form of independent audits and proper disciplinary measures for non-performance), and as a result, it is not always understood or interpreted correctly in the sector. In line with the South African constitution, the auditor general is an institution responsible for auditing the accounts and financial statements of all organisations under the public sector (Department of Public Service and Administration 2003:24). While audits are done annually, one can argue that the audit does not reflect the actual performance of the supply chain. Colyvas (2014:1) posits that public sector organisations should go beyond the minimum expectation from a regularity audit perspective and focus on the quality (appropriateness and cost-effectiveness) of their KPIs and targets to ensure that the correct behaviour within the organisation is being encouraged and that service delivery objectives will be achieved. He further emphasises that it is important for accounting authorities/officers and their executive authorities to have a sound understanding and appreciation of the importance of proper strategic performance management and reporting that focuses on desired outcomes and contributes to long-term impacts if we are to see an improvement in the real-world performance of the government entities that serve us.

4.3.5 The benefits of improving supply chain performance in the public sector

Effectiveness is the primary objective of the Institute of public procurement and should be managed by providing better services to the public at a lowest possible price that can be achieved (Mana, Matějkováa, Jurčíka & Heidua 2014:381). Effective supply chain management maximises value to the ultimate customers of the supply chain in terms of both satisfaction with the product and/or services and a relatively low total cost of the product and/or service, and depends on the ability to develop long-term, strategic relationships with supply chain partners (Zelbst *et al.,* 2009:667). While many organisations aim for an effective supply chain, the majority are reluctant to improve their supply chain. Many organisations embark on improvements only if the assumption is that it will bring benefits. Charann (2012:68) confirms that worldwide interest in supply chain management had increased steadily since the 1980s when organisations began to see benefits of collaborative relationships in business and operations. However, the main advantage would be one that can assist the public sector to deliver and excel in their mandate. Mahapa, Dzimbiri and Maphosa (2015:19) agree that supply chain performance should focus on the organisation's resources and efforts towards achieving results that will provide the most significant benefit to the jurisdiction and its stakeholders.

Supply chain performance improvement benefits depend on the level and types of initiatives the public sector has set. Therefore, it is important that government assess and prioritise

benefits they want to realise. Saldanha (2017:1) confirms that a performance management system provides major benefits. He identified the following three benefits, which:

- **clarifies the organisation's results and related accountability** - an effective organisation must be clear about what it is expected to deliver. Every unit, division, department or agency in the public service should be held accountable on a continuing basis for the goals assigned to it, and the value for money it delivers from the resources entrusted to its care. Within this context, every individual, manager, and chief executive should have annual performance targets whose attainment should be enforced by appropriate combinations of incentives and sanctions.

- **promotes synergy between agencies - e**very policy, regulation, service, the protection provided by the state is the work of numerous individuals, organisations and institutions. When each organisation is clear about its expected results, it also realises that some of those results can only be achieved through the support and collaboration of sister agencies within the public sector, and sometimes agencies within the private or voluntary sectors as well. The education department cannot deliver effective education services unless the department of finance provides it with adequate budgets, the department of works assists it with the maintenance of schools, and non-government educational organisations collaborate in areas where government outreach is not feasible.

- **encourages transparency by requiring reporting of results - t**he annual performance report of each public sector agency and government as a whole is therefore critical. It provides a clear indication as to whether the budget allocated to the agency for specific goods and services has indeed been used to good purpose. It clarifies whether the agency is indeed fulfilling its assigned mandate and purpose and whether management needs to be recognised or sanctioned for performance. It is also essential that budgets for each consequent period learn from and are based on the performance progress of the ongoing period. If they are not, this will ensure that budgets remain input and activity-based, rather than results-oriented.

Improving accountability and transparency in the public sector was the most crucial issue for the government to gain confidence from other countries and stay relevant (Kudo 2008:99). According to Mahapa *et al.* (2015:19), performance management improves accountability, supports confidence in government and further assesses the worthiness of an organisation with the main objective of achieving organisational goals. The introduction and implementation of

suitable information technology are one of the characteristics of improving supply chain performance in the public sector. Ibrahim *et al.* (2015:35) allude that computer technology and telecommunications permit all the actors in the supply chain to exchange information with each other. Vendors can access up-to-date information on all open opportunities, at no charge, and can be automatically notified of opportunities to bid for the categories of goods and services they can provide (Warn 2016:8). Phusavat *et al.* (2009:647) posit that information visibility and persistent communication throughout an organisation help and allow management to contribute where appropriate. Ibrahim *et al.* (2015:35) also confirm that managers will get considerable advantages with the use of IT, such as the fast flow of information in a coordinated way, data interchange and access to information, improved customer and supplier relationships, and inventory management on an international level. DeGroote & Marx (2013:909) raised another benefit where they confirm that information technology contributes to the flexibility of organisations. Sukati *et al.* (2012:226) concur that by using the technology of information, the public sector could manage the flow and impact of numerous supply chain dimensions, such as quality, cost, flexibility, delivery, and profit. They further add that the development and long-term utilisation of information technology lead to better firm performance regarding return on investment (ROI, return on equity (ROI) and market share.

This section analyses literature on supply chain performance and gives an overview of it globally and in South Africa. The section further provides an in-depth analysis on 1) factors influencing performance in the supply chain; 2) different supply chain measurement methods; 3) similarities and differences of supply chain performance globally and in South Africa; 4) the benefits of implementing supply chain performance, and 5) supply chain continuous improvement. It is therefore clear that supply chain performance is a critical element in the success of the public sector.

4.4 CONCLUSION

This chapter aimed to review the literature on supply chain flexibility and supply chain performance. The literature revealed that customer service is at the centre of every organisation, which makes supply chain performance a critical factor of success. Due to the influence of globalisation on supply chain performance, the public sector is forced to restructure and improve its performance continuously. It also revealed that the challenges of implementing supply chain performance in the public sector are common around the world. The lack of clear, practical and unified procedures for implementing supply chain performance contributes to the failures of supply chain management in the public sector. The literature further indicates that

the implementation of supply chain flexibility could minimise most of the issues experienced in the public sector and also improve its performance. The benefits of implementing supply chain flexibility and supply chain performance measurement were discussed in depth. However, the literature revealed that high costs and the lack of proper information systems are major limitations affecting the realisation of these benefits. It further identified corruption and political control as the main problems in the implementation of supply chain flexibility. The next chapter discusses the research methodology adopted for the study.

CHAPTER 5
RESEARCH METHODOLOGY

5.1 INTRODUCTION

This chapter discusses the research methodology utilised to achieve the objectives of the study. It starts with a focus on issues such as the research philosophy that was selected for this study. The discussions focus on the research philosophies and strategies used, followed by the research design, which includes the population, the target population, with emphasis on the selection of the sample. After that, it discusses the procedures for data collection, the analysis of data as well as ethical considerations. This chapter is important because it fosters an understanding of various methods, principles and techniques employed in conducting the study.

5.2 RESEARCH PARADIGM

This section concentrates on the dominant research paradigms that are important in effective research procedures. The design of a research study begins with the selection of a topic and a paradigm (philosophy). According to Zhang, Zhao and Wang (2016:416), a paradigm is a whole framework of beliefs, values and methods in which research takes place, and determines, at least to some degree, the quality of a research study. The authors also point out that most modern research studies adhere to a well-defined research design based on the appropriate selection of a research paradigm. Somekh and Lewin (2005:79) identify two dominant research paradigms, namely, phenomenology and positivism.

The phenomenological paradigm generally focuses on observing and understanding how individuals live and behave in their different environments (Lopez & Willis 2004:726). In contrast, the positivism paradigm as a scientific method of conducting research mainly requires factual scientific elements to determine the causal effect of a specific problem (Creswell 2013:14). Malina, Nørreklit and Selto (2011:60) assert that positivism searches for empirical truths and is not about confronting "things themselves" because direct observation of a phenomenon is subjective and hence not reliable. As a philosophy, positivism adheres to the view that only "factual" knowledge gained through observation, including measurement, is trustworthy (Collins 2010:38). The focus is generally on facts and figures relating to the causes and consequences of phenomena in the social world, and the approach tends to be associated with the use of quantitative data and statistics (Denscombe 2014:2).

This study has adopted a positivism paradigm. According to Taylor and Milton (2013:2), the positivism paradigm strives to investigate, confirm and predict law-like patterns of behaviour,

and is commonly used in graduate research to test theories or hypotheses where its focus is on the objectivity of the research process. The positivism paradigm was adopted because the study was about testing relationships between independent and dependent variables, which can be achieved through the use of the quantitative approach. Delice (2010:2002) also proclaims that quantitative research predominantly assumes a positivism worldview, which is tied firmly to research techniques. Gerring (2011:626) concurs that positivism is suitable where hypotheses have to be tested to provide answers to research questions. This study was aimed at testing for prediction and causality among independent and dependent variables and used hypotheses to examine the relationship between supply chain risks, supply chain flexibility and supply chain performance. Since these aspects are important to this study, the positivism paradigm was considered to be the appropriate paradigm.

5.3 RESEARCH APPROACH

Research approaches derive from research philosophies. There are three categories of widely used research approaches, namely, quantitative, qualitative, and mixed research methodologies (Zhang *et al.* 2016:417-418). Often, the distinction between qualitative research and quantitative research is framed in terms of using words (qualitative) rather than numbers (quantitative), or using closed-ended questions (quantitative hypotheses) rather than open-ended questions (qualitative interview questions) (Creswell 2013:32), whereas mixed methods research combines both words (qualitative) and numbers (quantitative) into one research approach (Bryman & Bell, 2015:38). Cohen, Manion and Morrison (2011:21) suggest that the terms quantitative and qualitative would be better replaced by 'confirmatory' and 'exploratory'. Zhang *et al.* (2016:417-418) add that quantitative research applies a measurement to phenomena that can be expressed in terms of quantity, while qualitative research tends to apply a more holistic and natural approach to the resolution of a problem, while mixed methodology is designed to answer the increasingly complex and multifaceted research questions using both quantitative and qualitative measurements.

Bryman and Bell (2015:39) assert that the qualitative strategy is characterised by an inductive view of the relationship between theory and research, which enables the researcher to understand the social domain through an examination of how respondents interpret the world. Creswell (2009:1) identified ethnography, grounded theory, case study, phenomenology and narrative as examples of qualitative research designs. Quantitative research is related to the collection of numerical data, which has an objective conception of social reality (Zou, Sunindijo & Dainty 2014:318). Delice (2010:2002) adds that a quantitative research paradigm

emphasises the importance of generalisability and reliability with the aim of applying the relationship obtained among variables to the general population. Mixed methods research is an approach to an inquiry involving collecting both quantitative and qualitative data, and its core assumption is that the combination of qualitative and quantitative approaches provides a complete understanding of a research problem than either approach alone (Creswell 2013:32). Examples of mixed methods design include triangulation, facilitation and complementarily (Bryman 2008:607).

This study adopted a quantitative approach. According to Creswell (2013:4), quantitative research is an approach for the testing of objective theories through the examination of the relationship amongst variables. These can be measured typically through the use of instruments, so that numbered data can be analysed using statistical procedures (Moutinho & Hutcheson 2011:5). Consistent with this view, this study was intended to test relationships existing between supply chain risks, supply chain flexibility and supply chain performance. Furthermore, in line with the suggestion by Khan (2014:34), the final written report in this study has a set structure that consists of the introduction, literature and theory, methods, results and discussion. The quantitative approach also offers high reliability, and generalisability, strength in the testing of hypotheses, reduced vulnerability to researcher bias and being fast and economical (Sedmak & Longhurst 2010:77), which made it a more attractive research approach for the present study.

5.4 RESEARCH DESIGN

Research designs are types of inquiry within qualitative, quantitative, and mixed methods approach that provides specific direction for procedures in a research study (Creswell 2013:41). Research design can also be defined as the plan and process for research that spans the decision from in-depth assumption to detailed methods of data collection and analysis (Bryman & Bell 2015:35). This study adopted a quantitative approach. Bryman and Bell (2007:71) listed examples of research designs associated with this quantitative approach, which include experimental design, longitudinal designs, case studies, comparative designs and cross-sectional survey designs. The cross-sectional survey design was adopted for the study. Cross-sectional studies involve the collection of data from respondents once in a specific period (Denscombe 2014:7). Data collection essentially characterises survey designs through questionnaires (Harrison & Reilly 2011:14). The survey research method is deemed as desirable for this study since it uses questionnaires to obtain data from a sample of respondents selected from the population and has more advantages than other methods (Chai & Xiao

2012:21). These advantages include representativeness, impartiality, being systematic, reliability, and objectivity (Booth, Colomb & Williams 2008:202).

5.5 SAMPLING DESIGN

Creswell (2009:145) defines a sampling design as a provision of a plan for a quantitative or numeric description of trends, attitude or opinion of a population by studying a sample of that population. Sampling design is made of elements that include the target population, sampling frame, sample size and sampling method. Section 5.5.1 to 5.5.5 will focus on how the sampling design was conducted in this study.

5.5.1 The population

Population refers to a set of individual units which the research question seeks to explore (Neil 2015:3). Marshall and Jonker (2010:7) further state that a population is a complete set of individuals, objects or measurements having some observable characteristics in common. The populations related to this study comprised supply chain professionals in the South African public sector, which consists of state-owned companies, municipalities, government departments and constitutional entities.

5.5.2 Target population

The difference between a population and target population is that the population involves anyone within the entire group whereas a target population specifies which entities within that entire group is relevant to the study at hand (Gupta 2011:95). In the current study, the target population was composed of supply chain professionals working in the South African public sector in Gauteng province. The study primarily focused on supply chain professionals who operate within the public sector in Gauteng province. Gauteng province was appropriate because it houses the head offices of most national departments and constitutional entities of South Africa, and the majority of state-owned companies have their head offices in Gauteng province as well. According to CIPS (2015:4), the South African government employs approximately 1,200 supply chain professionals in Gauteng province.

5.5.3 Sampling Approach

Sampling involves selecting individual units to measure from a large population (González, 2011:65). There are two types of sampling approaches used in research, namely, probability and non-probability procedures (Quinlan 2011:219). In the probability sampling approach, the sample selected from a population is considered to be representative of the community (Maree

2010:145). Examples of probability sampling include random, systematic, cluster, stratified and multistage sampling techniques (Sekaran & Bougie 2010:26).n

To select the sampling elements from the target population, this study adopted the non-probability sampling approach using the convenience sampling technique. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher (Quinlan 2011:221). The convenient sampling approach was deemed as appropriate for the study because there was no single sample frame or list from which the names and details of supply chain professionals in the South African public sector in Gauteng could be obtained. Maree (2010:146) further mentions that it is cheaper and relatively more straightforward to implement a convenient sampling approach, so making the research process simpler.

5.5.4 Sample size

Quantitative research aims to apply the relationship obtained between variables to the general population, which makes the selection of a representative sample essential (Delice, 2010:2002). According to Gupta (2011:196), sample size refers to the number or quantity of elements to be incorporated into a research study. The size of the sample was based on the supply chain professionals employed in supply chain management and working in the public sector in Gauteng province. However, Booth *et al*. (2008:113) state that the determination of sample size is a highly subjective process where researchers must use their judgement based on prior studies as well as available resources to conduct the research. Altunisik, Coskun, Bayraktaroglu and Yildirim (2004:125) reckon that sample sizes between 30 and 500 at 5% confidence level are generally sufficient for many quantitative studies. Based on this prescription, the sample size was pegged at n=500 respondents for this study.

5.5.5 Procedures for Data Collection

In this study, data were gathered through a structured questionnaire. The term questionnaire refers to documents that include a series of open and closed questions to which the respondent is invited to provide answers (Rowley 2014:308). Questionnaires are mostly used in conducting quantitative research, where the researcher wants to profile the sample in terms of numbers (e.g. the proportion of the sample in different age groups) or be able to count the frequency of occurrence of opinions, attitudes, experiences, processes, behaviours, or predictions (Rowley 2014:309). Another reason for using questionnaires is that they can be adapted from other measurement scales, which were already developed and validated in other studies, and that

ascertain that both sets of questions are closely related (Reichenheim & Moraes 2007:665). It is for this reason that careful consideration and attention was paid to selecting suitable instruments for this study. The literature review conducted in chapters three and four of this thesis also contributed to the compilation of the research questionnaire.

The questionnaire was broken down into four sections to elicit questions on demographic characteristics of respondents as well as the various constructs under consideration. Section A elicited general information on the background of supply chain professionals participating in the survey. It consisted of eight questions that requested respondents to indicate their gender and age group, race, number of years of experience in the public sector, confirmation of whether they held a formal qualification in supply chain management, highest qualification, work experience in the public sector and position occupied.

Section B consisted of questions related to the supply chain risk constructs under consideration, namely, government policies, supply complexity, skills shortage, supplier performance monitoring, information security and process inefficiency. Response options in this section were presented on five-point Likert-type scales anchored by 1= strongly disagree, and 5= strongly agree. The questions related to the government policies, which made use of five-items, were adapted from Tummers and Knies (2014:26). Supply complexity made use of five-items adapted from Hashemi, Butcher and Chhetri (2013:160). Skills availability was measured using five items adapted from Heys and Luke (2012:114). Supplier performance monitoring was measured using six items adapted from Prajogo, Chowdhury, Yeung, and Cheng (2012:127), while information security made use of six items adapted from Herath (2008:100). Process inefficiency was measured using six questions adapted from Betts and Tadisina (2009:17). Section C focused on supply chain flexibility. The variable was assessed with six questions adapted from Fantazy, Kumar and Kumar (2009:181). These questions were presented on a five-point Likert-type scale anchored by 1= much worse than the industry average and 5= much better than the industry average. Last, of all, Section D dealt with supply chain performance which was measured using six items adapted from Betts and Tadisina (2009:17). A five-point Likert-type scale anchored by 1=decreased significantly and 5=increased significantly was used to present the response options in Section D. A copy of this questionnaire is presented in Appendix 1.

Questionnaires were distributed between February and May 2017 to conveniently selected supply chain professionals in the South African public sector in Gauteng province. A

combination of the drop and collect method and e-mail surveys was used in which each respondent was given three weeks to complete the questionnaire. Questionnaires were distributed by the researcher using the assistance of contacts established in the various public departments that participated in the study.

5.6 LITERATURE REVIEW

The literature review accomplishes several purposes. Creswell (2013:60) asserts that it relates a study to the larger, ongoing dialogue in the literature, filling in gaps and extending prior studies, which also provide a framework for establishing the importance of the study as well as a benchmark for comparing the results with other findings. For this study, a review of the literature was conducted using South Africa and international literature sources to provide a theoretical picture of supply chain management in the South African public sector. This was accomplished in chapter two of this thesis. Another review of the literature was conducted in chapter three to provide theoretical perspectives on supply chain risks. Chapter four also reviewed the literature on supply chain flexibility and supply chain performance. The literature review involved sources such as journal articles, newspapers, magazines, textbooks, government documents and variety of internet sources.

Cooper (2010:21) discussed four types of literature reviews, namely, ones that: (1) integrate what others have done and said; (2) criticise previous scholarly works; (3) build bridges between related topics, and (4) identify the central issues in a field. From the literature review, it was relatively more straightforward for the researcher to build and add to the research of previous scholars.

5.7 5.7. PILOT TESTING OF THE QUESTIONNAIRE

According to Hair *et al.* (2010:101), it is possible that some of the response items in the questionnaire may cause problems. To avoid possibilities of such challenges, the questionnaire was pilot tested. In this study, it was reviewed by two faculty members at a university of technology located in southern Gauteng who have experience in the discipline of supply chain management. Their feedback facilitated minor amendments in which some problematic questions were removed while others were added to the questionnaire. The draft questionnaires were then pilot-tested with a conveniently chosen sample of 40 respondents who were based in public sector departments in southern Gauteng. The feedback collected from these respondents in the pilot test showed that some of the questions were unclear and that the questionnaire was too long and tiresome to complete. Therefore, several further minor revisions

were made to most of the questions. The final questionnaire was more accurate and more straightforward than the one before the pilot test. Supply chain professionals who participated in the pilot survey were excluded from the primary survey.

5.8 DATA ANALYSIS AND STATISTICAL APPROACH

Once all questionnaires were received from the respondents, they were subjected to screening to eliminate incomplete questions and those that had errors. The received data were then captured in Microsoft Excel spreadsheet. The spreadsheet with the captured data was also cleaned to identify and correct missing entries. This was followed by importing the data into the Statistical Package for Social Sciences (SPSS version 24.0) format. Once the data were formatted, the next step was to use descriptive statistics to analyse the data pertaining to the demographic profile of the respondents. The last stage of data analysis done included the use of Confirmatory Factor Analysis (CFA) and Path Modelling using the Analysis of Moments Structures (AMOS version 24.0) statistical software.

5.8.1 Descriptive Statistics

A wide variety of statistical methods can be applied to analyse the data obtained. Zikmund, Babin, Carr and Griffin, 2013:54 define statistics as a branch of mathematics which can be applied to analyse various data. The authors also state that the applications of statistical techniques promote the establishment of relationships between the quantitative data and the quantitative research questions, and to interpret the complicated resultant data pattern. Marshall and Jonker (2010:2) further highlight that statistics are used to demonstrate the meaning of the data, are based on numbers and can be used descriptively to illustrate the characteristics of a group of observations, i.e. the raw data; this is called descriptive statistics.

Descriptive statistics, also known as univariate analysis, profile the responses from respondents, one variable at a time (Rowley 2014:324). Zikmund *et al.* (2013:41) define descriptive statistics as the simple transformation of raw data to represent elementary and straightforward characteristics such as central tendency, distribution and variability. Rowley (2014:324) also points out that the typical output of descriptive statistics is a frequency table, or a chart or diagram and also include totals, percentages, averages (means, modes, medians), measures of spread (standard deviations, ranges, and quartiles/deciles). According to Helms, Henze, Sass and Mifsud (2006:639), researchers may use multiscale measures to assess different constructs potentially related at some higher level of conceptualisation (for more on

multiple measures of a construct using structural equation modelling. For this study, demographic profiles of respondents were analysed using frequency distributions.

Frequency distributions such as percentages, graphs, line charts, pie charts, histograms and bar charts were used to display research results. Frequency distributions are used to depict absolute and relative magnitudes, differences, proportions and trends (Zikmund *et al.*, 2013:69). These methods use both horizontal and vertical bars to examine different elements of a given variable (Malhotra 2011:84). The use of frequency distributions as applied to this study is shown in section 6.3 of chapter six. The application of frequency distributions facilitated the assessment of gender distribution, the age of respondents, the number of years under employment, type of employment, educational qualifications, and the current position held. Also, frequency distributions were employed in the analysis of the perceptions of respondents towards the research constructs, which was implemented in section 6.4 of chapter six.

5.8.2 Analysis of Mean Scores

Generally, the mean is the average, the value obtained by summing all elements in a set and dividing by the number of factors (Dharmendra & Lokesh, 2010:107). The mean, or average value, is the most commonly used measure of central tendency. It is used to estimate the mean when the data have been collected using an interval or ratio scale (Kruger, De Vos, Fouche & Venter, 2005:233). In the current study, the mean scores of the various measurement scales were analysed in conjunction with frequency analysis, which was done to explore the perceptions of respondents towards the multiple constructs under consideration in this study. (Refer to chapter six, section 6.14).

5.8.3 Confirmatory factor analysis (CFA)

Statistical procedural error by researchers is not uncommon. Typically, this error is not in the calculation of the test result, which nowadays is rarely undertaken by hand but using statistical packages such as Excel, Minitab, Supastat, and the comprehensive and commonly used SPSS (Statistical Package for Social Science) in the test selection (Marshall & Jonker 2010:5). Meredith (1993:525) defines Confirmatory Factor Analysis (CFA) as a statistical measure that allows for systematic tests of measurements invariances and also enables analysis of relationships, which involves latent constructs estimated after correction for measurement errors. It is a way of testing how well variables measured represents a smaller number of constructs (Hair *et al.,* 2014:602). CFA was conducted using the Analysis of Moment Structures (AMOS version 24.0) to assess psychometric properties of the measurement scales. Three

conditions that are tested in Confirmatory Factor Analysis include reliability, validity and model fit.

5.8.3.1 Reliability and validity

Reliability is defined as 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 1996:144). 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 refers to the consistency of either measurement or design and its coefficients range from 0.0, for results that are entirely inconsistent to 1.0 for measurements are entirely consistent (Hair *et al.,* 2014:39).

Salkind (2012:118) acknowledged that is difficult to have entirely consistent reliability (1.0) and suggests some means of increasing reliability. These means/ways include:

- conceptualise all constructs;

- increase the level of measurement;

- use pre-tests and pilot studies

- remove items that are unclear; and

- standardise 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). 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). An alpha of 0.70 or higher is often considered satisfactory for most research purposes (Hair *et al*., 2013). According to Fraering and Minor (2006:284), the minimum acceptable value for the AVE for each scale is 0.40. Accordingly, these thresholds were applied in this study. A pilot study was also conducted to ascertain the reliability of the measurement instrument.

5.8.3.2 **Validity**

Validity is the extent to which the instrument that was selected reflected the reality of the constructs being measured (Collins & Hussey 2003:58). Validity is also defined as the best available approximation to the truth or falsity of a given inference, proposition or conclusion

(Awang *et al.* 2012:25). It measures strength and accuracy of research design (Stivastava & Rego 2011:35). In this study, four validities, namely, face, content, convergent and discriminant validities were assessed. 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" (Neuman 2006:192). To ensure face validity, the research study used several experts in supply chain management to judge the questions independently (Bush 2002:61).

Content validity is "the degree to which a measure covers the range of meanings included within a concept" (Babbie 2013:66). To ascertain content validity in this study, a pilot study was conducted with a conveniently selected sample of 40 respondents, as recommended by Wade and Love (2006:135). 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" (Neuman 2006:194). To ascertain convergent validity, the factor loading for each item was checked. All values were above 0.50. 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 are positive (Litwin 2005:135).

5.8.3.3 Research model fit assessment

Diamantopoulos and Schlegelmilch (2000:43), describe model fit as statistical tests aimed at determining the extent to which the distribution of a variable follows some pre-specified functional form in the population. Jackson, Gillaspy, and Purc-Stephenson, (2009:14) suggest that the general rule of thumb requires applying the following:

a. the chi-square ($\chi2$) and the associated degree of freedom (df) (e.g. Likelihood ratio);

b. one absolute fit index (e.g. GFI, RMSEA or SRMR);

c. one incremental fit index (e.g. CFI or TLI);

d. one goodness-of-fit index (e.g. GFI, CFI or TLI); and

e. one badness-of-fit index (e.g. RMSEA or SRMR).

GFI represents the percent of observed covariance explained compared with the covariance predicted in the model. Value >0.9 indicates good fit (Bollen, 1989:32). SRMR is the average values across all standardised residuals; SRMR are best interpreted using the correlation matrix (Joreskog & Sorbom, 1993:294; Hu & Bentler, 1998:424; Byrne, 2004:13). Value =.05

indicates good model fit (Byrne, 2004:14). RMSEA shows the error approximation in the population. It indicates how well a proposed model with unknown optimally chosen parameter values would be able to fit the population covariance matrix if it were available (Browne & Cudeck, 1993:136). Value = .05 indicates good model fit; Value =.08 indicates adequate model fit (Browne & Cudeck, 1993:136). TLI is derived from the comparison of hypothesised model to the predicted model addressing the issue of parsimony and sample size by considering the degrees of freedom. Value > 0.9 indicates good fit (Hu & Bentler, 1998:424). NFI has been the practical criterion of choice; however, it has shown the tendency of not being flexible to sample size. Bentler (1999:238) revised NFI to take sample size into account and proposed CFI. CFI is the comparison of hypothesised model to the predicted model which measures complete covariation in the data. Value >0.9 indicates good fit (Hu & Bentler, 1998:424). AGFI compares the hypothesised model with the predicted model by adjusting the number of degrees of freedom in the specified model. Value >0.9 indicates good fit (Byrne, 2004:15). The results of the tests for these respective model fits are reported in chapter six.

5.8.4 Path Analysis and Structural Equation Modeling

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, Barkus & Yavorsky 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. It was conducted to test the validity of the proposed model and the hypothesis, using the AMOS 24.0 statistical software program. Therefore, SEM seeks to understand the relationships between latent variables and the observed variables, which form the structural framework from which they are derived (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, GF1, CFI, IFI, RFI, NFI and RMSEA, using the same thresholds to those applied in the CFA.

5.9 ETHICAL CONSIDERATIONS

Ethics refer to a body of moral principles or values that are particular to specific cultures and groups (Weinberg & Schneider 2007:218). According to Erikson and Kovalainen (2008:68), normative guidelines and codes of ethics and rules are needed to govern the integrity of scientific activities and create ways of handling mistakes of an academic institution and organisation. This study was conducted after permission to collect data, which has been obtained from relevant authorities in the South African public sector. The following ethical considerations were observed throughout the research process:

- Scientific validity: the extent to which both evidence and research theory sustain the interpretations of test scores entailed by proposed uses of tests (Roberts Priest & Traynor 2006:43). To ensure scientific validity, the research was conducted in a manner that guaranteed its academic integrity and scientific validity. Unethical practices such as fabrication and plagiarism were avoided.

- Participant confidentiality: this entails observing the privacy of participants and maintaining the anonymity of participants by ensuring that their names are not mentioned anywhere in the thesis or to anyone else (Collis & Hussey, 2009:48). Additionally, respondents were not asked to state their identities when participating in the study. Any details learnt about participants during their involvement in the study were maintained in the strictest confidence. This effectively protected respondents from any possible victimisation.

- Sharing of results: this means making efforts to make the results of the study available to all stakeholders to ensure that all research studies are directed at broadening the base knowledge in the field (Malhotra, 2011:56). Thus, the results of this research was to be freely available to all participants who were interested in the findings of the study.

- Respondents' right to non-participation involves ensuring that they are not coerced into participating in the study (Bryman & Bell, 2015:274). In this regard, respondents only participated in the study using their informed consent. Also, the draft covering letter

(refer to Appendix 1) was used to inform respondents that their participation is voluntary and to assure them that the information they gave was to be used for research purposes only.

5.10 CONCLUSION

This chapter discussed the research design and methodology used in this study. It also dealt with motivations as to why each approach adopted in the study was used. A discussion of the different research paradigms was done, with positivism emerging as the suitable one for the study. The selection of a paradigm led to the identification of the quantitative approach as the best suitable method for this investigation. Sampling design with was discussed in depth where the population, target population, sampling frame, sample size as well as the sampling technique were given emphasis. The data were collected through structured questionnaires and captured, coded and analysed using appropriate statistical software such as Microsoft Excel, SPSS and AMOS. Statistical techniques used to examine the data included descriptive statistics, correlations and structural equation modelling. The chapter also discussed the application of Confirmatory Factor Analysis (CFA) to ascertain the psychometric properties of the questionnaire through testing for reliability, validity and model fit. Lastly, ethical considerations followed in the study were discussed. The next chapter presents the presentation, analysis and interpretation of the collected data.

CHAPTER 6

DATA ANALYSIS AND INTERPRETATION

6.1 INTRODUCTION

The previous chapter discussed the research design and methodology used in this study and outlined the theoretical exposition of the research methodology. The current chapter presents the results of the study and discusses them together with their interpretations to address the research objectives presented in the first chapter. The results of the study are related to the literature review showing how, and the extent to which they support the postulations made in the literature review. The chapter begins by discussing the response rate, followed by a discussion of the demographic profile of respondents. Thereafter, the perceptions of respondents towards the research constructs are discussed. This is succeeded by a discussion of the inferential statistics, which include the testing of the psychometric properties of the measurement scales using confirmatory factor analysis as well as the results of the hypotheses tests. The chapter's closing sections provide an in-depth discussion of the effects of each hypothesis test.

6.2 RESPONSE RATE

The response rate for this research study is presented in Table 6.1.

Table 6.1: Response Rate

Description of Parameter	Statistic
Total number of questionnaires distributed	500
Total number of questionnaires returned	312
Unusable responses	6
Valid questionnaires retained	306
Usable response rate	62.4

As shown in Table 6.1, a total of 500 questionnaires were distributed to supply chain practitioners in the public sector in Gauteng Province. A total of 312 questionnaires were returned after data collection. Out of these questionnaires, six were unusable because they were either wrongly completed or were incomplete. This culminated in a total of 306 questionnaires that were retained for use in the final data analysis, giving a response rate of 62.4%. This response rate was considered acceptable, based on recommendations by scholars such as

Morton, Bandara, Robinson and Carr (2012:106) as well as Carley-Baxter *et al*. (2009:3) that response rates above 50 percent are acceptable in surveys.

6.3 DEMOGRAPHIC DETAILS OF THE RESPONDENTS

This section discusses the demographic details of the respondents. They were supply chain practitioners in the public sector based in Gauteng Province. Five demographic factors, namely, gender, race, age group, highest qualifications, position, racial profile and work experience were considered.

Table 6.2 Demographic Details of the respondents

Variable	Categories	Frequency (n)	Percentages (%)
Gender	Male Female	274 32	89.5 10.5
Totals		306	100
Age group	Below 25 26-33 years 34-41 years 42- 49 years 50 years and over	51 93 112 12 38	16.7 30.4 36.6 3.9 12.4
Totals		306	100
Highest Qualification	Matric Diploma Degree/Honours Postgraduate	11 223 69 3	3.6 72.9 22.5 1.0
Totals		306	100
Supply Chain Management Qualification Confirmation	Yes No	213 93	69.8 30.2
Totals		306	100
Work experience in Supply Chain Management	Less than 2 years Between 2 to 5 years Between 5 to 10 years Between 10 to 15 years 15 years and over	0 2 55 227 22	0.0 0.7 18.0 74.2 7.2
Totals		306	100

Variable	Categories	Frequency (n)	Percentages (%)
Work experience in public sector	Less than 2 years Between 2 to 5 years Between 5 to 10 years Between 10 to 15 years 15 years and over	0 11 112 168 15	0.0 3.6 36.6 54.9 4.9
Totals		306	100
Race	African White Indian/Asian Coloured	304 2 0 0	99.3 0.7 0.0 0.0
Totals		306	100
Occupational Position	Clerical Specialist Supervisor/Line Manager Middle Manager Senior Manager	12 265 19 9 1	3.9 86.6 6.2 2.9 0.3
Totals		306	100

The results in the preceding subsections are indicated using pie charts and bar graphs.

6.3.1 The Gender of Respondents

The frequencies and percentages for the respondents' gender are provided in Figure 6.1.
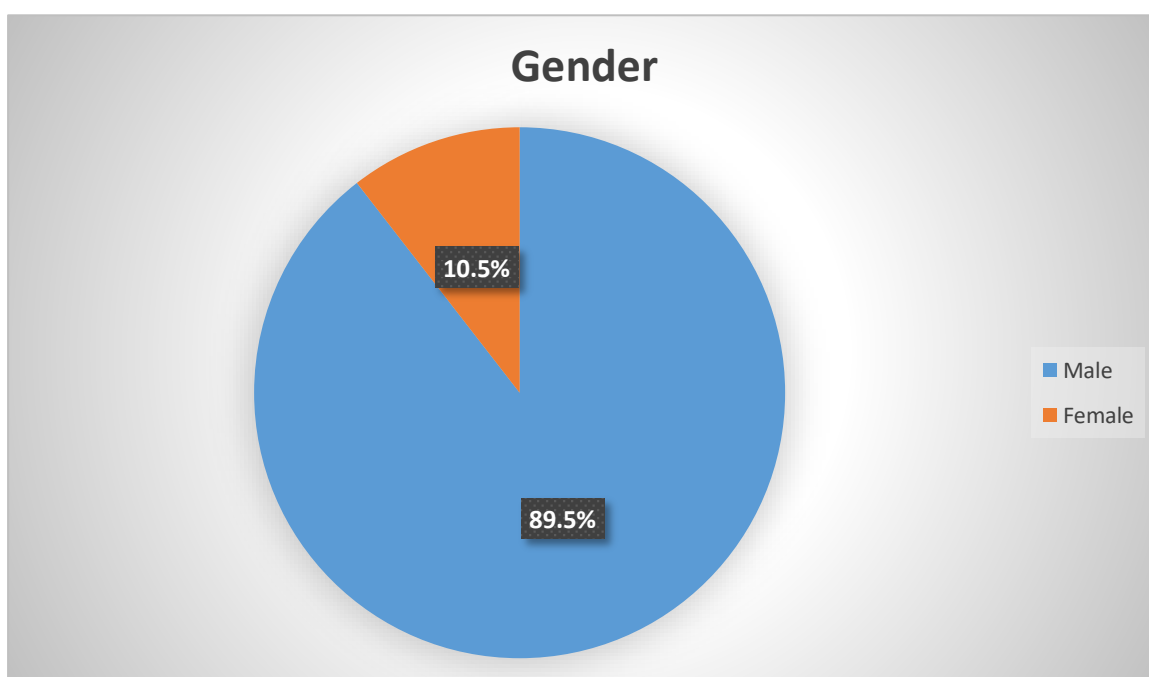
Figure 6.1: Gender of Respondents

Figure 6.1 shows that out of the 306 respondents who completed the questionnaire, 89.5 percent (n=274) were males and 10.5 percent (n=32) were females. This indicates that more males were willing to participate in this study than females.

6.3.2. Age Groups of Respondents

The frequencies and percentages for the respondents' gender are provided in Figure 6.2.
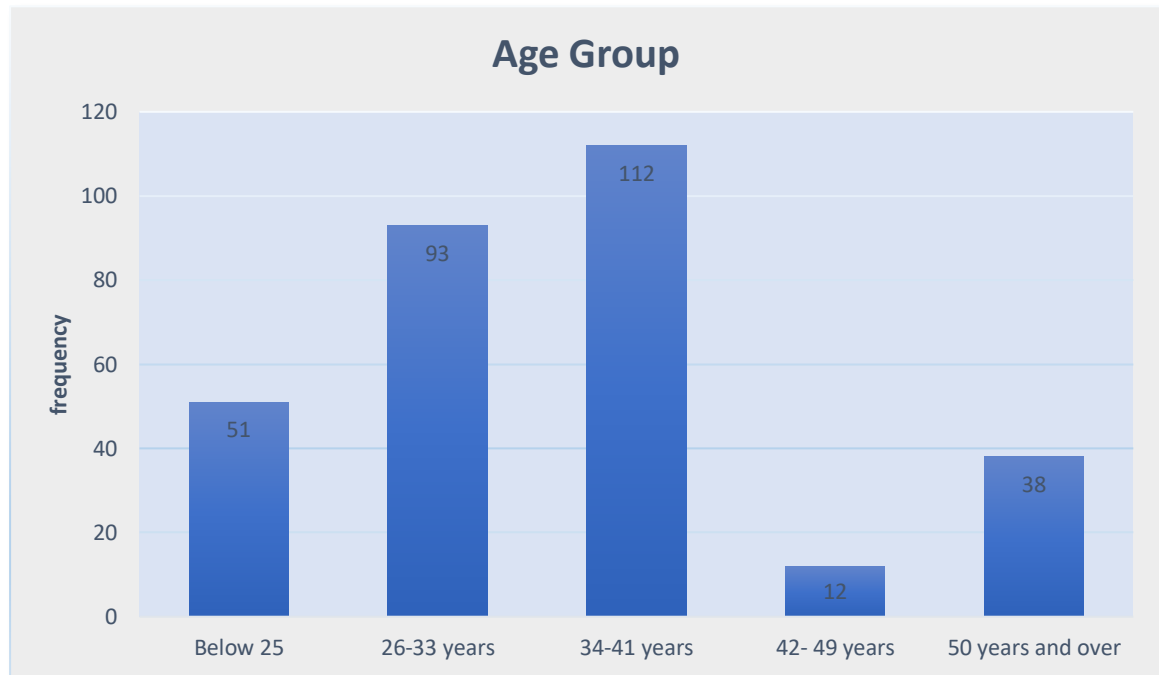
Figure 6.2: Age Groups of Respondents

The results in Figure 6.2 indicates that of the 306 respondents who completed the questionnaire, 16 percent (n=51) were aged below 25 years, while 30.4 percent (n=93) were aged between 26 and 33 years. The analysis further shows that 36.6 percent (n=112) of the respondents were aged between 34 and 41 years; 3.9 percent (n=12) were aged between 42 and 49 years while 12.4 percent (n=38) were above 50 years of age. The analysis indicates that the highest number of respondents were aged between 34 and 41 years. This distribution of respondents is expected, given that in South Africa an average student completes their matric at the age of 19 or 20, spends the next five years in a tertiary institution on obtaining a qualification and then enters the job market. A majority of graduates enter the job market as interns where they rotate in different departments to gain working experience. By virtue of this, people below the ages of 25 are either in learner-ships, roaming between various departments, or unemployed, based on the current statistics of unemployment in South Africa.

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6.3.2 Highest Qualifications of Respondents

The frequencies and percentages for the respondents' highest qualifications are provided in Figure 6.3.
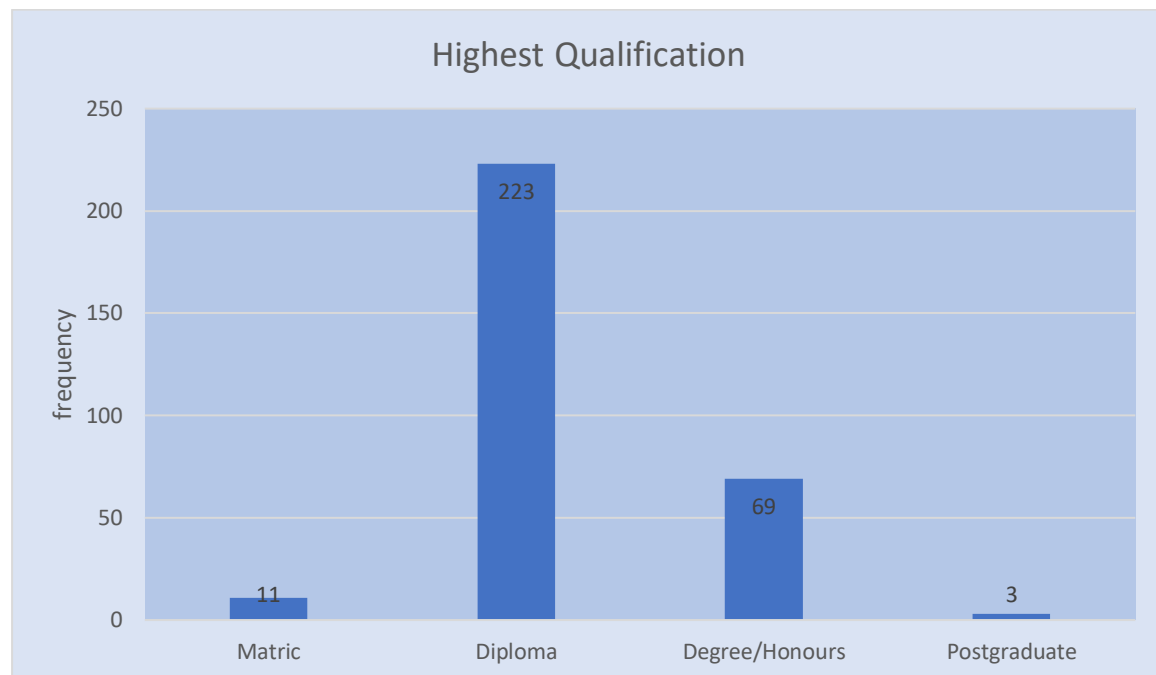
Figure 6.3: Qualifications of Respondents

The results in Figure 6.3 indicates that of the 306 respondents that answered the questionnaire, 3.6 percent (n= 11) were holders of matric/grade 12 while 72.9 percent (n=223) were holders of a diploma; 22.5 percent (n=69) were holders of a degree, and 1 percent (n=3) were holders of postgraduate degrees. This indicates that the majority of supply chain professionals in the study are holders of at least an essential qualification, which should enable them to perform their duties optimally. However, fewer respondents have advanced their qualification. This could be attributed to the lack of support regarding incentives or the lack of promotional opportunities after one has improved their studies. It could also be that there is too much work and so employees cannot find the time to engage in further studies.

6.3.3 Qualification Confirmation by Respondents

The frequencies and percentages for the respondents' supply chain management qualification confirmation are provided in Figure 6.4.
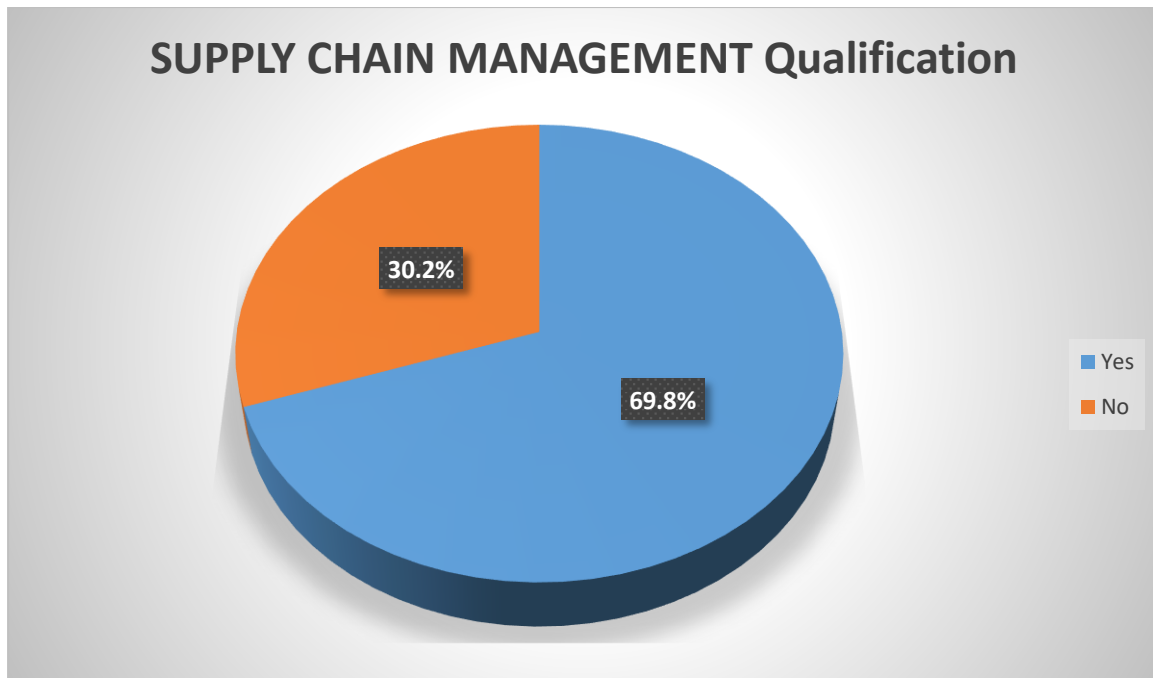
Figure 6.4: Supply Chain Management Qualification Confirmation by Respondents

The results in Figure 6.4 indicate that of the 306 respondents that answered the questionnaire, 69.8 percent (n=213) were holders of a qualification in supply chain management and 30.2 percent (n=93) did not hold a qualification in supply chain management. This indicates that the majority of respondents in this study are qualified in terms of knowledge and skills, which should enable them to perform their duties effectively.

6.3.4. The Work Experience of Respondents in Supply Chain Management

The frequencies and percentages for the respondents' supply chain management work experience are provided in Figure 6.5.
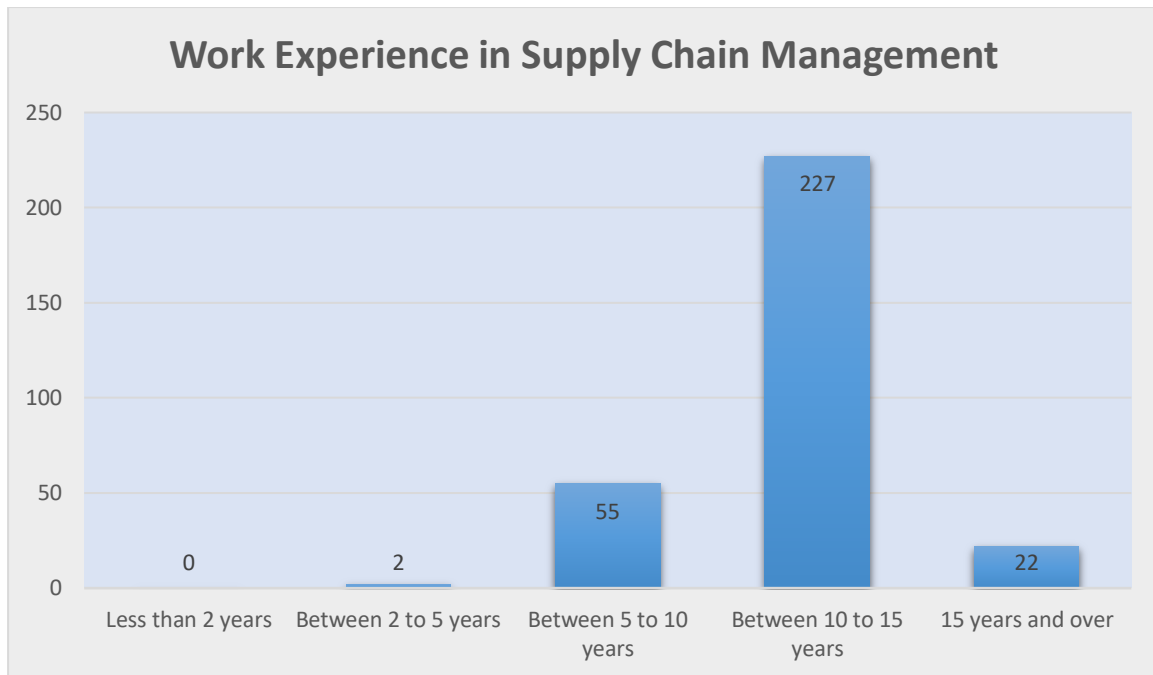
Figure 6.5: Work Experience of Respondents in Supply Chain Management

The results in Figure 6.5 indicate that of the 306 respondents that answered the questionnaire, 0.7 percent (n=2) have between two and five years of experience while 18.0 percent (n=55) had between five and ten years of experience. A total of 74.2 (n=227) of the respondents had between 10 and 15 years of experience and 7.2 percent had over 15 years of public sector supply chain management work experience. The results also show that there are no respondents who had less than two years of public sector supply chain management work experience.

6.3.5 Work Experience of Respondents in the Public Sector

The frequencies and percentages for the respondents' employment period are provided in Figure 6.6.
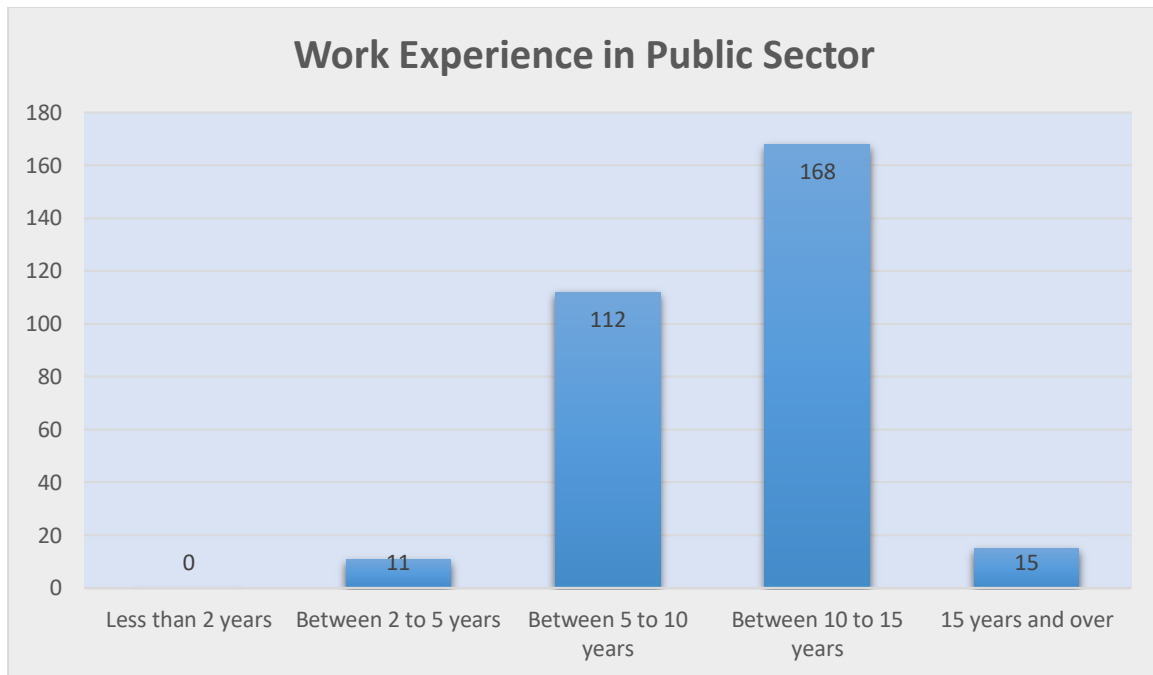
Figure 6.6: Work Experience of Respondents in the Public Sector

Figure 6.6 shows that of the 306 respondents who completed the questionnaire, 3.6 percent (n=11) had between two and five years of experience in the public sector and 36.6 percent (112) had between five and ten years of work experience. A total of 54.9 (n=168) of the respondents had between 10 and 15 years of experience while 4.9 (n=15) had worked in the public sector for over 15 years. The results also show that there were no respondents who had less than two (2) years of public sector work experience. These results indicate that a majority of the respondents in this study have been employed formally employed by the public sector for over two years. The public sector is the biggest employer in South Africa and is also renowned for providing learner-ships/training for graduates/matriculants. In many cases, learner-ships and training take at least 24 months to complete. Hence the majority of employees in the South African public sector only get employed after of two years in learner-ship or training programmes.

6.3.6 The Racial Profile of Respondents

The frequencies and percentages for the respondents' racial profile are provided in Figure 6.7.

Respondent's Race

Legend:
- African
- White
- Indian/Asian
- Coloured
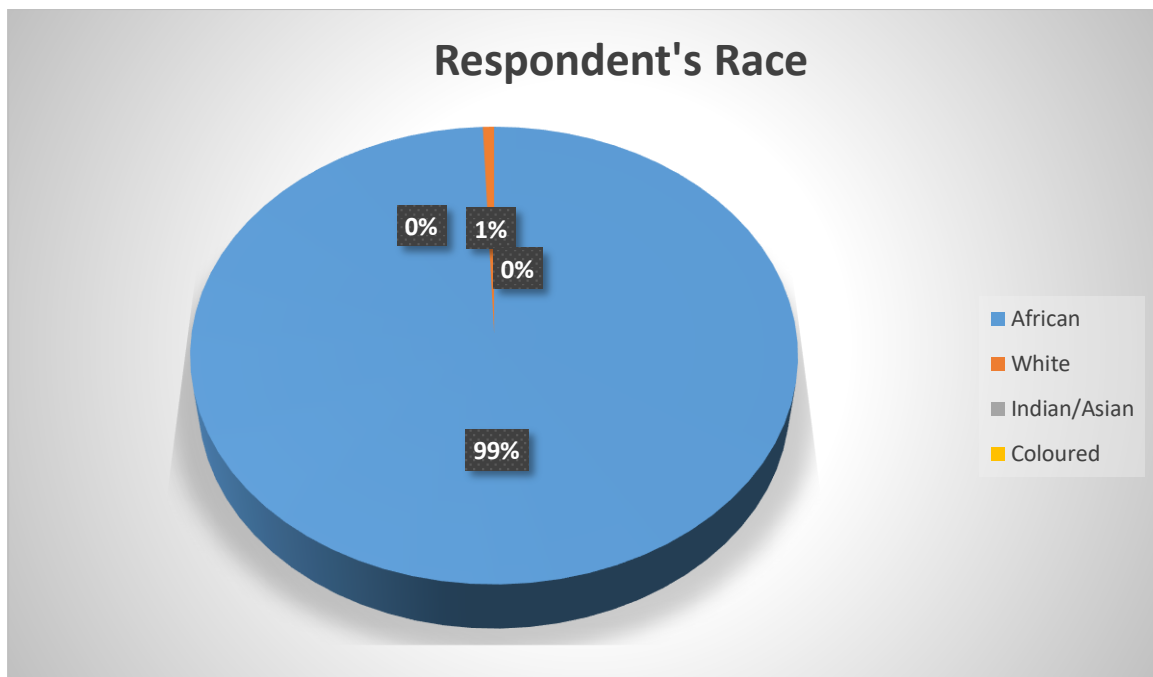
Figure 6.7: Racial profile of respondents

Figure 6.7 shows of the 306 respondents that participated in this study an overwhelming majority of 99.3 percent (n=304) were African, 0.7 percent (n=2) were white, and none were Indian/Asian or Coloured. With the history of inequality in South Africa, the government has introduced policies to advance the historically disadvantaged people. This indicates that the affirmative action policy introduced by the South African government is working, at least regarding race. As a result, the public sector, which is the custodian of the policy takes the lead in ensuring that African people fill positions that are perceived to be administrative.

6.3.7 Position of Respondents

The frequencies and percentages for the respondents' employment position are provided in Figure 6.8.
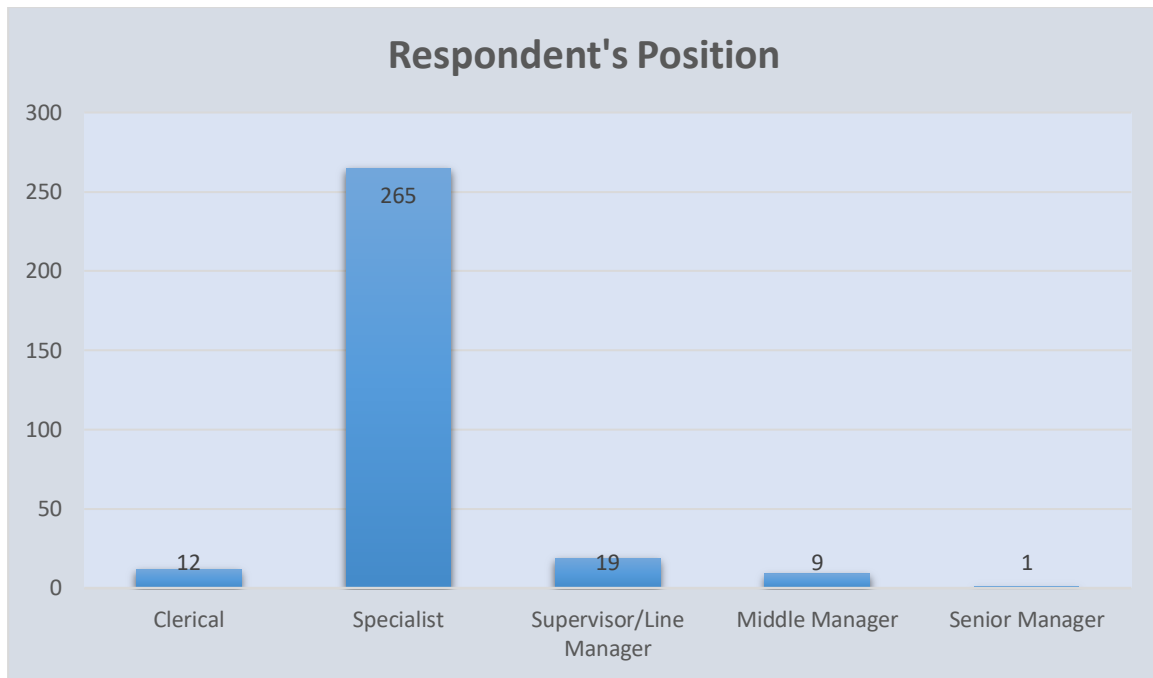
Figure 6.8: Employment position of respondents

In government, most supply chain management departments are primarily in the procurement of goods and services. As such, Figure 6.8 indicates that 86.6 percent (n=265) of the employees in the supply chain management department within the South African public sector are at a specialist level, which is dominated by buyers. The table also indicates that 3.9 percent (n=12) of employees are holders of a clerical position, 6.2 percent (n=19) are in supervisory/line management positions and 2.9 percent (n=9) were middle managers. The table further indicates that a mere 0.3 percent (n=1) were holders of the position of senior management. The South African public sector supply chain management is governed by PPPFA, which prescribes tenders to source products and services. As such, the South African public sector supply chain management is dominated by procurement and less of strategic sourcing. Also, in most South African public sector departments, supply chain management is still perceived as an extension to the finance department where senior managers such as the chief financial officer oversee the supply chain management.

6.4 PERCEPTIONS OF RESPONDENTS TOWARDS RESEARCH CONSTRUCTS

The first empirical objective of this study was to explore the perceptions of supply management practitioners towards supply chain risk management, supply chain flexibility and supply chain performance in the South African public sector. To achieve this, simple descriptive statistics in the form of frequencies, percentages and mean scores were analysed. This section presents the results of these descriptive statistics.

6.4.1 The Frequencies and Percentages for Government Policies

The views of respondents towards government policies are reported in Table 6.3.

Table 6.3: Frequencies and Percentages for Government Policies

Item	Description	Strongly Disagree (%)	Disagree (%)	Moderately Agree (%)	Agree (%)	Strongly agree (%)	Mean score	Standard deviation
GP1	My organisation gives employees the means to properly follow government rules and regulations.	6(2.0)	17(5.6)	94(30.7)	161(52.6)	28(9.2)	3.61	0.807
GP2	My organisation has effective structures to communicate government policies to stakeholders.	6(2.0)	30(9.8)	195(63.7)	75(24.5)	0(0)	3.11	0.641
GP3	My organisation ensures that employees adhere to rules and regulations.	31(10.1)	129(42.2)	140(45.8)	5(1.6)	1(0.3)	2.40	0.704
GP4	My organisation encourages employees to defend political choices even if they see shortcomings.	97(31.7)	197(64.4)	9(2.9)	3(1.0)	0(0)	1.73	0.561
GP5	My organisation clearly explains what is expected of employees regarding integrity and ethics.	3(1.0)	13(4.2)	196(64.1)	60(19.6)	34(11.1)	3.36	0.773
Scale: 1=strongly disagree; 2=disagree; 3= moderately agree; 4= agree; 5= strongly disagree								

Table 6.3 shows the perceptions of respondents towards government policies. An analysis of the results shows that 53 percent (n=161) of the respondents agreed that their organisation gives the employees the means to follow the rules and regulation properly. A total of 64 percent (n=195) of the respondents moderately agreed that their organisation has effective structures to communicate government policies to stakeholders. Another 46 percent (n=140) of respondents also moderately agreed that their organisation ensures that employees adhere to rules and regulations. At least 64 percent (n=197) of the respondents disagreed with the statement that their organisation encourages employees to defend political choices even if they see

shortcomings. Another 64 percent (n=196) of the respondents moderately agreed with the statement that their organisation clearly explains what is expected of employees regarding integrity and ethics.

In Table 6.3, the highest mean scores were obtained for the following statements:

- My organisation gives employees the means to properly follow government rules and regulations ($\bar{x}$=3.61, SD=±.81).
- My organisation clearly explains what is expected of employees regarding integrity and ethics. ($\bar{x}$=3.36, SD=±.77).
- My organisation has effective structures to communicate government policies to stakeholders. ($\bar{x}$=3.11, SD=±.64).

The lowest mean scores were obtained for the following statements:

- My organisation ensures that employees accurately adhere to rules and regulations ($\bar{x}$=2.40, SD=±.70).
- My organisation encourages employees to defend political choices even if they see shortcomings ($\bar{x}$=1.73, SD=±.56).

The results of this study demonstrate that the South African public sector provides their employees with the means to correctly follow the rules and regulations. The study also confirms that the South African public sector has useful structures to communicate government policies to stakeholders and ensures that employees accurately adhere to such rules and regulations. It further demonstrates that the South African public sector clearly explains what is expected of employees regarding integrity and ethics, while discouraging them to defend political choices even if they see shortcomings.

The results regarding the perceptions of respondents towards government policies mean are in line with a study conducted by Mofokeng and Luke (2014:1), which investigated the effectiveness of procurement practices in public entities in South Africa. Their research confirmed that the South African public sector through the National Treasury administers procurement legislation and policies, and provides support to employees in the public sector. Another survey by Nakyeyune, Tauringana, Ntayi and Nkundabanyanga (2016:1148) who investigated the public finance regulatory compliance amongst public secondary schools in Uganda, emphasizes leadership support as a tool to achieve compliance with public finance regulations in secondary schools. Arlbjørn and Freytag's (2012:204) study contrasted between private procurement and public procurement, confirming that public procurement is unique in that sector-wide special rules and regulations govern it to secure goods and service.

In addition, a study conducted by Fourie (2009:631) confirms that the South African public sector provides its employees with the means to properly follow the rules and regulations by publishing all relevant legislation, acts and practice notes on the National Treasury website. Another study by Fourie (2015:42) directed its attention to procurement in the South African public service; the results indicate that the South African public sector has a code of conduct of which all public service officials should adhere to. The code of conduct clearly explains what is expected from all officials in terms of ethics and integrity. The study further highlights that a number of public sector officials are on suspension pending a disciplinary hearing, which confirms that the South African public sector is continuously ensuring that employees are following the rules and regulations. Therefore, the South African public sector has adequate legislation and policies and measures that have taken place to ensure their compliance.

6.4.2 The Frequencies and Percentages for Supply Complexity

The views of respondents towards supply complexity are reported in Table 6.4

Table 6.4: Frequencies and Percentages of Supply Complexity

Item	Description	Strongly Disagree (%)	Disagree (%)	Moderately Agree (%)	Agree %)	Strongly agree (%)	Mean score	Standard deviation
SC1	My organisation can easily replace its key suppliers.	179(58.5)	112(36.6)	8(2.6)	5(1.6)	2.(0.7)	1.49	0.693
SC2	A high level of trust exists between my organisation and its suppliers.	59(19.3)	135(44.1)	108(35.3)	3(1.0)	1(0.3)	2.19	0.762
SC3	There are deep similarities between the business culture and structure of my organisation to that of its key suppliers.	62(20.3)	109(35.6)	132(43.1)	1(0.3)	2(0.7)	2.25	0.802
SC4	My organisation and its key suppliers have a huge influence on each other's supply chain decisions?	5(1.6)	10(3.3)	19(6.2)	101(33.0)	171(55.9)	4.38	0.869
SC5	There is a high level of information sharing between	4(1.3)	6(2.0)	6(2.0)	110(35.9)	180(58.8)	4.49	0.752

	my organisation and its key suppliers							
Scale: 1=strongly disagree; 2=disagree; 3= moderately agree; 4= agree; 5= strongly disagree								

Table 6.4 outlines the perceptions of respondents towards supply complexity. The results show that 59 percent (n=179) strongly disagreed with the statement that their organisation can easily replace its key suppliers. A total of 44 percent (n=135) of the respondents disagreed with the statement that there is a high level of trust that exists between their organisation and their suppliers. A total of 43 percent (n=132) of the respondents moderately agreed with the statement that there are deep similarities between the business culture and structure of their organisation and that of their suppliers. The percentage of respondents who strongly agreed that their organisation and their key suppliers have a huge influence on each other's supply chain decisions is 56 percent (n=171), whereas a total of 59 percent (n=180) respondents also strongly agreed that there is a high level of information sharing between their organisation and their key suppliers.

In Table 6.4, the highest mean scores were obtained for the following statements:

- There is a high level of information sharing between my organisation and its key suppliers ($\bar{x}$=4.49, SD=±.75).
- My organisation clearly explains what is expected of employees regarding integrity and ethics. ($\bar{x}$=4.38, SD=±.87).

The lowest mean scores were obtained for the following statements:

- My organisation can easily replace its key suppliers ($\bar{x}$=1.49, SD=±.69).
- A high level of trust exists between my organisation and its suppliers ($\bar{x}$=2.19, SD=±.76).

The results of this study demonstrate that the South African public sector finds it difficult to replace its key suppliers. Also, there appear to be high levels of mistrust between public organisations and their suppliers. However, the results also show that there are deep similarities between their organisations and their suppliers in terms of practices such as business culture and organisational structures. The results further indicate that there is a high level of information sharing and a considerable influence on each other's supply decisions between the South African public sector organisations and their key suppliers.

Similar to the results above, Gupta, Prakash and Jadeja (2015:296) examined supply chain complexity in a public procurement environment. Their study concludes that both the public and private sector have a need to source goods and services in accordance with their specifications and as such there are profound similarities between the South African public sector and their suppliers. Another study conducted by Koma (2009:453) investigated the conceptualisation and contextualisation of corporate governance in the South African public sector and demonstrated specific practices such as the King Code of Corporate Practice and Conduct, which defines the structures and conduct of organisations applicable to both private and public sector. Naude *et al.* (2013:3) examined supplier relationship management in the South Africa public sector and found that there is high level of information sharing and huge influence of supply decision between the South African public sector and its key suppliers during demand management and acquisition management processes, which are in line with the public sector supply chain management framework.

Carr (2016:175) investigated the relationships between information technology, organisational cooperation and supply chain performance. The results indicate that supply chain performance can be enhanced when organisations direct their efforts towards effectively managing the transfer of knowledge with their key suppliers. The results also state that the coordinated flow of information between the organisation and its key suppliers is critical to effective supply chain management. Mofokeng and Luke (2014:1) concentrated on the effectiveness of procurement practices within public entities. The results of their study confirm that both the private sector and the South African public does not trust the public sector, which leads to dysfunctional relationships. Panayides and Lun (2009:42) explored the impact of trust on innovativeness and supply chain performance. Their study shows that trust is a crucial factor in improving supply chain management performance. The results reveal that trust facilitates better understanding between organisations and their suppliers, which will enhance the service delivery. Thus, although there are significant information sharing and similarities between South African public sector organisations and their suppliers, mistrust still exists between them, and there is an overdependence on these suppliers.

 The Frequencies and Percentages for Availability of Skills

The views of respondents towards availability of skills are reported in Table 6.5

Table 6.5: Frequencies and Percentages for the Availability of Skills

Item	Description	Strongly Disagree (%)	Disagree (%)	Moderately Agree (%)	Agree (%)	Strongly agree (%)	Mean score	Standard deviation
AS1	My organisation finds it easy to recruit required supply chain professionals	279(91.2)	17(5.6)	8(2.6)	2(0.7)	0(0)	1.13	0.451
AS2	My organisation often experiences a high staff turnover (resignations)	2(0.7)	15(4.9)	79(25.8)	93(30.4)	117(38.2)	4.01	0.948
AS3	In this organisation, people are generally enthusiastic about their jobs	88(28.8)	110(35.9)	103(33.7)	5(1.6)	0(0)	2.08	0.828
AS4	Employees in my organisation have the necessary qualifications and skills for the positions they hold	114(37.3)	164(53.6)	21(6.9)	21(6.9)	7(2.3)	1.74	0.684
AS5	My organisation relies on external consultants to fill vacant positions	1(0.3)	1(0.3)	67(0.7)	67(21.9)	235(76.8)	4.75	0.517
Scale: 1=strongly disagree; 2=disagree; 3= moderately agree; 4= agree; 5= strongly disagree								

Table 6.5 indicates the perceptions of respondents towards availability of skills. An analysis of the results clarifies that 91 percent (n=279) of the respondents strongly disagreed with the statement that their organisation finds it easy to recruit required supply chain professionals, whereas 38 percent (n=117) strongly agreed with the statement that their organisation often experiences a high staff turnover (resignations). A total of 36 percent (n=110) of the respondents disagreed with the statement that in their organisation people are generally enthusiastic about their jobs. A total of 54 percent (n=164) of the respondents disagreed with the statement that employees in their organisation have the necessary qualifications and skills for the positions they hold. A majority of 77 percent (n=235) of the respondents strongly agreed with the statement that their organisation relies on external consultants to fill vacant positions.

In Table 6.5, the highest mean scores were obtained for the following statements:

- My organisation relies on external consultants to fill vacant positions ($\bar{x}$=4.75, SD=±.52).
- My organisation often experiences a high staff turnover (resignations) ($\bar{x}$=4.01, SD=±.95).

The lowest mean scores were obtained for the following statements:

- My organisation finds it easy to recruit required supply chain professionals ($\bar{x}$=1.13, SD=±.45).
- Employees in my organisation have the necessary qualifications and skills for the positions they hold ($\bar{x}$=1.74, SD=±.68).

The results of this study show that the South Africa public sector finds it difficult to recruit supply chain professionals and often experiences high staff turnover (resignations). In addition, the results imply that employees are generally not enthusiastic about their jobs, which may be a sign of dissatisfaction. The results further suggest that the South African public sector does not have the necessary qualifications and skills for the positions. Perhaps because of these deficiencies, the sector relies heavily on external consultants to fill vacant positions.

The results above support the findings of research conducted by Rasool and Botha (2011:10) who discovered that South Africa is losing a considerable percentage of its highly skilled and skilled workers to western economies. The National Treasury (2015:5) reviewed supply chain management performance in the South African public sector. The results showed that supply chain management practitioners do not have the skills, knowledge and experience necessary to execute the supply chain management mandate. They also reported that employees in the public sector lack adequate motivation. Similarly, a study conducted by Mabelebele (2017:250) explored prospects and challenges of implementing projects in the South African public sector. The study found that the South African public sector does not have in house-capacity such that consultants facilitate much of the work. A report by The World Bank (2011:49) focuses on issues of accountability in public services in South Africa. It underscores that many of the organisations within the South African public sector are relatively new on their mandate and as such, they find it challenging to attract capable professionals. Therefore, there are entrenched human resource issues within the South African public sector and the context of supply chain professionals. These challenges include the shortage of adequately skilled professionals, lack of motivation, which leads to staff turnover and the heavy dependence on external consultants to fill vacancies.

6.4.3 The Frequencies and Percentages for Supplier Performance Monitoring

The views of respondents towards supplier performance monitoring are reported in Table 6.6.

Table 6.6: Frequencies and Percentages of Supplier Performance Monitoring

Item	Description	Strongly Disagree (%)	Disagree (%)	Moderately Agree (%)	Agree (%)	Strongly agree (%)	Mean score	Standard deviation
SPM1	My organisation visits supplier premises to help suppliers improve their performance.	184(60.1)	120(39.2)	2(0.7)	0(0)	0(0)	1.41	0.505
SPM2	My organisation trains suppliers' personnel.	147(48.0)	158(51.6)	1(0.3)	0(0)	0(0)	1.15	0.507
SPM3	My organisation provides suppliers with feedback about their performance.	119(38.9)	182(59.5)	3(1.0)	2(0.7)	0(0)	1.63	0.540
SPM4	My organisation uses rewards to recognise suppliers' achievements	160(52.3)	141(46.1)	4(1.3)	1(0.3)	0(0)	1.50	0.545
SPM5	Price is a major consideration when my organisation selects suppliers	3(1.0)	9(2.9)	95(31.0)	126(41.2)	73(23.9)	3.84	0.855
SPM6	Suppliers inform my organisation on major changes in their organisations.	0(0.0)	1(0.3)	14(4.6)	177(57.8)	114(37.3)	3.68	0.574
Scale: 1=strongly disagree; 2=disagree; 3= moderately agree; 4= agree; 5= strongly disagree								

Table 6.6 provides statistics regarding the perceptions of respondents towards supplier performance monitoring. An analysis of the results indicates that 60 percent (n=184) of the respondents strongly disagreed with the statement that their organisation visits supplier premises to help suppliers improve their performance. The results also show that 52 percent (n=158) of the respondents disagreed with the statement that their organisation trains supplier personnel. A total of 60 percent (182) of the respondents disagreed with the statement that their organisation provides suppliers with feedback about their performance. A total of 52 percent

(n=160) of the respondents strongly disagree with the statement that their organisation uses rewards to recognise suppliers' achievements. At least 41 percent (n=126) of the respondents agreed with the statement that price is a major consideration when their organisation selects suppliers. The results further clarify that 58 percent (n=177) of the respondents agreed with the statement that their suppliers inform their organisations on significant changes at their organisations.

In Table 6.6, the highest mean scores were obtained for the following statements:

- Price is a major consideration when my organisation selects suppliers ($\bar{x}$=3.84, SD=±.86).
- Suppliers inform my organisation on major changes in their organisations ($\bar{x}$=3.68, SD=±.57).

The lowest mean scores were obtained for the following statements:

- My organisation trains suppliers' personnel ($\bar{x}$=1.15, SD=±.51).
- My organisation visits supplier premises to help suppliers improve their performance. ($\bar{x}$=1.41, SD=±.51).
- My organisation uses rewards to recognise suppliers' achievements ($\bar{x}$=1.50, SD=±.55).

The results of this study point to a deficiency in site visits since the South African public sector does not visit supplier premises to help employees improve their performance. The results also point to a lack of supplier development since the South African public sector neither trains nor gives feedback about performance to suppliers. Also, there are no rewards in place for the recognition of supplier achievements. However, on a positive note, information sharing appears to be effective since suppliers do not hesitate to inform the South African public sector about significant changes occurring in their businesses. The results further show that price is a major consideration when the South Africa public sector selects suppliers.

The above results are consistent with the report by the National Treasury (2015:5), which revealed supplier performance monitoring is often neglected in the South African public sector. Some studies (Naude *et al.,* 2013:4: Mofokeng & Luke, 2014:2) support the view that supplier performance management, including activities such as visiting supplier premises to assess their performance, provides suppliers with training where needed and gives them feedback so that employees can improve what is lacking in the South African public sector. A study conducted by Dewhurst, MartõÂnez-Lorente and Dale (1999:267) that examined the implementation of

total quality management in public organisations found that the incentive to reduce costs is not typically considered critical for the public sector. In another study, the Worldbank (2011:39) discovered that suppliers to the South African public sector are hardly rewarded for successful delivery. Quinot (2014:1131) considered the role of quality in the adjudication of public sector transactions and demonstrated that the South African public sector (in line with the PPPFA) use price as the most important criterion to award tenders to suppliers. Therefore, there exists a need to improve supplier performance monitoring activities such as site visits to suppliers, supplier development and the provision of rewards to the South African public sector.

6.4.4 The Frequencies and Percentages for Information Security

The views of respondents towards information security are reported in Table 6.7.

Table 6.7: Frequencies and Percentages of Information Security

Item	Description	Strongly Disagree (%)	Disagree (%)	Moderately Agree (%)	Agree (%)	Strongly agree (%)	Means score	Standard deviation
IS1	Information security awareness is communicated well throughout the organisation.	10(3.3)	17(5.6)	178(58.2)	95(31.0)	6(2.0)	3.23	0.724
IS2	Users receive adequate security training prior to receiving a network account.	69(22.5)	220(71.9)	12(3.9)	3(1.0)	2(0.7)	1.85	0.585
IS3	A variety of business communications (notices, posters, newsletter, etc.) are used to promote security awareness.	37(12.2)	191(62.4)	74(24.2)	2(0.7)	2(0.7)	2.15	0.652
IS4	Information security policies are written in a manner that is clear and understandable.	5(1.6)	19(6.2)	120(39.2)	87(28.4)	75(24.5)	3.68	0.966
IS5	Information security rules are enforced by sanctioning the employee who breaks them.	2(0.7)	12(3.9)	153(50.0)	55(18.0)	84(27.5)	3.68	0.943
IS6	Employee computer practices are properly	28(9.2)	97(31.7)	141(46.1)	37(12.1)	3(1.0)	2.64	0.846

	monitored for policy violations.						

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

Table 6.7 reports on the perceptions of respondents towards information security. An analysis of the results indicates that 58 percent (n=178) of the respondents moderately agreed with the statement that information security awareness is communicated well throughout their organisation. At least 72 percent (n=220) of the respondents disagreed with the statement that in their organisation, users receive adequate security training before receiving a network account. At least 62 percent (n=191) of the respondents also disagreed with the statement that their organisation uses a variety of business communications (notices, posters, newsletters, etc.) to promote security awareness. A total of 39 percent (n=120) of the respondents moderately agreed with the statement that in their organisation, information security policies are written in a manner that is clear and understandable. The percentage of those respondents who moderately agreed with the statement that in their organisation information security rules are enforced by sanctioning the employee who breaks them is 50 percent (n=153). Those respondents who moderately agree that in their organisation, employee computer practices are adequately monitored for policy violations is 46 percent (n=141).

In Table 6.7, the highest mean scores were obtained for the following statements:

- Information security policies are written in a manner that is clear and understandable ($\bar{x}$=3.68, SD=±.97).
- Information security rules are enforced by sanctioning the employee who breaks them ($\bar{x}$=3.68, SD=±.94).
- Information security awareness is communicated well ($\bar{x}$=3.23, SD=±.72).

The lowest mean scores were obtained for the following statements:

- Users receive adequate security training before receiving a network account ($\bar{x}$=1.85, SD=±.59).
- A variety of business communications (notices, posters, newsletters, etc.) are used to promote security awareness ($\bar{x}$=2.15, SD=±.65).

The results of this study demonstrate that information security awareness is communicated effectively in the South African public sector. However, the results suggest that the South

African public sector does not use a variety of business communications such as notices, posters, and newsletters to promote security awareness. The results also show that information security awareness is provided in a manner that is clear and understandable. The results further suggest a lack of information security training, since users do not receive adequate security training before receiving a network account. Also, employee computer practices are properly monitored for policy violations, and information rules are enforced by sanctioning the employee who breaks them.

As reported by the National Treasury (2015:23), the public has the right to public sector information. The South African public sector communicates information, which includes information security awareness through policies, government plans and practice notes through the Internet. Jaarsveldt (2010:177) investigated information technology skills for the South African public services. The study highlighted that the South African government published a Green Paper on E-Commerce in November 2000 to make people aware of the influence of information technology on the public. The study shows that the Green Paper was written in a manner that the public could understand. Also, it demonstrated that the employees in the South African public sector do not have the required skills to navigate the information systems in their organisations, which presents information security challenges.

6.4.5 The Frequencies and Percentages for Process Efficiency

The views of respondents towards process efficiency are reported in Table 6.8.

Table 6.8: Frequencies and Percentages of Process Efficiency

Item	Description	Strongly Disagree (%)	Disagree (%)	Moderately Agree (%)	Agree (%)	Strongly agree (%)	Mean score	Standard deviation
PE1	The top management team emphasises team work.	4(1.3)	8(2.6)	135(44.1)	138(45.1)	21(6.9)	3.54	0.720
PE2	The top management team provides clear feedback to employees.	59(19.3)	239(78.1)	4(1.3)	2(0.7)	2(0.7)	1.85	0.520
PE3	My organisation involves waste reduction in its operations.	106(34.6)	192(62.7)	6(2.0)	1(0.3)	1(0.3)	1.69	0.560
PE4	The IT system in my organisation is convenient to	13(4.2)	40(13.1)	150(49.0)	84(27.5)	19(6.2)	3.18	0.890

	access information.						
PE5	The IT system in my organisation has well-developed guide material for using the system.	0(0)	3(1.0)	12(3.9)	227(74.2)	64(20.9)	3.86	0.564
PE6	My organisation standardises operational processes.	12(3.9)	27(8.8)	111(36.3)	82(26.8)	74(24.2)	3.58	1.069
Scale: 1=strongly disagree; 2=disagree; 3= moderately agree; 4= agree; 5= strongly disagree								

Table 6.8 provides statistics on the perceptions of respondents towards process efficiency. An analysis of the results shows that 45 percent (n=138) of the respondents agree with the statement that in their organisation top managers emphasize teamwork. A total of 78 percent (n=239) of the respondents disagreed with the statement that in their organisation top management team provides clear feedback to the employees. At least 63 percent (n=192) of the respondents disagree with the statement that their organisation involves a waste reduction in its operations. The results further show that 49 percent (n=150) of the respondents moderately agreed with the statement that the IT system in their organisation is convenient to access information. The perception of respondents who disagreed with the statement that the IT system in their organisation has a well-developed guide material for using the system is 74 percent (n=227). At least 36 percent (n=111) of the respondents moderately agreed with the statement that their organisation standardises operational processes.

In Table 6.8, the highest mean scores were obtained for the following statements:

- The IT system in my organisation has well-developed guide material for using the system. ($\bar{x}$=3.86, SD=±.56).
- My organisation standardises operational processes ($\bar{x}$=3.58, SD=±1.07).
- The top management team emphasises team work ($\bar{x}$=3.54, SD=±.72).

The lowest mean scores were obtained for the following statements:

- My organisation involves a waste reduction in its operations ($\bar{x}$=1.69, SD=±.56).
- The top management team provides clear feedback to the employees. ($\bar{x}$=1.85, SD=±.52).

The results of this study imply that in the South Africa public sector, top managers have done well in encouraging teamwork amongst staff. It also appears that most operational processes are standardised, which makes them easier to manage. The results further demonstrate that the South African public sector has an IT system that is convenient for accessing information and there is a well-developed guide material for using that system. However, the provision of feedback by top managers to employees is lacking, and there is no emphasis on waste reduction in organisational processes.

The results of the study support the findings of research conducted by Arlbjørn and Freytag (2012:207) that investigated private and public procurement processes. The study shows that process efficiency is a major challenge in the public sector, especially when dealing with the tendering system. In the same vein, National Treasury (2015:59) reported that adoption of IT in supply chain management could increase efficiency and effectiveness of public sector spending processes. The Worldbank (2011:6) also stated that although the South African public sector has IT systems, more practical, comprehensive and user-friendly operation manuals should be made available to work on the systems. Ngoepe 2014:6 examined the role of records management as a tool to identify risks in the South African public sector. The results show that the South African public sector depends on the Internal Audit Department to assume the role of managing the waste reduction in their operations. The results concluded that the South African public sector does not build in risk avoidance in their operations.

6.4.6 The Frequencies and Percentages for Supply Chain Flexibility

The views of respondents towards Supply Chain Flexibility are reported in Table 6.9.

Table 6.9: Frequencies and Percentages of Supply Chain Flexibility

Item	Description	Much worse than the industry average (%)	Worse than the industry average (%)	Similar to the industry average (%)	Better than the industry average (%)	Much better than the industry average (%)	Means score	Standard deviation
SCF1	Involving and supporting suppliers in new product/ service development.	155(50.7)	147(48.0)	3(1.0)	0(0)	1(0.3)	1.51	0.556
SCF2	Handling a number of new product/service development projects in design at	155(50.7)	143(46.7)	6(2.0)	1(0.3)	1(0.3)	1.53	0.590

	a given time and at reasonable cost.							
SCF3	Managing reasonably the cost of switching from one supplier to another.	166(54.2)	132(43.1)	7(2.3)	0(0)	1(0.3)	1.49	0.580
SCF4	Managing the time and cost implications of changing the quantity and types of products/services to be delivered.	147(48.0)	151(49.3)	4(1.3)	2(0.7)	2(0.7)	1.57	0.625
SCF5	Speeding the flow of information throughout the supply chain network.	152(49.7)	144(47.1)	7(2.3)	2(0.7)	1(0.3)	1.55	0.611
SCF6	The efficiency of existing information system applications to integrate with other systems applications.	117(38.2)	177(57.8)	8(2.6)	2(0.7)	2(0.7)	1.68	0.625
Scale: 1=strongly disagree; 2=disagree; 3= moderately agree; 4= agree; 5= strongly disagree								

Table 6.9 indicates the perceptions of respondents towards supply chain flexibility. An analysis of the results indicates that 51 percent (n=155) of the respondents perceived that the performance of their organisation in involving and supporting suppliers in the development of new products and services was much worse than the industry average. Similarly, another 51 percent (n=155) of the respondents perceived that the performance of their organisation in handling new products/services development projects in design at a given time at a reasonable cost was also much worse than the industry average. A total of 54 percent (n=166) of the respondents perceived that the performance of their organisation in managing the cost of switching from one supplier to another was worse than the industry average. At least 49 percent (n=147) of the respondents' percent perceived that the ability of their organisation to manage the time and cost implications of changing the quality and type of products/services to be delivered was worse than the industry average. Also, 50 percent (n=152) of the respondents felt that the performance of their organisation in speeding up the flow of information throughout the supply chain network was much worse than the industry average. Further, at least 58 percent (n=177) of the respondents believed that the performance of their organisation

regarding the efficiency of existing information system applications to integrate with other systems applications was worse than the industry average.

In Table 6.9, all mean scores were inclined towards the worse/ much worse than the industry average positions on the Likert-type scale, as follows:

- The efficiency of the existing information system applications to integrate with other systems applications. ($\bar{x}$=1.68, SD=±.63).

- Managing the time and the cost implications of changing the quantity and types of products/services to be delivered ($\bar{x}$=1.57, SD=±.62).

- Speeding the flow of information throughout the supply chain network. ($\bar{x}$=1.55, SD=±.61).

- Handling some new product/service development projects in design at a given time and at a reasonable cost ($\bar{x}$=1.53, SD=±.59).

- Involving and supporting suppliers in new product/ service development. ($\bar{x}$=1.51, SD=±.56).

- Managing reasonably the cost of switching from one supplier to another ($\bar{x}$=1.49, SD=±.58).

The results demonstrate that the South African public sector does not involve and support suppliers in new product/ service development. The results also point out that the South African public sector cannot handle some new products/services development projects in design at a given time at reasonable cost. Also, the South African public sector is failing to reasonably manage the cost of switching from one supplier to another. The results further imply that the South African public sector has not managed effectively the time and cost implications of changing the quality of products and services to be delivered. The study further reveals that the flow of information throughout the supply chain network is slow and that supply chain integration is lacking.

A report by the National Treasury (2016:4) shows that the South African public sector does not have a single data center where supply chain management data is consolidated. Network connectivity in the South African public sector is less than optimal, resulting in delays in capturing and processing transactions (Terblanche 2011:54). Hendriks (2012:7) found that the current information system solutions used across the South African public sector are poorly integrated and does not allow system-driven operating procedures with a single interface. Gupta, Prakash and Jadeja (2015:300) explored supply chain management in the public

procurement environment. The study found that when organisations do not provide incentives for suppliers to improve product design and value engineering, the contribution of suppliers in continuous improvement will also be very limited. A study conducted by Carr (2016:172) indicates that while buyers seek qualified suppliers to provide raw materials and components at a low cost, finding the appropriate supplier to give items is time-consuming and require extensive use of supply chain management resources. As a result, many organisations typically avoid switching from one supplier to another, which constitutes another cost. However, it appears that these costs are not considered as the South African public sector switches between suppliers, and hence it cannot handle or reasonably manage the time and cost of handling product/services development and switching suppliers.

6.4.7 The Frequencies and Percentages for Supply Chain Performance

The views of respondents towards supply chain performance are reported in Table 6.10.

Table 6.10: Frequencies and Percentages of Supply Chain Performance

Item	Description	Decreased signify-cantly (%)	Decreased (%)	Somewhat Increased (%)	Increased (%)	Increased signify-cantly (%)	Mean score	Standard deviation
SCP1	Quality of services	124(40.5)	118(38.6)	47(15.4)	10(3.3)	7(2.3)	1.21	0.848
SCP2	Procurement costs	18(5.9)	18(5.9)	80(26.1)	109(35.6)	81(26.5)	3.70	1.141
SCP3	Delivery speed	90(29.4)	140(45.8)	55(18.0)	11(3.6)	10(3.2)	1.12	0.890
SCP4	Customer/client satisfaction	114(37.3)	138(45.1)	35(11.4)	10(3.2)	9(2.9)	1.27	0.826
SCP5	Supplier performance	139(45.4)	98(32.0)	49(16.0)	10(3.3)	10(3.3)	1.16	0.848
SCP6	External collaboration	24(7.8)	94(30.7)	103(33.7)	83(27.1)	2(0.7)	2.82	0.943
Scale: 1=Much worse than industry average; 2=worse than industry average; 3=moderately better than industry average; 4 better than industry average; 5= much better than the industry average								

Table 6.10 presents the perceptions of respondents towards supply chain performance. An analysis of the results reveals that 41 percent (n=124) of the respondents indicated that the quality of services in their organisation had decreased significantly. A total of 36 percent (n=109) of the respondents noted that procurement costs in their organisation had increased

significantly. A total of 46 percent (n=140) of the respondents showed that the delivery speed within their organisation had decreased. At least 45 percent (n=138) of the respondents reported that customer/ client satisfaction within their organisation had also reduced. Another 45 percent (n=139) indicated that supplier performance had been reduced, and at least 34 percent (n=103) of the respondents indicated that external collaboration had increased, albeit slightly.

In Table 6.10, the highest mean scores were obtained for the following supply chain performance indicator:

- Procurement costs ($\bar{x}$=3.70, SD=±1.14).
- External collaboration ($\bar{x}$=2.82, SD=±.94).

The lowest mean scores were obtained for the following indicators:

- Delivery speed ($\bar{x}$=1.12, SD=±.89).
- Supplier performance ($\bar{x}$=1.16, SD=±.85).
- Quality of services ($\bar{x}$=1.21, SD=±.85).

The results of this study imply that the quality of services and delivery speed has declined in the South African public sector and procurement costs have increased. They further show that that customer/client satisfaction, as well as supplier performance, have both declined in the South African public sector. Lastly, the results suggest that there is a meaningful collaboration between the South African public sector and external stakeholders.

The results are consistent with a study conducted by Quinot (2014:1131), which considered the role of quality in the adjudication of the public tenders. The results of that study show that the South African public sector considers the cost to be more important that quality, leading to poor service delivery. Another study conducted by the National Treasury (2016:3) concluded that the general public is dissatisfied with the service they receive, hence the high incidence of service delivery protests in the country. Molver and Gwala (2015:262) further highlighted that suppliers tend to take advantage of the current weak public sector supply chain management practices by delivering poor quality services late and at unreasonably high prices. A study by Srinivasan, Mukherjee and Gaur (2011:267) examined the relationship between buyer-supplier partnership quality and supply chain performance. Their study found out that effective management of the supply chain plays an important role in contributing to competitive advantage for organisations, which can be achieved when organisations focus on exploiting collaboration by working closely with their key suppliers. In their study, Phusavat,

Anussornnitisarn, Helo and Dwight (2009:659) examined performance measurement roles and challenges in the public sector. Their study found that most successful public sector organisations have championed and embraced international participation, partnership and collaboration. The South African public sector must, therefore, continue on its collaborative path, while improving on those areas where poor performance exists, such as service quality, cost reduction, delivery speed, supplier performance and customer satisfaction.

6.5 INFERENTIAL STATISTICS

This study was intended to test the relationship between supply chain risk management practices, supply chain flexibility and supply chain performance in the South African public sector. To achieve this, a structural equation modelling (SEM) approach was adopted to test for this relationship. According to Andersen and Gerbing (1988:411), this involves a two-step approach which begins with the testing of the psychometric properties of the measurement instrument through confirmatory factor analysis (CFA). This would then be followed by a testing of the hypotheses through the path analysis approach. The CFA is intended to test for three major issues, namely, reliability, validity and model fit. The CFA was conducted using the Analysis of Moment Structures (AMOS version 24.0) to assess scale accuracy. The results of the CFA tests are reported in Table 6.11.

Table 6.11: Accuracy Analysis Statistics: Reliability Tests

Research Construct		Descriptive statistics		Cronbach's Test		C.R	AVE	Factor Loading	Highest S.V.
		Mean	SD	Item total	Alpha value				
Government Policies	GP 1	4.31	1.28	0.74	0.81	0.83	0.51	0.698	0.44
	GP 2			0.55				0.778	
	GP 3			0.57				0.781	
	GP 4			0.62				0.689	
	GP 5			0.73				0.687	
Supply Complexity	SC 1	4.04	1.35	0.55	0.83	0.85	0.74	0.845	0.52
	SC 2			0.67				0.812	
	SC 3			0.82				0.893	
	SC 4			0.54				0.811	
	SC5			0.77				0.801	
Skills Availability	SA 1	4.68	1.68	0.56	0.74	0.77	0.65	0.669	0.59
	SA 2			0.68				0.687	
	SA 3			0.54				0.753	
	SA4			0.61				0.595	
	SA5			0.75				0.536	

Supplier Performance Monitoring	SPM1	4.81	1.54	0.52	0.78	0.79	0.77	0.536	0.59
	SPM2			0.66				0.783	
	SPM3			0.57				0.639	
	SPM4			0.60				0.752	
	SPM5			0.64				0.653	
	SPM6			0.76				0.757	
Information Security	IS1	3.71	0.78	0.52	0.76	0.80	0.52	0.517	0.44
	IS2			0.54				0.597	
	IS3			0.63				0.765	
	IS4			0.62				0.697	
	IS5			0.66				0.816	
	IS6			0.59				0.807	
Process Efficiency	PE1	3.94	1.06	0.55	0.72	0.75	0.69	0.756	0.57
	PE2			0.61				0.793	
	PE3			0.78				0.786	
	PE4			0.74				0.795	
	PE5			0.71				0.706	
	PE6			0.66				0.754	
Supply Chain Flexibility	SCF1	4.12	0.38	0.68	0.75	0.78	0.60	0.711	0.32
	SCF2			0.93				0.575	
	SCF3			0.74				0.646	
	SCF4			0.56				0.500	
	SCF5			0.72				0.606	
	SCF6			0.64				0.539	
Supply Chain Performance	SCP1	4.00	1.54	0.57	0.80	0.81	0.67	0.520	0.52
	SCP2			0.60				0.621	
	SCP3			0.59				0.517	
	SCP4			0.73				0.764	
	SCP5			0.65				0.506	
	SCP6			0.61				0.799	

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

6.5.1 Testing for Reliability

Reliability may be perceived as the ability to test the same data and obtain similar results (Tang, Cui & Babenko, 2014:205). An instrument is said to be reliable when respondents are tested by the same tool at different times and respond identically to the instrument (Revelle & Zinbarg, 2009:146). Scale purification was conducted using item-total correlations. As recommended by Nunnally and Bernstein (1994:16), all items with item-total correlations lying

below 0.3 were removed to improve the reliability of the measurement scales. Two items were subsequently removed from the Supplier Performance Monitoring scale, one item was removed from the information security scale, and two items were removed from the supply chain performance scale. As shown in Table 6.11, item-total correlations for all retained scales were above the recommended minimum value of 0.5, which resulted in scale with acceptable reliabilities.

To test for reliability, two measures, namely, the Cronbach's Alpha Coefficient and Composite Reliability (CR) were used. The Cronbach's Alpha coefficient is a measure of the degree to which the items in an instrument are related, and the recommended threshold is a minimum value of 0.7 (Cho & Kim, 2014:207). In this study, Cronbach alpha values for the measurement scales ranged from 0.72 to 0.83, which are well above the recommended thresholds. This depicts that with the use of that indicator, all measurement scales under consideration in this study are deemed to be reliable.

The composite reliability test is an alternative to the Cronbach alpha test in testing for reliability and is directed to examine the internal steadiness of each research construct (Nunnally & Bernstein, 1994:81). The composite reliability was examined with the subsequent formula suggested by Raykov (2012:475).

$$CR\eta = (\Sigma\lambda yi)\,2/\,[(\Sigma\lambda yi)\,2 + (\Sigma\varepsilon i)]$$

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

The recommended minimum value for the Composite reliability is 0.7 for each scale in a measurement instrument (Padilla & Divers, 2015:438). In this study, composite reliability values were well above the recommended 0.7 thresholds, as they ranged between 0.75 to 0.85. This demonstrates that reliability, as measured by that indicator, was satisfactory in this study.

6.5.2 Testing for Validity

Validity is a measure of the extent to which the instrument that was selected reflected the reality of the constructs that were being measured. In this study, three validities were measured. The first one is face validity. Face validity refers to the degree to which a procedure, especially a psychological test or assessment, appears effective regarding its stated aims (Gravetter & Forzano, 2012:78). In other words, a test can be said to have face validity if it superficially appears to measure what it is supposed to measure. In this study, face validity was ascertained

through a panel review of the questionnaire. Three academics whose lines of expertise are in the field of supply chain management were given an opportunity to review the questionnaire items to determine whether they were addressing the issues they were intended to capture. Recommendations from these academics were used to modify the questionnaire, hence improving its face validity.

The second type of validity tested in this study is content validity. Content validity is the estimate of how much a measure represents every single element of a construct (Wilson, Pan & Schumsky, 2012:197). In this study, content validity was ascertained through a pilot test of the questionnaire. A pilot test is a small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict an appropriate sample size and improve upon the study design prior to performance of a full-scale research project (Billé, 2010:1). In other words, a pilot study is a process of finding out if the survey, key informant interview guide or observation form will work in the real world by trying it out first on a few people. Pilot testing of the questionnaire was necessary since the questionnaire scales used in this study were adapted from scales developed for other studies. It was important then, to pilot test the questionnaire used in this study to determine whether they were suitable. The pilot study was conducted using 50 conveniently selected supply chain practitioners drawn from various public sector departments in Gauteng province. The pilot study was conducted in February 2017. Respondents that participated in the pilot study were excluded from the main survey. Feedback obtained from the survey was also used to adjust the questionnaire to improve its content validity. Improvements made to the questionnaire were regarding the wording of the questions, arrangement of questions and the length of the questionnaire. In addition, a reliability test of the pilot data was also conducted, which ensured that all data fell within recommended thresholds.

The third type of validity ascertained in this study is content validity. Construct validity may be perceived as the appropriateness of inferences made by observations or measurements (often test scores), specifically whether a test measures the intended construct. Construct validity examines the question: Does the measure behave like the theory says a measure of that construct should behave? Two subtypes of construct validity that were considered in this study are convergent validity and discriminant validity. Convergent validity refers to the degree to which two measures of constructs that theoretically should be related, are in fact related (Kline, 2011:54). In contrast, discriminant validity tests whether concepts or measurements that are supposed to be unrelated are, in fact, unrelated (Henseler, Ringle & Sarstedt, 2014:115).

Convergent validity was measured using factor loadings and the Average Variance Extracted (AVE). The recommended threshold for individual factor loadings of all the items in a measurement scale is 0.5 (Westland, 2015:26). As indicated in Table 6.11, factor loadings for all of the measurement scales were above the minimum threshold of 0.5. This demonstrates that convergent validity was satisfactory in this study. The AVE measures the level of variance captured by a construct versus the level due to measurement error; values above 0.7 are considered very good, whereas the level of 0.5 is acceptable (Alumran, 2014:4). To calculate the AVE values for all scales, the following formulae were applied:

$V\eta = \Sigma\lambda yi2/ (\Sigma\lambda yi2 + \Sigma\epsilon i)$

AVE = {(summation of the squared of factor loadings)/ {(summation of the squared of factor loadings) + (summation of error variances)}

As indicated in Table 6.11, AVE values were between 0.51 and 0.7 for all measurement scales, which is above the recommended thresholds. This further shows that convergent validity was acceptable in this study.

Two procedures were used to measure discriminant validity. First, it was expected that the AVE values for each construct would be higher than the corresponding highest shared variance (HSV). Shared variance is the extent to which the variations between two correlated variables of a construct tend to overlap (Gefen & Straub, 2005:94). In this study AVE values for each construct were higher than the HSV for these constructs, thereby showing that discriminant validity was adequate in this study. Second, discriminant validity was ascertained through the use of correlations between constructs, as derived from the CFA model. Positive associations less than 0.8 are more acceptable for testing for discriminant validity (Fornell & Larcker, 1981:37). As indicated in Table 13, there were positive inter-construct correlations, which attests that discriminant validity was adequate in this study.

Model Fit Analysis

According to Anderson and Gerbing (1988:416), model fit refers to the extent to which a hypothesised model is consistent with the data, or a process that assesses how well the model represents the data. 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), Normative Fit Index (NFI), Goodness of fit (GFI), Adjusted Goodness of fit (AGFI) and Random Measure of Standard Error Approximation (RMSEA). The acceptable thresholds should be equal to or higher than 0.90 for CFI, IFI, RFI, NFI, GFI and AGFI. 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). The general model fit indices for both the CFA and SEM models are presented in Table 6.12.

Table 6.12: Model-fit Statistics

Fit indices	Acceptable fit indices	CFA (Measurement model)	SEM (Structural model)
Chi square/degree of freedom (d/f)	< 3.0	2.701	2.634
Incremental fit index (IFI)	> 0.90	0.963	0.922
Tucker-Lewis Index (TLI)	> 0.90	0.900	0.905
Comparative fit index (CFI)	> 0.90	0.913	0.947
Normative Fit Index (NFI)	> 0.90	0.955	0.938
Goodness of fit (GFI)	> 0.90	0.942	0.951
Adjusted goodness of fit (AGFI)	> 0.90	0.978	0.971
Root mean square error of approximation (RMSEA)	< 0.08	0.065	0.074

As shown in Table 6.12, all thresholds for model fit indices were met for both the CFA and the structural model, which confirms that model fit was acceptable in this study.

Table 6.13: Correlations between Constructs

Constructs	GP	SC	SA	SPM	IS	PE	SCF	SCP
Government Policies (GP)	1.000							
Supply complexity (SC)	-.325**	1.000						
Skills availability (SA)	.618**	-.273**	1.000					
Supplier performance monitoring (SPM)	.122**	-.298**	.770**	1.000				
Information security (IS)	.764**	-.408**	.546**	.374**	1.000			
Process efficiency (PE)	.401**	-.365**	.667**	.473**	.454**	1.000		
Supply chain flexibility (SCF)	.336**	-.500**	.569**	.112**	.334**	.624**	1.000	
Supply chain performance (SCP)	.567**	-.722**	.836	.401**	.245**	.580**	.283**	1.000
**. Correlation is significant at the 0.01 level (2-tailed).								

Apart from confirming discriminant validity, the correlation analysis further serves to establish the association and direction of the association between the constructs. Inter-factor correlations were positive and significant, ranging from r=0.122 to r=0.722. This result demonstrates that when one construct increases, positive increases can be expected in the other constructs while the reverse is also true. However, this result does not imply that the constructs predict each other, hence the need to test the hypotheses using the path analysis procedure.

Hypotheses Tests Results

Hypotheses were tested using the SEM procedure. The results are reported in Table 6.14.

Table 6.14: Structural Equation Modelling Hypotheses Testing Results

Paths	Hypothesis	Path coefficients	Significance	Hypotheses Results
GP → SCF	H1	0.531**	0.008	Supported
SC → SCF	H2	-0.137**	0.026	Supported
SA → SCF	H3	0.820**	0.000	Supported
SPM → SCF	H4	0.236**	0.002	Supported
IS → SCF	H5	0.503**	0.041	Supported
PE → SCF	H6	0.473**	0.034	Supported
SCF → SCP	H7	0.624**	0.026	Supported
**significant at p<0.05 GP=Government policy; SC=Supply complexity SA= Skills availability; SPM=Supply performance monitoring; IS=Information sharing; PE=Process Efficiency; SCF=Supply chain flexibility; SCP=supply chain performance				

Table 6.14 shows that all of the seven hypotheses tested in this study were supported. All relationships were positive, except the second hypotheses which proposed that there is a significant negative relationship between supply complexity and supply chain flexibility. The results of each hypotheses tests are discussed in greater detail in Section 6.6.

6.6 DISCUSSION OF THE RESULTS

6.6.1 Government Policies and Supply Chain Flexibility

The first hypothesis of the study suggested that effective government policies lead to increased flexibility of the public supply chain. This hypothesis was supported in this study since government policies were statistically significant (β =0.531; p=0.008) in predicting supply chain flexibility. This result implies that government policies act as a catalyst for flexibility

within the public supply chain. An enabling policy framework usually supports public supply chains that are able to adapt and respond to changes with minimum costs in terms of time, cost, quality and performance. In South Africa, the major governing policy framework that controls supply chain management activities include the Public Finance Management Act of 1999, the Preferential Procurement Policy Framework Act (PPPFA) Act No 5 of 2000 and the Municipal Finance Management Act No 56 of 2003. In addition to these is the Broad-Based Black Economic Empowerment Act of 2003, which also provides guidance on how public resources are to be used as government acquires products and services. In 2012, the office of the Chief Procurement Officer was also created at the national treasury to superintend the implementation of the available legislative policies in public supply chain management.

Despite the availability of the above legislative frameworks, the public supply chain in South Africa remains inflexible and continues to face many challenges. While supply chain management in the country is primarily intended to promote principles of good governance and introduce a fair preferential procurement system (Ambe, 2016:277), this has not been achieved. The public sector supply chain management system is highly decentralised, which is meant to allow managers within the different arms of government to control it. This has, however, made the supply chain management system highly fragmented, making it difficult for the government to obtain maximum value in the purchase and use of goods and services (South African National Treasury, 2016:47). Linked to this decentralisation is ineffective corporate governance from which unethical activities such as corruption, fraud and inefficiency have become entrenched in most public organisations.

A study conducted by Ambe and Badenhorst-Weiss (2012:242) unearthed numerous supply chain management related challenges in the South African public sector. These included the lack of experienced and knowledgeable people to manage the supply chain management system, ineffective demand planning, the lack of monitoring and evaluation systems, unethical conduct, non-compliance with both policies and legislation, and the general ineptitude of black empowerment policies. Given that the public supply chain management spending expected to reach a significant amount of up to R1.5 trillion within between 2016 and 2020 (South African National Treasury, 2016:2) there is a continuous need to find solutions to these challenges, to enable the South African government to fulfill its socio-economic goals and objectives. It may be argued then that the inflexibility and poor performance of the public supply chain management function in South Africa are attributed, in part to manifest deficiencies and fragmentations in governance, interpretation and implementation of these available policies.

6.6.2 Supply Complexity and Supply Chain Flexibility

The second hypothesis of the study suggested that increased supply complexity leads to decreased flexibility of the public supply chain. This hypothesis was supported because supply complexity was statistically significant (β =-0.137; p=0.026) in predicting supply chain flexibility. The negative beta result implies an inverse relationship between supply complexity and supply chain flexibility, such that the latter decreases as the recent increases. In other words, it would be expected that a public supply chain exposed to a highly complex mix of supply to be unable to respond positively to any disruptive changes occurring in that supply chain.

As mentioned in the first principle of systems theory to supply chain management (Yourdon, 1989:43), the more specialised or complex a system is, the less adaptable it is to changing environments. This principle suggests that the longer the supply chain in terms of its links (that is, third, fourth or more party logistics providers are involved), the less adaptable or flexible that supply chain will be to possible changes needed for it to survive (Copacino, 1997:43; Foster, 1999:35; Parker, 1999:17). Wang, Liu and Yang (2009:206) highlight that supply complexity limits the achievements of a supply chain, leading to possible instability and control problems and ultimately, poor supply chain performance. Furthermore, once there is a downstream disturbance in that supply chain, it has is a ripple effect upstream, which affects all organisations in that supply chain (Skipper, 2008:51). As such, extended supply chains qualify as complex dynamic systems, which are subject to potential problems of time delays, discontinuities, non-linearities (Ellis, Henry & Shockley, 2010:35), and difficulties in adaptability to changing environments. The more complex and protracted the supply chain network, the more replete it would experience regarding material-flow and information feedback loops (Tang & Tomlin, 2008:13).

The public supply chain in South Africa is very complicated since it involves numerous stakeholders, suppliers, and services that are offered, processes and procedures as well as diversity in the recipients of these services. This complexity is detrimental to the ability of this supply chain to adapt to changes in the market, leading to its underperformance. For instance, in the South African public supply chain, an unethical practice such as a kickback by an official in a procurement transaction will have an ultimate effect on the service that was to be delivered through that transaction. This may further lead to service delivery challenges downstream and financial leakages upstream. Hence the complexity of the public supply chain is negatively related to its flexibility.

6.6.3 Skills Availability and Supply Chain Flexibility

The third hypothesis of the study suggested that the availability of skills leads to increased flexibility of the public supply chain. This hypothesis was supported because skills availability was statistically significant (β =0.820; p=0.000) in predicting supply chain flexibility. This result illustrates that the availability of qualified, knowledgeable and well-experienced human resources in the public supply chain improves the flexibility of that supply chain. This being the case, a supply chain that is equipped with adequate and appropriate human resources can quickly adapt and respond to any changes occurring within the market. It also has to be noted that amongst the six supply chain risk factors considered in this study, skills availability scored the highest beta value. This demonstrates that the availability of skills is the most essential and critical supply chain risk factor in determining the degree of flexibility within a public supply chain.

Generally, there is a short supply of skilled supply chain professionals in South Africa. The list of occupations on high demand, published by the Department of Higher Education and Training (2016:12) includes supply and distribution managers, logistics managers amongst those critical skills in short supply in South Africa. Also, the Critical Skills List developed by the Department of Home Affairs (2014:12-23), which showcases the most critical skills that are in short supply in South Africa, includes some occupations that have a direct or indirect bearing on supply chain management. These include corporate general managers, business analysts, risk assessors, information and technology specialists, customer services managers, quality analysts, engineers and technicians of various trades and academics. In the public sector, the shortage of skills may be manifested in two ways, such as the non-availability of required supply chain professionals and the lack of skills amongst those employed as supply chain professionals (Bhorat, Goga & Stanwix, 2013:16). As a result, efficiency and effectiveness regarding work related to supply chain management are compromised. This is evidenced in the entrenchment of malpractices such as red tape, bureaucracy, poor corporate governance, ineffective supplier selection and relationship management, as well as financial indiscretions (Naudé *et al.,* 2013:4). The unavailability of appropriate skills, as well as the competency levels of available supply chain practitioners, could account for these malpractices (Dlamini, 2016:148). Moreover, there is a growing need for soft skills in supply chain management and an emphasis on effective communication, teamwork and employee retention. Ultimately, the public supply chain in South Africa remains rigid and unable to adapt to developments on the ground, leading to poor service delivery and a generally underperforming economy.

6.6.4 Supplier Performance Monitoring and Supply Chain Flexibility

The fourth hypothesis proposed that the monitoring of supplier performance leads to increased flexibility of the public supply chain. This hypothesis was supported in this study because supply complexity was statistically significant (β =0.236; p=0.002) in predicting supply chain flexibility. This result denotes that a public supply chain is likely to be highly flexible, provided the performance of suppliers to that supply chain is monitored.

Lack of monitoring and evaluation across the entire South African public sector has been identified as a key area of deficiency (Nelson, 2016, 17). The gaps in monitoring and evaluation have been linked to the absence, or the weak presence of a control environment and departments are placed in an awkward position to give effect to or implement monitoring and evaluation (Fourie, 2011: 154; Govender, 2013. 811). This has resulted in deviations or non-compliance that typically goes undetected or is identified after the fact (Nkuna & Nemutanzhela, 2012:355). The absence of robust monitoring and evaluation in the public sector has been detrimental to most public functions, inclusive of supply chain management. In supply chain management, suppliers are the key stakeholders responsible for providing all of the required goods and materials, and hence their actions present a great risk (Zagarnauskas, 2012:14; Sarkar & Mohapatra, 2006:149). Performance of suppliers is usually measured regarding their ability to provide the right quality and quantity of required goods/services at the right time and appropriate cost, to the correct location/place of delivery (Chaharsooghi & Ashrafi, 2014:5). Underperformance by suppliers in any of these areas has an adverse downstream effect on the entire supply chain through the shortage of the required materials/services, the provision of low-quality materials/services, high procurement and delivery costs and sometimes the poor delivery scheduling of goods and materials (Mandiyambira, 2012:307).

That many suppliers to the South African public sector have failed to deliver as expected is a generally accepted fact. It has been mentioned by National Treasury (2016:7) that at least 20 percent of the government's procurement budget alone is wasted each year through corruption, incompetence, and negligence by public servants who fail to monitor the performance of contracted suppliers. The report takes note of the failure to conduct regular inspections of the supplied goods and services during the contract period to ensure that they meet specifications and are of a suitable standard has been a common challenge in public supply chain management in South Africa. Public officials have also failed to check that all conditions and clauses in the contract have been acted upon. Where breaches or nonconformance with the contract is

detected, legal action that should have been taken against the supplier has not been taken. The maintenance of adequate, written records of all dealings with suppliers and the administration of the contract (for example, file notes of inspections, telephone conversations, records of meetings and documented invoice processing), its complexity and associated risks are some of the issues lacking in public supplier performance monitoring in the country. As a result, this area remains a major threat to effective supply chain performance as suppliers who do not deliver the value they are contracted to provide are seldom held accountable for their performance, yet massive amounts of government funds are paid to acquire these services and materials (Du Toit & Vlok, 2014:26).

6.6.5 Information Security and Supply Chain Flexibility

The fifth hypothesis proposed that effective information security leads to increased flexibility of the public supply chain. This hypothesis was supported in this study because information security was statistically significant (β =0.503; p=0.041) in predicting supply chain flexibility. This result validates that the more secure the information used in the public sector is, the more adaptable to changes the supply chain will be. Information security pertains to the prevention of unauthorised access, use, disclosure, disruption, modification, inspection, recording or destruction of information (Spagnoletti & Resca 2008:46). It is a general term that can be used regardless of the form the data may take. The chief area of concern for the field of information security is the balanced protection of the confidentiality, integrity and availability of data while maintaining a focus on efficient policy implementation and no significant hampering of organisation productivity.

As shown by the results of the study, information security as a risk management practice is positively related to supply chain flexibility. However, due to ineffective work culture in the South African public sector, information security between stakeholders remains a major inhibitor to supply chain flexibility. As shown in a study by Griffiths (2016:1), which focused on cybersecurity as an emerging challenge to national security in South Africa, the growth in the use of the internet has triggered the issue of cybersecurity, as hackers continue to develop more sophisticated software, which can be used to capture confidential and private information from organisations. Another report by Alfred (2016:1) indicates that South African businesses are ill-equipped to deal with emerging cybersecurity threats and rely on outdated protection strategies, says a security expert. The report further mentions that cybercriminals have increased their attacks on South Africa, but organisational strategies have lagged the merging threats.

According to Stewart (2012:255), some of the universal threats to information security include viruses, phishing attacks, worms and Trojan horses, which are a few typical examples of software attacks. In addition, the theft of intellectual property cannot be written out and has also been an extensive issue for many organisations. Another common problem is identity theft, which is the attempt to act like someone else with the intention to obtain that person's personal information or to take advantage of their access to vital information. Then there is theft of equipment or data since today most devices are mobile. Another challenge is sabotage, which involves the destruction of an organisation′s website in an attempt to cause loss of confidence on the part of its customers. Information extortion consists of theft of a company′s property or information as an attempt to receive payment in exchange for returning the information or property to its owner. Given the high information technology illiteracy amongst many supply chain professionals in the South African public sector (Sebake & Coetzee 2013:11; Mkhize, 2015:6), information security remains a leading threat and could emanate from any of these sources.

6.6.6 Process Efficiency and Supply Chain Flexibility

The sixth hypothesis suggested that process efficiency leads to increased flexibility of the public supply chain. This hypothesis was supported in this study because process efficiency was statistically significant (β =0.473; p=0.034) in predicting supply chain flexibility. By implication, the adoption and implementation of efficient processes and procedures within a public supply chain lead to better flexibility. A business process is a set of steps or tasks that are repeatedly utilised in creating products or services, reach specific goals, and to provide value to either customers or suppliers (Desel, Pernici, Weske, 2004:202). When processes work well, they can significantly improve efficiency, productivity, and customer satisfaction. Process efficiency itself is the capability of human resources to conduct a certain process in the way that ensures minimised consumption of effort and energy (Malakooti, 2013:17). In simpler terms, process efficiency is a situation in which a process is implemented in the right way. Through process efficiency, implementation is simplified as more significant results are achieved with fewer resources. Process efficiency leads to the achievement of the highest savings and performance through waste minimisation and the optimisation of resource consumption (Björk, Szücs & Härenstam, 2014:29).

The issue of inefficiency in the South African public sector has become a topical issue in recent years. A study by Fourie and Poggenpoel (2017:173) found entrenched inefficiencies in various public sector processes. The study attributed these inefficiencies to six major challenges,

namely, ethics, resource optimisation, service delivery, compliance, transparency and accountability and expenditure management. A previous study by Crous (2002:24) underscores that in the South African public sector, there were efficiency-related challenges in policy-making; financing, personnel provision and use, organising, determining work procedures and methods, and controlling that hampered public service delivery efforts. A report by the South African National Treasury (2015:7) highlights that it is well known that public sector supply chain management in South Africa is imperfect, as there are constant allegations of corruption and inefficiency. The same report alleges that service delivery protests are a sign that people feel that they are not receiving the quantity or quality of services they need. Process inefficiency was further identified by Ambe and Badenhorst-Weiss (2012:281) as a major factor affecting the implementation of supply chain management in the South African public sector. It thus remains that process efficiency still has to be addressed since it is a dominant risk facing supply chain management.

6.6.7 Supply Chain Flexibility and Supply Chain Performance

The seventh hypothesis suggested that supply chain flexibility leads to the increased performance of the public sector supply chain. This hypothesis was supported in this study because the process was statistically significant (β =0.624; p=0. 026) in predicting supply chain performance. This result suggests that the higher the flexibility of a public supply chain, the greater the performance of that supply chain. The result also shows that supply chain flexibility mediates the relationships between each supply chain risk management practice and supply chain performance.

Supply chain flexibility is the ability to adapt or respond to deviations from the surroundings of the chain, as well as a fluctuation from within the chain (Sánchez & Pérez, 2005:681). It can be argued that the South African public sector should be able to innovate and implement new strategies and programmes to support changes in overall supply chain strategies or modifications within the economy. The South African political, social and economic landscape is very dynamic, resulting in ripple effects on various sectors of the economy. Some of the pressures from which this dynamism emanates include the need for transformation, frequent policy shifts in order to address corruption and fraud, a high incidence of social unrest through mass protests from the disgruntled public, and the need for continuous training and development to increase the competencies of staff, amongst others (Franks, 2015:132). Since the suppliers to the public sector are in the private sector, turbulence in private supply chains sends shock waves which are felt even within the public sector. It is imperative for the public

supply chain to be able to respond to these short-term changes in supply and demand more quickly. The South African supply chain must therefore continually evolve and improve as times and conditions change, to improve its performance.

6.7 CONCLUSION

This chapter discussed the results of the study through data analysis and interpretation. Analysis of the demographic factors showed an acceptable representation of most demographic categories of supply chain professionals. Analysis of frequencies showed varied levels of disagreement and agreement with the items on the scale, which demonstrates that respondents were satisfied with the degree of implementation of some of the issues under consideration in this study (constructs) but were dissatisfied with others. To check the psychometric properties of the measurement scales, a CFA was performed, which proved that all of them had acceptable reliability, validity and model fit. Hypotheses tests through structural equation modelling showed that all proposed relationships were statistically significant. By implication, implementation of supply chain risk management practices in the South African public sector leads to improved supply chain flexibility. In turn, supply chain flexibility leads to superior supply chain performance and also mediates the relationship between each supply chain risk management practice and supply chain performance. Availability of skills proved to be the most important risk management practice in influencing supply chain flexibility. The next chapter discusses the conclusions and recommendations.

CHAPTER 7

CONCLUSIONS, RECOMMENDATIONS, LIMITATIONS AND IMPLICATIONS FOR FURTHER RESEARCH

7.1 INTRODUCTION

The purpose of this chapter is to provide a final analysis of the study. The chapter's first purpose is to provide a summary review of the study. Its second purpose is to present conclusions to each objective set for the study. The third purpose is to recommend strategies that may be adopted and implemented to enhance supply chain performance within the South African public sector through supply chain flexibility to minimise supply chain risks, in line with the findings emanating from the study. The fourth purpose is to acknowledge the limitations of the study. The fifth purpose is to propose a direction for future studies. Finally, the chapter provides the overall conclusion to the study.

7.2 REVIEW OF THE STUDY

The purpose of the study was to examine the relationship between supply chain risks, supply chain flexibility and supply chain performance in the South African public sector. The thesis is divided into seven chapters. The first chapter provides an introduction and background to the study and outlines the problem statement, the research objectives, a summary of research hypotheses, the delimitations of the study, a brief research methodology, statistical analysis, ethical considerations and chapter outline. The second chapter provides a review of literature related to the supply chain management in the public sector. The chapter focused on the overview of the public sector from a global perspective, legislative framework applicable to the public sector, procurement best practices and challenges associated with the public sector. In the third chapter, literature pertaining to supply chain risk and its sub-dimensions, which are government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency were discussed. In the fourth chapter, literature related to supply chain flexibility and supply chain performance was analysed. In the fifth chapter, the research methodology employed in the study was discussed in greater depth. In the sixth chapter, data were analysed to produce the research results, and their interpretation was provided. The seventh chapter closes the study by discussing the conclusions, recommendations, limitations of the study as well as suggestions for further research.

7.3 CONCLUSIONS BASED ON THE THEORETICAL OBJECTIVES

Conclusions drawn from the following theoretical objectives set for the study were:

- to conduct a literature review on the South African public sector's supply chain;
- to conduct a literature review on supply chain risks;
- to conduct a literature review on supply chain flexibility; and
- to conduct a literature review on supply chain performance.

7.3.1 Conclusions based on the literature review on the South African public sector's supply chain

The first theoretical objective focused on conducting a literature review on the South African public sector's supply chain. This objective was achieved in the second chapter of the thesis, where literature on supply chain management in the public sector was discussed. The review acknowledges the importance of public sector's supply chain towards addressing the needs of the South African public. It also outlines the South African public sector's supply chain compared to the other public sector supply chains around the world. Furthermore, it emphasised the objectives, best practices and different legislation governing the South African public sector. The chapter pointed out that in the public sector in South Africa, supply chain management is about using public funds that are collected through tax efficiently and effectively to provide service delivery to the public while promoting transparency and ensuring that corrupt activities are dealt with.

It also emerged that there are various challenges associated with the implementation of an effective public sector supply chain in South Africa. A major problem refers to the lack of the basic understanding of the concept of supply chain management within the public sector. Also, inconsistencies in the application of applicable legislation and corruption remain significant challenges. The study acknowledges that the objectives of public sector supply chain management in South Africa can be realised once the existing difficulties are addressed. It, therefore, concludes that although the South African public sector is aware of its mandate and the expectation by South African citizens regarding the implementation of supply chain management, it has hitherto been unable to address the bottlenecks that prevent it from delivering that mandate.

7.3.2 Conclusions based on the literature review on supply chain risks

The second theoretical objective focused on reviewing the literature on supply chain risks, attained in the third chapter of the study. The reviewed literature clarified the characteristics of

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supply chain risks, acknowledging that today's supply chain is complex and vulnerable. The chapter highlighted the different day-to-day sources of supply chain risk. However, only a few selected supply chain risks applicable to the public sector were discussed, which include government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency.

The reviewed literature on government policies highlighted that section 217 of the constitution governs the South African public sector. National Treasury through applicable legislation dictates how the South African public sector must manage its supply chain. However, the review pointed out that policies and regulations put forward by the National Treasury are often confusing and cumbersome and supply management professionals are unable to interpret and apply some of them. Also, it is difficult for suppliers to keep up with the ever-changing policies and procedures, which makes government policies a supply chain risk. Literature revealed that when supply and demand are not stable and balanced, they result in supply complexity. Regarding availability of skills, the literature showed that the shortage of skilled manpower is a global problem, which is attributed to a different number of issues. The most common issue is that skills training needs to catch up with the changing times. Regarding supplier performance monitoring, the literature showed that supplier performance monitoring contributes positively to the success of an organisation although it comes with huge risks that have to be managed and mitigated.

The reviewed literature on information security reveals that the public sector takes the lead in making information available to the public, which is in line with the need for transparency. The literature further showed that information comes with major risks. Example of such risks includes unavailability of information at the time when needed, incomplete information, information getting in the hands of the wrong audience, all of which can be costly and cause serious damage to an organisation's reputation. With regard to process inefficiency, the literature emphasised that organisations conduct their operations through business processes. Processes provide a flow of information and decision points within an organisation. Literature also revealed that failing to address process risks may result in unnecessary costs and other instances reputational consequences, which will, in turn, affect the overall organisation's performance. Therefore, this study concludes that supply chain risks cannot be separated from supply chain efficiency and effectiveness. However, it is the responsibility of each organisation to find ways on how to mitigate them.

7.3.3 Conclusions based on the literature review on supply chain flexibility

The third theoretical objective focused on conducting a literature review on supply chain flexibility, which was achieved in the fourth chapter of this study. The study acknowledged the need for flexibility in the public sector's supply chain. There is commonality regarding the definition of supply chain flexibility; namely, the ability of the supply chain to continue operating effectively and efficiently during disruptions by various supply chain risks. The study classified the different forms of supply chain flexibility and emphasised its importance in managing different supply chain risks.

It also emerged from this study that organisations are adopting flexibility to satisfy customer needs and increase their competitive advantage. The study also recognised that factors such as government policies, availability of skills, supply complexity, internal processes, a commitment by management contribute to the drive to achieve supply chain flexibility in the public sector. It pointed out that organisations that have implemented supply chain flexibility are quick to sense and respond to market changes, which further contribute to supply chain performance. However, the study accepts that the implementation of supply chain flexibility comes with its challenges, which include the requirement for time and other resources such as adequate staff and finances. This study, therefore, concludes that the public sector operates in an environment that is uncertain when an element of supply chain flexibility is required to ensure that the public sector delivers on their mandate.

7.3.4 Conclusions based on the literature review on supply chain performance

The fourth theoretical objective focused on conducting a literature review on supply chain performance, which was attained in the fourth chapter of this study. The study recognised the importance of the supply chain function within an organisation. It further revealed that supply chain management is becoming widely acknowledged as an important function responsible for increasing organisational competitiveness in unstable environments. The study also emphasised that most organisations consider the supply chain management function as the cornerstone of their differentiation strategy, hence the need to optimise the performance of that function.

In this study, it also emerged that for organisations to have a successful supply chain, they must move from a reactive mode to a planning mode, from risk avoidance to risk management, from hoarding information to sharing information, amongst other things. The study also acknowledges that to obtain a successful supply chain, government departments must

implement and enforce a variety of management techniques and performance indicators, including procedures for risk assessment, training, sanctions, self-reviews and reports by internal and external auditors. It is further emphasised that organisations can use performance measurement to assess the effectiveness of strategies in their supply chain management and identify future successes and opportunities. However, the literature review reveals that this notion can only be realised when the public sector sets and links objectives with key performance reporting. The study further accepts that the public sector is unable to manage their supply chains due to several challenges, which include corruption and government policies (implementation and enforcing of such policies). It is therefore concluded that a successful supply chain management can be achieved when organisations manage and match their key performance indicators with organisational objectives.

7.4 CONCLUSIONS BASED ON EMPIRICAL OBJECTIVES

Conclusions drawn from the following empirical objectives and set for the study were:

- to explore the perceptions of supply management professionals towards supply chain risks, supply chain flexibility and supply chain performance in the South African public sector;

- to determine the influence of supply chain flexibility on supply chain risks in the South African public sector; and

- to assess the influence of supply chain flexibility on supply chain performance in the public sector in South Africa;

7.4.1 Conclusions Regarding Perceptions of Supply Management Professionals towards Supply Chain Risks, Supply Chain Flexibility and Supply Chain Performance in the South African Public Sector

The first empirical objective was aimed at exploring the perceptions of supply chain professionals towards supply chain risks, supply chain flexibility and supply chain performance. To achieve this objective, descriptive statistics in the form of frequencies, percentages and mean scores were applied to each construct under consideration in this study.

7.4.1.1 Perceptions regarding government policies

With regards to government policies, supply management professionals perceived that the South African public sector provides its employees with the resources necessary for adherence to laid down rules and regulations. They further indicated and confirmed that effective structures to communicate government policies to stakeholders are available. Supply management professionals further verified that expectations regarding integrity and ethics are

laid out and that employees are discouraged from using political reasons to make their professional choices. The study, therefore, concludes that the South African public sector has put in place satisfactory legislation, policies and that adequate measures have been put in place to ensure compliance.

7.4.1.2 Perceptions regarding Supply Complexity

Supply chain professionals perceived that in the South African public sector replacement of key suppliers remains a noteworthy challenge. Also, there is minimal buyer-supplier trust between public organisations and their suppliers. However, the results also show that there are broad similarities between their organisations and their suppliers regarding practices such as business culture and organisational structures. Results further show that there are adequate information sharing and an immense influence on each other's supply decisions between the South African public sector organisations and their key suppliers. It is concluded, therefore, that significant information sharing and similarities between South African public sector organisations and their suppliers exists, but relationships are hampered by a lack of trust and an overdependence on the available suppliers.

7.4.1.3 Perceptions regarding the Availability of skills

Supply chain professionals perceived that there is a shortage of a skilled workforce in their profession within the South African public sector, which is also failing to recruit and retain appropriately qualified supply chain management. The lack of motivation amongst supply chain professionals is also evident, as they are not passionate about their jobs. The sector has had to depend on external consultants in the recruitment of supply chain professionals. This study concludes that the South African public sector faces the shortage of adequately skilled supply chain professionals and relies heavily on external consultants to fill vacancies. Supply chain professionals are experiencing the lack of motivation, which has led to high staff turnover in the South African public sector.

7.4.1.4 Perceptions regarding Supplier Performance Monitoring

Supply chain professionals perceived that there is a deficiency in site visits since the South African public sector does not visit supplier premises to help them improve their performance. Supplier development is lacking since the South African public sector does not train and give feedback about performance to suppliers. Suppliers that excel in their performance are not rewarded. However, it is noteworthy that information sharing appears effective since suppliers often inform the South African public sector about the main changes occurring in their

businesses. Price is also a weighty consideration when the South African public sector selects suppliers. This study, therefore, concludes that supplier performance monitoring activities such as site visits to suppliers, supplier development and the provision of rewards to suppliers lack in the South African public sector.

7.4.1.5 Perceptions regarding information security

Supply chain professionals perceived that information security awareness is communicated effectively in the South African public sector. However, a variety of business communications such as notices, posters, newsletters to promote security awareness are not used in raising awareness for information security. A lack of information security training exists since staff do not receive adequate security training before getting employment. Employee computer practices are also monitored adequately for policy violations, and information rules are enforced in cases of infringement of these rules. It is therefore concluded that employees in the South African public sector do not have the required skills to navigate the information systems in their organisations, which presents information security challenges.

7.4.1.6 Perceptions regarding process efficiency

Supply chain professionals perceived that strategic managers in the South African public sector had done well in encouraging teamwork amongst staff. Most operational processes are user-friendly since they have been standardised. The South African public sector has an IT system that is convenient for accessing information, and there is a well-developed guide material for using it. However, the provision of feedback by top managers to employees is lacking, and there is no emphasis on waste reduction in organisational processes. It is therefore concluded that in the South Africa public sector, strategic managers have done well in encouraging teamwork amongst staff and streamlining some of the organisational processes.

7.4.1.7 Perceptions regarding supply chain flexibility

Supply chain professionals perceived that the South African public sector does not involve and support suppliers in new product/service development. The sector is failing to handle some new products/services development projects in design at a given time at reasonable cost. The costs of switching from one supplier to another remain high and unreasonable, and supply chain integration is lacking. It is therefore concluded that supply chain management costs are not considered as the South African public sector switches between suppliers, and hence it cannot handle or reasonably manage the time and cost of handling product/services development and

switching suppliers, and accordingly, supply chain flexibility represents an area of underperformance.

7.4.1.8 Perceptions regarding supply chain performance

Supply chain professionals perceived that quality of services and delivery speed has declined in the South African public sector while procurement costs have increased. Customer/client satisfaction is low, and supplier performance has also decreased. However, meaningful collaboration between the South African public sector and external stakeholders remains in place. The study, therefore, concludes that the South African public supply chain is still underperforming, regarding service quality, cost reduction, delivery speed, supplier performance and customer satisfaction. However, the sector must continue on its collaborative path.

7.4.2 Conclusions Regarding the Influence of Supply Chain Risks on Supply Chain Flexibility in the South African Public Sector

The second empirical objective focused on the influence of supply chain flexibility on supply chain risks in the South African public sector. To address this objective, the impact of supply chain flexibility was used in eliciting information from selected supply chain professionals in the South African public sector. This was followed by the use of the structural equation modelling procedure (SEM) to analyse the hypothesised relationships between supply chain flexibility and six supply chain risks, namely, government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency were discussed as the sources of supply chain risks.

The results obtained in the study show that government policies exert a positive influence on supply chain flexibility. This leads to the conclusion that implementation of effective government policies leads to higher flexibility within the public supply chain, whereas both poorly designed government policies, as well as the ineffective implementation of government policies, lead to decreased supply chain flexibility within the public sector. The results of the study further indicate that supply complexity exerts a negative influence on supply chain flexibility. This triggers the conclusion that the more complex the public supply chain, the less flexibility of that supply chain, and vice versa. The results of the study also show that skills' availability exerts a positive influence on supply chain flexibility. This leads to the conclusion that the availability of adequately skilled and experienced supply chain professionals in the public sector enhance the flexibility of that supply chain. Also, amongst all supply chain risks considered in this study, availability of skills exerted the strongest influence on supply chain

flexibility. The study, therefore, concludes that the availability of qualified and skilled supply chain professionals is the most important factor in stimulating supply chain flexibility in the public sector.

The results additionally show that supplier performance monitoring exerts a positive influence on supply chain flexibility. This leads to the conclusion that in the public sector, supply chain flexibility can be improved through the monitoring of the performance of suppliers. Moreover, the results show that information security exerts a positive influence on supply chain flexibility. In line with this result, this study concludes that ensuring the prevention of unauthorised access or use, disclosure, disruption, modification, inspection, recording or destruction of information leads to higher supply chain flexibility in the public sector. The study also found that professional efficiency exerts a positive influence on supply chain flexibility. This leads to the conclusion that implementation of efficient processes leads to better supply chain flexibility in the public sector.

Regarding supply chain risks and supply chain flexibility, the study provides an overall conclusion that the stronger the supply chain risk, the lesser the flexibility of the supply chain. A more desirable scenario would be to minimise all supply chain exposures, threats and risks, which would lead to better supply chain flexibility.

7.4.3 Conclusions regarding the Influence of Supply Chain Flexibility on Supply Chain Performance in the Public Sector in South Africa

The third empirical objective focused on the influence of supply chain flexibility on supply chain performance in the South African public sector. This objective was addressed by analysing data using SEM to test the hypothesised relationship between the two constructs. The study found that supply chain flexibility exerts a positive influence on supply chain performance. This leads to the conclusion that in the public sector, the more flexible the supply chain, the better the performance of that supply chain.

7.5 RECOMMENDATIONS

The results of the study suggest that minimisation of the impact of each supply chain risk will lead to better supply chain flexibility, which in turn leads to higher supply chain performance. It is, therefore, necessary to suggest recommendations that could be useful to reduce each of the supply chain risks as well as improve supply chain flexibility.

7.5.1 Recommendations based on the relationship between the supply chain risks and supply chain flexibility

Since it emerged that the six supply chain risks, namely, government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency are related with supply chain flexibility, it is necessary that these supply chain risks are addressed.

7.5.1.1 Recommendations regarding government policies

It appears that current government policies are adequate and they are well-promoted within the public sector. The dominant policies that directly influence public supply chain management include the Preferential Procurement Framework Act of 2000, Public Finance Management Act of 1999, Municipal Finance Management Act 56 of 2003 and the Constitution of the Republic of South Africa. It is recommended that training is provided to supply chain professionals on the purposes and correct interpretations of these policies. This will increase policy literacy amongst these professionals and reduce the cases of misinterpretation and sometimes the lack of proper implementation of these policies. Consequence management must also be emphasised so that those individuals and groups who are found to have infringed on government policies will be held accountable for their actions. Amendments of supply chain management policies should be allowed only when this is warranted. The current practice of irregular and frequent amendments only serves to confuse users of these policies who often struggle to satisfy the provisions of these policies. Where changes are necessary, they should be communicated effectively to all stakeholders and training should be provided to users of that policy.

7.5.1.2 Recommendations regarding supply complexity

The results of this study showed that the South African public sector finds it difficult to replace its key suppliers and that there is mistrust between the public organisations and their suppliers. To reduce this dependence on a few available suppliers, organisations in the public sector should increase the network of possible suppliers. The best option may be to employ three suppliers for each product/service. One could be employed as the major supplier, providing 70% of the materials, the next one could be allocated 20 % of the required materials and the final one allocated 10% of the required materials. If the major supplier underperforms for any reason, it would be easier to switch to any of the other two available suppliers without disruption operations. Also, it is necessary to build trust between the public sector and its suppliers. This could be achieved through increasing information sharing, ensuring that the

shared information is of high quality, getting into joint ventures with key suppliers and supplier development initiatives aimed at assisting the performance of suppliers.

7.5.1.3   Recommendations regarding skills availability

The view that employees are generally not enthusiastic about their jobs is a sign of job dissatisfaction. This can be countered through the provision of incentives that address both the intrinsic and extrinsic needs of supply chain professionals. For extrinsic motivation, incentives include sufficient pay, fringe benefits, bonuses, acceptable working conditions and promotions while intrinsic motivators include recognition, opportunities for personal development, autonomy, acceptance and influence (leadership). The public sector can focus on providing a correct mix of both intrinsic and extrinsic motivators to ensure that supply chain professionals become motivated to do their work. This would also ensure that the turnover of such professionals is reduced. Provision and training and development facilities for supply chain professionals can go a long way to increase their competencies regarding skills and qualifications. The headhunting of suitably qualified professionals and other innovative recruitment solutions is essential, instead of just relying on the traditional approaches to recruitment.

7.5.1.4 Recommendations regarding supplier performance monitoring

Supply chain professionals should be encouraged to perform site visits before final approval of any supplier is given. This would effectively assist in ascertaining the capacity of these suppliers to provide the material or services sought. It would be useful to ensure that these provisions are included in current policies. The public sector should also be involved in the development of key suppliers, especially when there are signs that the latter are struggling to perform. Switching suppliers should be the last option after efforts to improve these suppliers have not yielded any meaningful results. Regular feedback should be provided to suppliers regarding their performance, with indications of areas for improvement. Rewards should be provided to suppliers who excel in their performance. These may include more contracts, positive referrals and performance bonuses. Once these are provided, suppliers will be motivated to deliver at an even better standard. The use of price as the primary anchor for making decisions during supplier selection should be corrected. Other criteria such as the capacity to deliver quality, previous history, ability to perform on time and reputation, amongst others should be considered as well in addition to price. Overall, a supplier relationship management programme should be launched in the public sector, and each department should have a dedicated office for this purpose. This would ensure that critical issues pertaining to

supplier performance are addressed by staff members who are exclusively devoted to that activity.

7.5.1.5 Recommendations regarding information security

To improve security, information on security awareness should be made a priority in the public sector so that employees can be vigilant to the common threats. Awareness should be with regard to uses such as passwords, antivirus software, firewalls, encryption software, legal liability and user/administrator training standards. A dedicated portfolio aimed at ensuring the security of information should be created. Upon discovering the potential threat of information security, some organisations have even established the position of chief information officer, who amongst other things, superintends over the security of the organisation's information. The department should be manned by people who are experts in this area, given that hackers and other people who are notorious in cyberspace are usually well ahead of the latest technology. A full battery of resources should be provided to this department to ensure that the organisation's information interests are secure. In this manner, only the correct and complete information will be available when needed, in a form desired, to the right audience, to serve the desired purpose.

7.5.1.6 Recommendations regarding process efficiency

To improve process efficiency, it is recommended that the South African public sector uses automated systems more often than manual systems are used to speed up the rate at which information is processed. Given that some supply chain professionals are currently lagging behind regarding technology adoption, a change management process is essential to nurture those attitudes that are inclined towards technology-adoption. Training and development are also needed to improve the ability of these professionals to use technology. It is also important to remove sources of inefficiencies and waste from the system. Examples of these sources include wasted time, wasted movement, customer delays, waiting for approvals (red tape and bureaucracy), unnecessary steps, duplication of effort, and errors and rework. A focus on increasing the value delivered to ultimate customers (in this case end-users of services) could also lead to the streamlining of organisational processes.

7.5.2 Recommendations Based on the Relationship between Supply Chain Flexibility and Supply Chain Performance

Several mechanisms should be put in place to ensure that the supply chain is flexible enough to enhance its performance. It should be noted that supply chain flexibility can be improved by improving the flexibility of other sub-functions within the supply chain. First, it is

recommended that the public sector ensures flexibility in its sourcing activities. Sourcing flexibility consists of the capability of an organisation to reconfigure its supply chain, its ability to adapt to market changes and its ability to increase the supplier responsiveness. This flexibility in sourcing within individual public departments could drive flexibility in the entire supply chain. In addition, public departments could also strive for flexibility in their supply flexibility. Supply flexibility is the ability to reconfigure the supply chain, altering the supply of the product/service in line with customer demand.

By altering supply flexibility, the public sector could adjust the quality and levels of services and products required by end users, depending on how much these end users demand. Information technology flexibility could also be pursued, which represents the ability of the organisation's information system to adapt to changing circumstances, especially in situations of unexpected disturbances (Moon *et al.,* 2012:193). Information technology flexibility ensures that the correct system is used at the right time and increases the flow of information. Then there is the accurate flow of information in an organisation when employees can respond and access information in real time, which would, in turn, manage to process an inefficiency risk and improve supply chain performance.

Overall, Enterprise Risk Management (ERP) could be adopted and implemented for management in an organisation to understand and measure the number of risks they are exposed to. The adoption of ERP enables an organisation to determine the strategy needed to improve its supply chain performance. ERP further enables the business to select the right supply chain flexibility necessary to address supply chain risks.

7.6 CONTRIBUTION OF THE STUDY

The present study is significant in several ways. Theoretically, it contributes to the existing body of knowledge since it is an addition to the available literature on supply chain risks, supply chain flexibility and supply chain performance. It is also an important source of information on research methodologies for studies in supply chain management. Furthermore, the study provides a specific conceptualisation of the relationship between supply chain risks, supply chain flexibility and supply chain performance within the South African public sector, where no such study had been conducted before.

Practically, the study provides information to supply chain professionals in the South African public sector regarding the improvement of supply chain performance. It underscores that the performance of public supply chain in South Africa can be improved by managing the six risks

considered, and their contribution to supply chain flexibility. This denotes that where supply chain underperformance is an issue, such as when service delivery is inadequate, the solution is to minimise the effects of the risks mentioned in this study, which improves the extent to which the supply chain can become flexible. This, in turn, will lead to better supply chain performance. Therefore, this study provides a fundamental solution to the services delivery challenges facing the South African public sector. The solution is to mitigate the available supply chain risks, which stimulates flexibility of that supply chain, which leads to better performance.

7.7 LIMITATIONS OF THE STUDY

The current study provided some useful insights on the relationship between supply chain risks, supply chain flexibility and supply chain performance. It is the responsibility of the researcher to ensure that the study is without flaws. Despite the effort, it has several limitations that need to be highlighted so that they are addressed in future. The first limitation is that the study was restricted to a small sample size of 312 respondents who were based in one geographic location, namely, Gauteng Province. The second limitation is that it did not consider all supply chain risks that exist in the public sector. It only acknowledged those risks assumed to be the major ones, namely, government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process inefficiency. The third limitation is that the researcher could not confirm the accuracy of the responses because respondents completed the questionnaires in their own time in the absence of the researcher. The researcher did not have time to sit with each respondent in their own time to monitor the completion of the questionnaires. Also, the use of the convenience sampling technique increased the susceptibility of the research sample to sampling bias.

7.8 SUGGESTIONS FOR FURTHER RESEARCH

Several implications for further research can be put forward. First, since the study was inclusive of various public sector departments, future studies should consider specific government entities separately, such as state-owned enterprises, municipalities, government departments and constitutional entities. The scope of the study could be expanded to other supply chain risks excluded from this current study, such as among other things economic factors, social factors, political factors, environmental risk, human behaviour risk and legal risk. Since the current study was conducted using the quantitative methodology, a different view would be to perform similar research using a mixed method approach, which also involves the qualitative methodology where interviews are conducted. The results of the study could be informative if

the views of consultants working in the space were included and compared. This presents the need for conducting similar studies using perceptions of consultants working temporarily in the public sector's supply chain departments. Since data were collected from supply chain professionals based in Gauteng Province, future samples could also include those provinces that were excluded from this study.

7.9 CONCLUSION

The results of this study provide statistical evidence that there is a relationship between supply chain risks, supply chain flexibility and supply chain performance in the South African public sector. While there is a lot of literature on supply chain risks, supply chain flexibility and supply chain performance, information on their relationship, specifically in the South African public sector, is rare. The current study shows that in the South African public sector supply chain performance is at its lowest and supply chain risks continue to flourish. These risks include government policies, which employees find difficult to interpret or implement; availability of skills where either employee are not enthusiastic about their roles, or they just do not have qualifications and skills needed to fulfil them, which leads the public sector to rely on consultants to fill in positions; and an ineffective process whereby information is either incomplete, late or takes time to come. Although the South African public sector is run by service providers who would have been awarded tenders, their performance is monitored. Corruption and supply complexity are also among the risks that inhibit supply chain performance. The study validates that supply chain risks influence supply chain flexibility, which in turn influences supply chain performance in the public sector. The study further reports that supply chain flexibility can be improved through the management of the individual risks considered in this study, which, in turn, leads to superior supply chain performance.

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APPENDIX 1

RESEARCH QUESTIONNAIRE

Date: 16 January 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 **"The association between Supply Chain Risks, Supply Chain Flexibility and Supply Chain Performance in the South African public sector".**

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 10 minutes.

If you have any query concerning the nature of this research or should you have any question/s please feel free to contact me at mhelembek@gmail.com or 0732452745.
Your response and time is greatly appreciated. Thank you!

Yours sincerely,

_____
Khomotso Mhelembe

SECTION A: Demographic Information

In this section we would like to find out more about yourself and the profile of your organisation. Please place a cross (x) in the appropriate block

A1	Your gender	Male	Female

A2	Your age group	Below 25 years	26 – 33 years	34 – 41 years	42 – 49 years	50 years and over

A3	Highest Qualification	Matric	Diploma	Degree/Honours	Postgraduate

A4	Do you hold any supply chain management or related formal qualification (e.g. logistics, transportation, warehousing, procurement, customer services)	Yes	No

A5	Experience in the supply chain management environment (e.g. logistics, transportation, warehousing, procurement, customer services)	Less than 2 years	Between 2 – 5 years	Between 5 – 10 years	Between 10 -15 years	Over 15 years

A6	Employment period in public sector	Less than 2 years	Between 2 – 5 years	Between 5 – 10 years	Between 10 -15 years	Over 15 years

A7	Ethnicity				
	African	White	Indian/Asian	Coloured	Other (Specify)..

A9	Position in your organisation	Clerical	Specialist	Supervisor/ Line manager	Middle manager	Senior manager

SECTION B: Supply Chain Risks

We would like to find out more about the supply chain risks facing your organisation. 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 points towards a moderate acceptance of the statement. The supply chain risks selected for the study are government policies, supply complexity, availability of skills, supplier performance monitoring, information security and process efficiency.

Government Policies

GP1	My organisation gives employees the means to properly follow government rules and regulations.	Strongly disagree	1	2	3	4	5	Strongly agree
GP2	My organisation has effective structures to communicate government policies to stakeholders.	Strongly disagree	1	2	3	4	5	Strongly agree
GP3	My organisation ensures that employees adhere to rules and regulations.	Strongly disagree	1	2	3	4	5	Strongly agree
GP4	My organisation encourages employees to defend political choices even if they see shortcomings.	Strongly disagree	1	2	3	4	5	Strongly agree

GP5	My organisation clearly explains what is expected of employees regarding integrity and ethics.	Strongly disagree	1	2	3	4	5	Strongly agree

Supply Complexity

SC1	My organisation can easily replace its key suppliers.	Strongly disagree	1	2	3	4	5	Strongly agree
SC2	A high level of trust exists between my organisation and its suppliers.	Strongly disagree	1	2	3	4	5	Strongly agree
SC3	There are deep similarities between the business culture and structure of my organisation to that of its key suppliers.	Strongly disagree	1	2	3	4	5	Strongly agree
SC4	My organisation and its key suppliers have a huge influence on each other's supply chain decisions?	Strongly disagree	1	2	3	4	5	Strongly agree
SC5	There is a high level of information sharing between my organisation and its key suppliers	Strongly disagree	1	2	3	4	5	Strongly agree

Availability of Skills

AS1	My organisation finds it easy to recruit required supply management professionals	Strongly disagree	1	2	3	4	5	Strongly agree

AS2	My organisation often experiences a high staff turnover (resignations).	Strongly disagree	1	2	3	4	5	Strongly agree
AS3	In this organisation, people are generally enthusiastic about their jobs	Strongly disagree	1	2	3	4	5	Strongly agree
AS4	Employees in my organisation have the necessary qualifications and skills for the positions they hold.	Strongly disagree	1	2	3	4	5	Strongly agree
AS5	My organisation relies on external consultants to fill vacant positions	Strongly disagree	1	2	3	4	5	Strongly agree

Supplier Performance Monitoring

SPM1	My organisation visits supplier premises to help suppliers improve their performance.	Strongly disagree	1	2	3	4	5	Strongly agree
SPM2	My organisation trains suppliers' personnel.	Strongly disagree	1	2	3	4	5	Strongly agree
SPM3	My organisation provides suppliers with feedback about their performance.	Strongly disagree	1	2	3	4	5	Strongly agree
SPM4	My organisation uses rewards to recognise suppliers' achievements.	Strongly disagree	1	2	3	4	5	Strongly agree
SPM5	Price is a major consideration when my organisation selects suppliers.	Strongly disagree	1	2	3	4	5	Strongly agree
SPM6	Suppliers inform my organisation on major changes in their organisations.	Strongly disagree	1	2	3	4	5	Strongly agree

Information Security

IS1	Information security awareness is communicated well throughout the organisation.	Strongly disagree	1	2	3	4	5	Strongly agree
IS2	Users receive adequate security training prior to receiving a network account.	Strongly disagree	1	2	3	4	5	Strongly agree
IS3	A variety of business communications (notices, posters, newsletter, etc.) are used to promote security awareness.	Strongly disagree	1	2	3	4	5	Strongly agree
IS4	Information security policies are written in a manner that is clear and understandable.	Strongly disagree	1	2	3	4	5	Strongly agree
IS5	Information security rules are enforced by sanctioning the employee who breaks them.	Strongly disagree	1	2	3	4	5	Strongly agree
IS6	Employee computer practices are properly monitored for policy violations.	Strongly disagree	1	2	3	4	5	Strongly agree

Process Efficiency

PE1	The top management team emphasises team work.	Strongly disagree	1	2	3	4	5	Strongly agree
PE2	The top management team provides clear feedback to employees.	Strongly disagree	1	2	3	4	5	Strongly agree
PE3	My organisation involves waste reduction in its operations.	Strongly disagree	1	2	3	4	5	Strongly agree

PE4	The IT system in my organisation is convenient to access information.	Strongly disagree	1	2	3	4	5	Strongly agree
PE5	The IT system in my organisation has well-developed guide material for using the system.	Strongly disagree	1	2	3	4	5	Strongly agree
PE6	My organisation standardises operational processes.	Strongly disagree	1	2	3	4	5	Strongly agree

SECTION C: Supply Chain Flexibility

We would like to know more about supply chain flexibility in your organisation. Please indicate your views by encircling the corresponding number between 1 (Much worse than the industry average) and 5 (much better than the industry average). A rating of 3 points towards a neutral view of the statement.

Supply Chain Flexibility

SCF1	Involving and supporting suppliers in new product/ service development.	Much worse	1	2	3	4	5	Much better
SCF2	Handling a number of new product/service development projects in design at a given time and at reasonable cost.	Much worse	1	2	3	4	5	Much better
SCF3	Managing reasonably the cost of switching from one supplier to another.	Much worse	1	2	3	4	5	Much better
SCF4	Managing the time and cost implications of changing the quantity and types of products/services to be delivered.	Much worse	1	2	3	4	5	Much better

SCF5	Speeding the flow of information throughout the supply chain network.	Much worse	1	2	3	4	5	Much better
SCF6	The efficiency of existing information system applications to integrate with other systems applications.	Much worse	1	2	3	4	5	Much better

SECTION D: Supply Chain Performance

We would like to find out more about the performance of the supply chain in which your organisation operates. Please indicate the extent to which you agree or disagree by encircling the corresponding number between 1 (Decreased significantly) and 5 (Increased significantly). A rating of 3 points towards a neutral view of the statement.

Supply Chain Performance

SCP1	Quality of services	Decreased Significantly	1	2	3	4	5	Increased Significantly
SCP2	Procurement costs	Decreased Significantly	1	2	3	4	5	Increased Significantly
SCP3	Delivery speed	Decreased Significantly	1	2	3	4	5	Increased Significantly
SCP4	Customer/client satisfaction	Decreased Significantly	1	2	3	4	5	Increased Significantly
SCP5	Supplier performance	Decreased Significantly	1	2	3	4	5	Increased Significantly

SCP6	External collaboration	Decreased Significantly	1	2	3	4	5	Increased Significantly

The end

Thank you for taking your time to complete this questionnaire

DECLARATION BY LANGUAGE EDITOR

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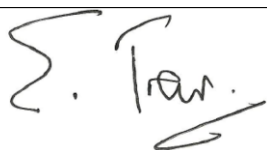Faculty of Management Sciences

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8 December 2017

LANGUAGE EDITING

This is to certify that I language edited, together with technical editing, the dissertation "The relationship between supply chain risk, supply chain flexibility and supply chain performance in the South African public sector", by Khomotso Mhelembe in partial fulfilment for his degree of D Tech: Business in the Faculty of Management Sciences.

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