SUPPLY CHAIN MANAGEMENT PRACTICES, SUPPLIER PERFORMANCE AND SUPPLY CHAIN RESILIENCE IN THE SOUTH AFRICAN PUBLIC SECTOR

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DECLARATION

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

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STATEMENT 1

This thesis is being submitted in partial fulfilment of the requirements for the Doctor of Philosophy (PhD) degree in Business Administration measuring supply chain practices in the public sector.

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STATEMENT 2

This thesis is the result of my own independent investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A list of references is appended.

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DEDICATION

I dedicate this study to my family for their love and care, kind-heartedness, trust and the encouragement they have shown me. Their undying support boosted my confidence and increased my inspiration towards achieving this goal. I also especially dedicate this study to my brother, Simon Tinashe Mugwenhi, for his encouragement and for always being there for me when I needed him most.

ABSTRACT

The most important decisions that direct the operations of a nation are made in the public sector. The public sector performs the duty of facilitating the efficient and sustainable delivery of goods and services to the general public. In South Africa, public sector institutions have failed to fulfil their role of providing effective services, and this failure has been attributed to corruption and other inconsistencies inherent within supply chain management (SCM) transactions occurring between government and its suppliers. To streamline SCM, various legislative pieces such as the public SCM Policy Framework, the Preferential Procurement Policy Framework (PPPF) and the Broad-Based Black-Economic Empowerment (BBBEE) Act, among others were implemented in tandem with a host of other interventions. However, the challenges linked to public SCM continue to this day and the intended outcomes are yet to be fully realised, thereby negatively impacting on the effective delivery of services by the public sector. This study investigated the relationship between SCM practices, supplier performance and supply chain resilience in the South African public sector. The study is premised on the need to investigate how SCM practices may be applied to improve the effectiveness of supplier performance, and hence the resilience of the public supply chain in South Africa, in light of the numerous challenges faced by the sector.

This study followed a quantitative method in which a cross-sectional survey was applied to collect data to test the relationships between seven SCM practices (supply chain collaboration, supply chain synergies, supply chain innovation, information sharing, information quality, supply chain design, supply chain integration), supplier performance and supply chain resilience. A structured survey questionnaire was developed using adapted measurement scales and administered to 333 SCM professionals recruited from public sector organisations based in the Gauteng Province. The data collected were analysed using the Statistical Package for Social Sciences (SPSS Version 25.0) and the Analysis of Moment Structures (AMOS Version 25.0) statistical software. The actual data analysis techniques applied included descriptive and inferential statistics and hypotheses were tested using structural equation modelling.

The results of the study showed that three SCM practices, namely collaboration, innovation and integration exerted a significant positive influence on supplier performance. However, supply chain synergies, information quality and supply chain design were statistically insignificant. Moreover, information sharing exerted a significant negative influence on supplier performance. In turn, supplier performance exerted a significant positive influence on supply chain resilience.

The study contributes in various ways to both public SCM theory and practice. Theoretically, it provides information on how the SCM dimensions considered in this study, which are supply chain collaboration, synergies, innovation, information sharing and quality, design, and integration are linked to supplier performance and supply chain resilience within the public sector in South Africa. Given the limited evidence of previous studies of this nature in the South African public sector, the results are an essential addition to the existing body of literature within the public SCM context in developing countries such as South Africa. From a managerial standpoint, the study provides information on which SCM practices deserve attention in the efforts to improve the performance of suppliers, and how the performance of suppliers can be harnessed to enhance the resilience of the public supply chain. Hence, the study offers an important diagnostic framework through which the SCM challenges facing the public supply chain in South Africa can be addressed.

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LIST OF ABBREVIATIONS

AMOS	Analysis of Moment Structures
AVE	Average Variance Extracted
BBBEE	Broad-Based Black Economic Empowerment
CFA	Confirmatory Factor Analysis
CFI	Comparative Fix Index
CSCMP	Council of Supply Chain Management Professionals
CSD	Central Supplier Database
EFA	Exploratory Factor Analysis
GDP	Gross Domestic Product
GFI	Goodness of Fit Index
HSV	Highest Shared Variance
ICT	Information and Communication Technology
IFI	Incremental Fit Index
INV	Supply Chain Innovation
IQ	Information Quality
IS	Information Sharing
MFMA	Municipal Finance Management Act
NFI	Normed Fit Index
PFMA	Public Finance Management Act
PPPFA	Preferential Procurement Policy Framework Act
RMSEA	Random Measure of Standard Error Approximation
SC	Supply Chain
SCC	Supply Chain Collaboration
SCD	Supply Chain Design
SCI	Supply Chain Integration
SCM	Supply Chain Management
SCR	Supply Chain Resilience
SCS	Supply Chain Synergies
SD	Standard Deviation

SEM   Structural Equation Modelling

SP   Supplier Performance

SPSS   Statistical Package for Social Sciences

TLI   Tucker-Lewis Index

CHAPTER 1
OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

It is generally acknowledged that the public sector is the engine of the economy and the organ through which all important decisions that direct the operations of a nation are made (Economic Commission for Africa, 2010:4). The public sector is owned and operated by the government on behalf of the public and is the machinery of the government through which public goods and services are delivered (Dube & Danescu, 2011:1; Hughes, 2012:3). It performs the duty of ensuring the efficient delivery of goods and services to the general public in a way that promotes sustainable development both in the economy and standards of living (Roodhooft & Abbeele, 2006:490; Uyarra & Flanagan, 2010:123; Naude, Ambe & Kling, 2013:3; Seidu, Fatawu & Ahmed, 2014:4). The goods and services that the public sector provides to the general populace include energy, water, sanitation, health, education, security, communication and infrastructure, amongst others (Murimoga & Munyafi, 2014:99; Sandada & Kambarami, 2016:45). These services are provided through public sector organisations (entities) such as government ministries, departments, local governments, public enterprises and corporates commonly referred to as parastatals (Roodhooft & Abbeele, 2006:490; Ambe, 2012:134; Sandada & Kambarami, 2016:45).

The importance and contribution of the public sector to the economy in terms of efficient service delivery is linked to the effectiveness of the public procurement system in place (Tukuta & Saruchera, 2015:4). Service delivery involves the use of financial resources by the government, the latter which is primarily conducted through procurement (Licenji, 2015:239). However, in most developing countries, public procurement systems have been severely compromised by numerous challenges (Bhasheka & Tshombe, 2017:1). Various scholars (Mamiro, 2010:8; Ameyaw, Mensah & Osei-Tutu, 2012:55; Mathaba *et al.,* 2015:508) have identified problems such as weak and outdated procurement systems, public procurement remaining an operational activity and not a strategic activity, lack of transparency and accountability, lack of knowledge and skills, embedded fraud and corruption, political interference and inability to implement appropriate reforms, especially public supply chain management, as inhibiting challenges to efficient public

service delivery. Due to these inhibiting challenges, governments in developing countries have been regarded as inefficient and unable to meet the service delivery imperatives of the public (Bhasheka & Tshombe, 2017:1).

One of the most advocated and applauded resolutions to the challenges facing the public sector challenges is the adoption and implementation of a supply chain management (SCM) system, which is an important tool for managing public procurement (Arora, 2014:3). In recent years, SCM has become an integral strategic tool for ensuring fiscal prudence in procurement activities, not only in the private sector but also to governments (public sector) (Ambe, 2016:20; Maleka, 2016:1). Dzuke and Naude (2015:1) suggest that globally, public SCM is central to the delivery of public services and performance of public entities. Mathaba, Nzimakwe, Pfano and Muapo (2015:507) support this view by stating that most governments have adopted SCM as a way to improve financial prudence as well as the efficiency and effectiveness of their service delivery. SCM is concerned with the coordination of all parties involved in delivering the combination of inputs, outputs or outcomes that will meet a specified public sector requirement (Sun *et al.,* 2012:54; Malhan, 2015:21). Ambe and Badenhorst-Weiss (2012:244) suggest that SCM is aimed at adding value at each stage of the procurement process, from the demand of goods or services though their acquisition, managing the logistics process and finally, after use, to their disposal. However, despite the adoption of SCM as a remedy prescribed to treat a plethora of problems that have affected public procurement systems, its adoption and implementation appears to be a challenge as well (Sodhi, Son & Tang, 2012:1; Msimangira & Tesha, 2014:130; Bhasheka & Tshombe, 2017:2).

Similarly to any other country, South Africa has adopted and implemented SCM as a measure of governing and managing government transactions and its basis lies in the supreme law, which is the Constitution of the Republic of South Africa, Act No. 108 of 1996, Section 217(1) (National Treasury, 2015:4). However, despite the adoption and implementation of SCM in the South African public sector as a strategic tool for ensuring fiscal wisdom and discipline in government transactions, it is well known that its SCM is imperfect and dysfunctional (Hendriks, 2012:4; National Treasury, 2015:4). This has also been noted by a number of scholars (Boateng, 2009:1; Bent, 2014:14; Turley & Perera, 2014:45) who observe that in South Africa despite the reform

process in procurement and the employment of SCM as a strategic tool, service delivery is far from convincing. Problems identified in the public sector include non-compliance with regulations and policies related to procurement and SCM as well as irregularities in tendering (Ameyaw *et al.,* 2012:61; Ambe, 2016:20). Livhuwani (2012:44) adds that problems related to poor service delivery are likewise a result of insufficient training, lack of experience and inadequate skills regarding the SCM profession in the South African public sector. This has resulted in the failure to interpret policies, acts, rules and regulations that govern SCM by public sector professionals, who then tend to award contracts to unqualified service providers and create a breeding ground for unethical practices (Livhuwani, 2012:44; Dzuke & Naude, 2015:4). Other problems identified include too many and cumbersome procedures, corruption, political interference, lack of monitoring and evaluation mechanisms and a generally poorly performing public sector supply chain (Boateng, 2009:1; Ngwakwe, 2012:314; Wall, Watermeyer & Pirie, 2013:1; National Treasury, 2015:4).

The intended outcomes of SCM reforms have not been fully achieved in the South African public sector (Ambe, 2016:20). Bent (2014:14) supports this view by concluding that it is of no doubt that the SCM is not reaping its intended goals as there are constant allegations of corruption and inefficiency in service delivery. Ngwakwe (2012:315) describes corruption as a cancer that appears to be widespread in most African public sectors and it remains a major threat to achieving economic and sustainable social development. In agreement, Boshomane (2014:1) mentions that without proper transparent and accountability systems, the vast resources channelled through the public SCM system face the risk of misuse and abuse. Also, despite the existence of a fleet of policies and regulations developed by the South African National Treasury to direct public SCM, high levels of non-compliance, especially in procurement activities, still remain (Boshomane, 2014:2; Uromo, 2014:54). This has resulted in a strained relationship between the general public and public sector organisations. As evidence to this, strained relationship service delivery protests have become widespread in South Africa, which are a sign of dissatisfaction as the public perceives that they are not receiving the quality and quantity of services they need (National Treasury, 2015:4).

The above backdrop makes it evident that South African public sector SCM is still tainted by a myriad of challenges that are hindering it from performing optimally (Jordaan, 2013:147). To overcome these challenges there is a need for the effective adoption and implementation of SCM best practices (Ambe, 2012:434; Setino, Ambe & Badenhorst-Weiss, 2016:1). As recommended by Ambe and Badenhorst-Weiss (2011:1104) one of the approaches through which governments may improve efficiency in the delivery of public goods and services is through the introduction of best SCM practices. These practices include supply chain collaboration (SCC) (Sayuti, 2011:288; Walters, 2012:3; Autry, 2013:275), innovation (INV), information sharing (IS) and quality (IQ), supply chain integration (SCI) and design (SCD) (Chow, Madu, Kuei, Lu & Lin, 2008:20; Sundram, Ibrahim & Govindaraju, 2011:840; Hamister, 2012:429-430; Riley, Klein, Miller & Sridharan, 2016:953; Al-Shboul *et al.,* 2017:369). It is anticipated that if these practices are adopted, performance of the SCM function in the public sector will improve, and will be manifested, amongst other things, by an improvement in the performance of suppliers, which in turn may lead to a more resilient public supply chain that is able to react and respond appropriately to ensuing developments in the network (Jabbour, Filho, Viana & Jabbour, 2011:210; Pule, 2014:137).

1.2 PROBLEM STATEMENT

Since the emergence of democracy in 1994, South Africa as a country has witnessed a number of important developments in the public procurement system, which were aimed at promoting good governance and economic development (Molver & Gwala, 2015:261; Maleka, 2016:3). One of these developments was the adoption and implementation of SCM in the public sector in 2003 as an instrument for instilling fiscal prudence in procurement processes (Mkhize, 2004:5; Maleka, 2016:25). From the concept, it was clear what needed to be done, how it should be done and with what results. However, the standard of service delivery within public institutions has not shown positive results, which is attributed to numerous SCM challenges facing public institutions (Corporate Counsel Association of South Africa, 2016:2). Also, despite various training and development programmes intended to capacitate public employees with the necessary skills, the SCM function remains dysfunctional (National Treasury, 2015:5). This is further noted in a report by the Auditor General (2014:6), which mentions that it is well known that public sector SCM in

South Africa is imperfect and faces various challenges that are preventing it from performing as expected. Motuba (2014:3) further states that the implementation of SCM in South Africa is far from satisfactory. The most dominant challenges include fraud and corruption; non-compliance with rules and regulations; lack of proper monitoring and evaluation measures; lack of skills, experience and qualifications; irregularities in the application of SCM, especially in tendering processes, and political interference (Ambe, 2012: 249-253; Ngobeni, 2016:24-25).

The existence of the aforementioned challenges has resulted in a tense relationship between government institutions and the general populace who are the recipients of goods and services produced through the SCM function (Akinboade, Kinfack & Mokwena, 2012:183). The result has been sporadic torrents of public service delivery protests which are a general sign of dissatisfaction. Likewise, the print media, television, radio stations and social media have been awash, and are saturated, with daily reports of irregularities, bribes and allegations of fraud and corruption (Auditor Reports, 2011:120; 2012:6; 2013:29; National Treasury, 2015:3; Corruption Watch, 2016:1). In accordance with Ngwake (2012:315), corruption remains the chief threat to achieving sustainable SCM not only in South Africa but the entire continent. Africa Check (2015:1) indicates that South Africa as a nation loses an estimated 20 percent of its Gross Domestic Product annually through corruption. A former South African Chief Procurement Officer also noted that as much as 40 percent of the country's R600 billion budget for goods and services is consumed by fraud and inflated prices from suppliers (Mkokeli, 2017:1). The African Check (2015:1) further reports that every year about 20 percent of the overall government procurement budget of R150 billion is lost through fraud and corruption. This clearly shows that public sector SCM in South Africa requires solutions in order to reduce these fiscal leakages.

Against this background, this study intends to generate information for dealing with SCM challenges facing the public sector in South Africa. It has to be noted that financial leakages facing the public sector can be traced to the implementation of SCM practices and how effective the public sector is in dealing with its suppliers. It is the interaction between these two components that determines whether or not the supply chain will be effective. This study proposes that effective application of SCM practices such as SCC, INV, IS, IQ, SCD, and SCI leads to better performance of suppliers, which in turn enhances the resilience of the public supply chain. In support of this view, several studies (Li, Rao, Ragu-Nathan & Ragu-Nathan, 2005:618; Wu, Melnyk & Swink, 2012:121; Chakraborty, Bhattacharya & Dobrzykowski, 2014:677; Mutuerandu & Iravo, 2014:62)

suggest that the implementation of SCM practices leads to improved performance of suppliers, with obvious implications for supply chain resilience (SCR) and service delivery. In addition, Maleka (2016:10) notes that the lack of suitable implementation of SCM practices is a major factor behind the poor audit outcomes in most public sector departments. Information is therefore required that can be used to alleviate SCM related problems, leading to better economic performance in the South African public sector.

Since the emergence of SCM in the South African public sector, various studies have been conducted on different topics. Dekker (2005) focuses on the impact of new supply chain regulations. Matthee (2006) investigated the potential of internal audits to enhance public supply chain outcomes. Rabodiba (2006) and Van Zyl (2006) focus on SCM practices in South African municipalities. Jacobson (2007) researched the impact of SCM in government institutions, whilst Ismay and Codogan (2008) direct their study to the institutionalisation of SCM and challenges facing local government. Stemele (2009) assessed good governance in procurement in the Letjeleutswe District Municipality whereas Larson (2009) directs his research to public and private sector perspectives on SCM. Rampedi (2010) conducted a study on the application of the supply chain system in the Office of the Premier in the Mpumalanga Province, whilst Nel (2010) developed a conceptual framework to analyse SCD practices. Ambe and Badenhorst-Weiss (2011) studied the critical component features and benefits of SCM. Ngobeni (2011) focuses on the tendering process.

A study conducted by Wall, Watermeyer and Pirie (2013) concentrates on SCM and service delivery, while Ambe (2012) focuses on SCM perspectives in the public sector. Marokana (2012) researched the impact of the implementation of the supply chain policy in the Department of Local Government and Housing in the Limpopo Province. Muguni (2012) also centres his investigation on the evaluation of the implementation of SCM in service delivery with a focus on procurement of goods and services, whereas Tsamaano (2012) evaluates the impact of supply chain on service delivery. Naude, Ambe and Kling (2013) explore supplier relationship management in public sector procurement and Mhlongo (2013) focuses on transparency in local authorities. Motuba (2014) concentrates on the challenges of SCM in municipalities. Maleka (2016) assessed the extent of SCM implementation. Mahlangu and Pooe (2017) direct their attention to the relationship

between supply chain integration, collaborative planning and supply chain capabilities. A noteworthy view is that these previous studies disregard the importance of the relationship between SCM practices, supplier performance (SP) and SCR as an important front for resolving the crisis in public SCM in South Africa. Moreover, from the reviews conducted of various digital databases, there is little evidence of studies on the relationship of SCM practices, SP and SCR in the South African public sector. This study, therefore, seeks to fill that gap and establish the link between SCM best practices, SP and SCR.

1.3 RESEARCH OBJECTIVES

The objectives of this study include primary and secondary objectives.

1.3.1 Primary objective

The primary objective of this study is to investigate the relationship between SCM practices, supplier performance and supply chain resilience in the South African public sector.

1.3.2 Secondary objectives

The secondary objectives of this study include theoretical and empirical objectives:

1.3.2.1 Theoretical objectives

The following theoretical objectives were formulated:

i. to conduct a literature review on SCM in the public sector;
ii. to conceptualise SCM practices, namely, SCC, INV, IS, IQ, SCD and SCI from literature;
iii. To review literature on the institutional theory;
iv. to explore literature on supplier performance (SP); and
v. to analyse literature on SCR.

1.3.2.2 Empirical objectives

The following empirical objectives were formulated:

   i. to determine the perceptions of SCM professionals towards the implementation of SCM practices in the South African public sector.
  ii. to explore the perceptions of SCM professionals towards the levels of SP in the South African public sector.
 iii. to explore the perceptions of SCM professionals towards the degree of SCR in the South African public sector.
  iv. to determine the influence of SCM practices on SP in the South African public sector.
   v. to establish the relationship between SP and SCR in the South African public sector; and
  vi. to develop a model for managing SCM practices, SP and SCR in the South African public sector.

1.4 CONCEPTUAL FRAMEWORK

A conceptual framework was developed to illustrate the relationships between SCM practices, SP and SCR. In the framework, SCM practices are the predictor variables, leading to SP, which is the mediating variable, which in turn influences SCR. The SCM practices factor is classified into six dimensions, namely, SCC, INV, IS, IQ, SCD, and SCI. A total of seven hypotheses (H_1 to H_7) have been put forward, which link the dependent and independent variables. The conceptual framework under consideration in this study is illustrated in Figure 1.1.
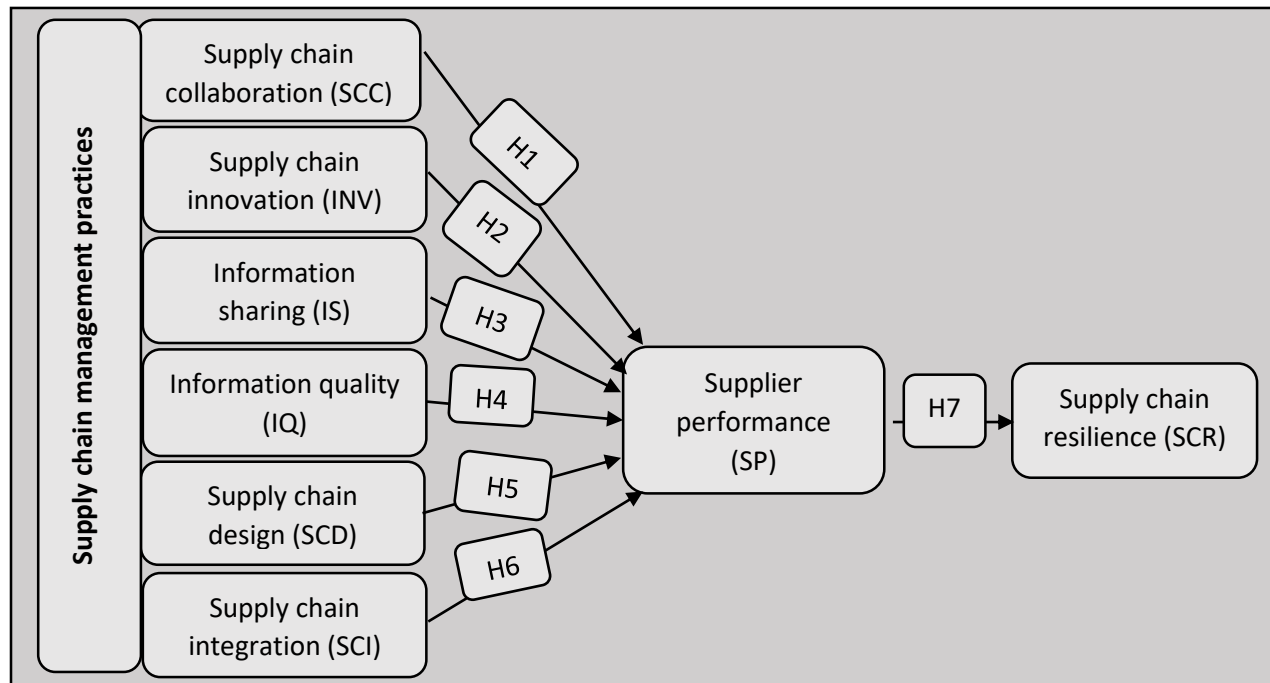
Figure 1.1: Conceptual framework for supply chain management practices, supplier performance and supply chain resilience

Source: Author's own compilation

1.5 HYPOTHESES

The study tests the following hypotheses which are based on the conceptual framework in Figure 1.1:

H_1: Supply chain collaboration (SCC) exerts a significant positive influence on supplier performance in the South African public sector.

H_2: Supply chain innovation (INV) exerts a significant positive influence on supplier performance in the South African public sector.

H_3: Information sharing (IS) exerts a significant positive influence on supplier performance in the South African public sector.

H_4: Information quality (IQ) exerts a significant positive influence on supplier performance in the South African public sector.

H$_5$: Supply chain design (SCD) exerts a significant positive influence on supplier performance in the South African public sector.

H$_6$: Supply chain integration (SCI) exerts a significant positive influence on supplier performance in the South African public sector.

H$_7$: Supplier performance (SP) exerts a significant positive influence on supply chain resilience in the South African public sector.

1.6 PRELIMINARY LITERATURE REVIEW

This section briefly discusses literature on the research theory selected for the study as well as the constructs under consideration in this study. A more comprehensive discussion on the theoretical framework and the review of literature is provided in Chapters Three and Four.

1.6.1 Research theory

The Institutional theory provides a relevant foundation for this study. However, there is no general consensus as to when the theory emerged. According to Eisenhardt (1989:492), it originated in the early 1970s. The theory examines how external pressures influence organisations to adopt certain practices. Kauppi (2013:1119) highlights that the institutional theory has two variants, namely, sociological and economic variables that influence organisational behaviour. The central thesis of the institutional approach is that many structures, programmes and practices in organisations seek to achieve economic efficiency and legitimacy through desired constructs of reality (Mayer & Rowan, 1977:340; Zucker, 1987:443; Kauppi, 2013:1119; Palthe, 2014:60). The theory primarily focusses on the rationalisation, legitimacy, practicality and aspects of social structure and related processes in establishing guidelines and best practices in compliance with applicable laws, rules, standards and norms (Rezaee, 2017:71). On the one hand, the well-established sociological version of the institutional perspective suggests that organisations are driven by legitimacy motives, that is, the perception that the actions are desirable and appropriate within the specific context (DiMaggio & Powell, 1983:147; Suchman, 1995:571; Rogers, Purdy, Safayen & Duimering, 2007:556). On the other hand, the economic variant suggests that organisations are perceived as

economically motivated and driven by economic efficiency (Turkulainen, Kauppi & Nermes, 2017:1120).

The prominent argument in the institutional theory hypothesis is that organisations operating in similar fields tend to have the same practices and structures for them to survive external pressures (Palthe, 2014:60). These pressures emanate from governments in the form of rules and regulations, customers' expectations and following competitors because of their success (Sarkis, Zhu & Lai, 2011:7). In this study, the institutional theory has been identified for its potential value in SCM. The study rationalises that the relationship between SCM practices, SP and SCR can be managed to achieve efficiencies in both social and economic areas of an organisation. The institutional theory also offers important insights into the adoption and implementation of tools and practices within public sector SCM, which will enhance SP, leading to improved SCR.

1.6.2 Supply chain management practices

SCM has been described by Al-Shboul *et al*. (2017:580) as a strategic management philosophy and practice containing all supply chain partners from suppliers to customers in order to enhance performance and satisfy customer needs, wants and requests. Chow *et al.* (2008:665) define SCM as a holistic approach to demand sourcing and procurement, production, and logistics process management. SCM as a managerial philosophy is aimed at achieving better performance, gaining competitive advantage and increasing customer satisfaction in business (Al-Shboul *et al.,* 2017:580). It encompasses all activities involved in planning and management, sourcing and procurement, conversion and all logistic management activities as well as coordination and collaboration with channel members (Soosay *et al.,* 2008:160). It is essential to note that the benefits of SCM to businesses are realised through the means of various practices. These SCM practices are a set of actions undertaken by suppliers, manufacturers, distributors and customers to improve the performance of the integrated supply chain (Koh *et al.,* 2007:103; Hamister, 2012:429; Barros, Barbosa-Póvoa & Blanco, 2013:1041; Al-Shboul *et al.,* 2017:367). Gawankar, Kamble and Raut (2017:259) view SCM practices as the set of activities undertaken in an organisation to promote effective management of its supply chain. SCM practices consider internal processes of an organisation and link them with the external operations of members in the entire

supply chain (Truong *et al.,* 2017:179). SCM practices are implemented to achieve and enhance performance throughout the supply chain by integrating both the internal cross functional activities and external integration with suppliers and customers (Kannan & Tan, 2010:207). Therefore, SCM practices are aimed at improving the performance of organisations and the supply chain as well as increasing their competitive advantage.

SCM practices include strategic supplier partnerships, customer relationships, risk and reward sharing, customer satisfaction supply integration and inventory management (Gharakhani *et al.,* 2012:5943; Gawankar *et al.,* 2013:145). Other SCM practices identified by scholars include information sharing (IS), information quality (IQ), supply chain collaboration (SCC), supply chain design (SCD), supply chain integration (SCI), supply chain innovation (INV), supplier performance (SP) and supply chain resilience (SCR) amongst others (Chow *et al.,* 2008:666; Sundram *et al.,* 2011:840; Hamister, 2012:430; Al-Shboul, 2017:369). This study is directed towards the SCM practices identified by Hamister (2012:430), which include SCC, INV, IS, IQ, SCD, SCI, SP and SCR.

1.6.2.1 Supply chain collaboration

Several authors (Simatupang *et al.,* 2002:289; Cao *et al.,* 2010:6613; Fantazy, 2010:685; Autry, 2013:298; Autry *et al.,* 2014:275; Gumboh & Gichira, 2015:224; Salam, 2017:299) view SCC as two or more members of a supply chain working together to create a competitive advantage by sharing information, making joint decisions and sharing benefits, which results in greater profitability gained by satisfying the needs of end customers. Autry (2013:298) denotes that SCC is identified as one of the leading game-changing trends for future supply chains. Forces such as securing a company's strategic position in the supply chain, focusing on building a winning team and improving financial performance stimulate the need for collaboration amongst firms within their supply chain (Fawcett, 2012:67; Salam, 2017:299).

The main objective of SCC is to focus on improving the efficiency of inter-organisational relationships from source to consumer with particular importance on the interfaces of the various operations in the supply chain (Fantazy, 2010:685; Gumbo & Gichira, 2015:223). It is also

significant to note that SCC, as a construct of SCM practices, is based on mutual respect, IS and trust, mutual ownership of decisions and shared responsibility for outcomes (Kahn, 2006:118; Salam, 2017:299). If executed successfully, SCC can yield benefits such as reduced inventory, customer satisfaction, reduced time in product development, better risk management, and improved product quality to mention a few (Gumboh & Gichira, 2015:255; Liao, Hu & Ding, 2017:143; Salam, 2017:300). Public sector institutions tend to benefit from collaborative partner relationships since the latter enables organisations to increase competitive advantage, manage knowledge flow, share information, manage inventory levels, align supply chain risk coordination and enhance supply chain performance (Mentzer *et al.,* 2000:52; Cao & Zhang, 2011:163; Du, Lai, Cheung & Cui, 2012:89; Purwaningrum & Yaniasih, 2012:62; Quoc Le *et al.,* 2013:776; Ramanathan, 2013:431; Tsou, 2013:5204; Yang *et al.,* 2013:557; Masten & Kim, 2015:1).

1.6.2.2 Supply chain innovation

Supply chain innovation refers to tools that can improve organisational processes needed for effective SCM through interactions with suppliers, manufacturers, distributors and customers (Lee, Lee & Schniederjans, 2011:1195). Lavastre *et al.* (2011:9) define INV as a set of practices previously non-existent in organisations that will be generated, developed and deployed within supply chains to tackle different supply chain issues such as quality, cost and lead time. From the aforesaid definitions, it can be noted that INV is dynamic in nature and varies from organisation to organisation. Supply chain innovations rely on logistics network reconfigurations, stock outsourcing, information technology and information systems development, and they aim to increase collaborative relationships within the supply chain (Bello *et al.,* 2004:135; Wagner, 2010:8; Ageron, 2013:266). Supply chain innovations tend to span from smaller or incremental changes to large and more radical changes and they can have both intra and inter organisational origin and application (Arlbjorn *et al.,* 2011:4; Ageron, 2013:266; Jensen *et al.,* 2013:127). Effective supply chain innovations facilitate a reduction in costs and a development of flexibility for dealing with rapid changes in the business environment (Li, 2008:19; Lee *et al.,* 2011:1193). Other benefits of supply chain innovations include the efficient supply of goods and services, accuracy in service delivery, improved quality of goods and services and creation of value for customers (Parnaby & Towill, 2008:141; Lee *et al.,* 2011:1195; Kim & Chai, 2017:43). Public

sector organisations that embrace innovations also benefit by enhancing their survival and success in turbulent environments (Ageron, 2013:266).

1.6.2.3 Information sharing

IS is an inter-organisational sharing of data, information or knowledge in supply chains (Kembro, Kostas & Naslund, 2014:609; Jonsson & Holmstrom, 2016:62). Ding *et al.* (2014:91) view IS as a paradigm with a widespread belief that achieving a high degree of cooperative behaviour requires that supply chain members voluntarily share operating information and jointly plan strategies. IS requires firms voluntarily to exchange not only transacted data such as materials and product orders but also strategic supply chain information (Prajogo & Olhager, 2012:514). In doing this, actors or members are expected to act in the utmost good faith, and information in a supply chain can be shared on the Internet or other web-based technologies (Jonsson & Myrelid, 2016:1770). Gimenez and Loureco (2008:309) argue that the Internet or other web-based technologies can have a positive impact on the manufacturing flow management as sharing information about demand and supply chain capacity can make the product flow through manufacturing facilities more efficient.

IS as a construct of SCM practices is considered as an especially useful facet for promoting collaboration and cooperation in the supply chain (Kim & Chai, 2017:43). It builds better partnerships and promotes integration between suppliers and manufacturers in the supply chain, leading to better performance (Du *et al.,* 2012:90). Khan *et al.* (2016:116) add that IS in a supply chain allows partners to work as a single entity by regularly exchanging information. Public sector organisations that embrace and put IS into practice benefit much, which can have a significant impact on planning, product and delivery practices, customer satisfaction and delivery performance (Cai *et al.,* 2010:163; Fawcett *et al.,* 2011:38; Ding *et al.,* 2014:91; Song *et al.,* 2016:741).

1.6.2.4 Information quality

IQ is a concept which has been analysed by many researchers in an attempt to identify and qualify its dimensions (Marinagi, 2015:472). Gustavsson and Wänström (2009:325) define IQ as the ability to satisfy stated and implied needs of information users. The Information Quality Guidelines provided by the United States Patent and Trademark Office (2014:1) define quality as an encompassing term comprising objectivity, utility and integrity of the information. According to Ding *et al.* (2014:92), dysfunctional effects of inaccurate or delayed information can be detrimental to operational effectiveness and efficiency of the supply chain. To minimise the effects of ineffective IQ, Gustavsson and Wänström (2009:326) propose and define ten dimensions as the determinants of IQ, which are complete, concise, reliable, timely, valid, accessible, appropriate amount, credible, relevant and understandable. These dimensions influence the efficiency of supply chains (Ding *et al.,* 2014:92).

1.6.2.5 Supply chain design

SCD refers to the task of determining the basic, long-term structure of the supply chain by defining its elements, objectives, location and key organisation (Leukel & Sugumaran, 2013:288). It involves decisions about the number of suppliers, proximity to supplier, supplier selection and evaluation, planned capacities in each facility, definition of contractual terms and reactions to the possible disagreements between channel members (Chopra & Meindle, 2004:15). SCD as a facet of SCM practices has several elements, which include location factors, manufacturing performance and supplier selection, capacity planning and sufficiency of distribution channels, among others (Sezen, 2008:234). According to Leukel and Sugumaran (2013:288), SCD faces two critical difficulties. The first one is the design space, which contains a vast number of alternatives that make it hard for designers to evaluate and select the best alternatives. The second difficulty is that designing a supply chain incorporates stakeholders from both the supply and demand side, which requires sharing and understanding design information by various parties. However, a well-designed supply chain in terms of location, distance, capacity and planning can provide competitive advantage for the firms in that particular chain (Sezen, 2008:238). The benefit of a

well-designed supply chain is that it allows performance flexibility and impacts significantly on resource and firm performance (Sezen, 200:238; Leukel & Sugumaran, 2013:288).

1.6.2.6 Supply chain integration

SCI refers to the degree to which an organisation strategically collaborates with its supply chain partners and manages intra and inter organisational processes to achieve effective and efficient flows of products, services, information, money and decisions with the objective of providing maximum value to customers (Zhao *et al.,* 2008:374). As a management practice, SCI includes both internal and external integration (Braunscheidel & Suresh, 2009:119; Braunscheidel *et al.,* 2010:883; Flynn *et al.,* 2010:58; Huo, 2012:596; Danese, Romano & Formentini, 2013:125). Internal integration is characterised by overall systems visibility across organisational functions such as procurement, production logistics, sales, marketing and distribution (Boon-itt & Wong, 2011:253). External integration refers to the establishment of linkages with customers and suppliers (Wong *et al.,* 2011:604; Zhao *et al.,* 2011:17; Kamal & Irani, 2014:523; Cao, Huo, Li & Zhao, 2015:26). External integration is more powerful than internal integration as it is considered as the key strategic approach to acquire competitive advantage in an uncertain, turbulent and dynamic environment (Quesada *et al.*, 2008:296). SCI can bring positive outcomes to public sector organisations such as a reduction in transactional costs, improvements in financial performance and enhanced efficiency and competitiveness (Danese & Bortolotti, 2014:7062; Mackelprang, Robinson, Bernardes & Webb, 2014:72; Ralston, 2014:8; Cao *et al.,* 2015:24).

1.6.3 Supplier performance

SP relates to how well a supplier provides the required products to the buyer and is manifested as the operations outcome in terms of quality, delivery responsiveness, cost and technical support (Wu, Choi & Rungtusanatha, 2010:118). SP is essential in supply chains in that it has a significant impact on the maintenance of collaborative relationships based on product quality, operational support service quality and delivery performance (Huang, Yen & Liu, 2014:64). Suppliers play an imperative role in influencing the overall performance on supply performance networks, especially in a competitive business environment (Ho, Feng, Lee & Yen, 2012:7102). Organisations have to

regularly evaluate their suppliers' performance since their efforts to adequately integrate supply chain activities have an important effect on their operations (Huang *et al.,* 2014:64).

1.6.4 Supply chain resilience

Supply chain resilience is the system's ability to return to its original state after facing interruptions, especially those with negative effects within a proper time span (Wallace & Choi, 2011:284; Day, 2013:1970; Pereira, 2014:626; Heckmann *et al.,* 2015:119). Reyes, Levalle and Nof (2015:83) view resilience within a supply chain network as the emergence capability to anticipate errors and conflict, prevent them from creating disruptions to normal operations and overcome disruptions with minimum losses in quality service and sustainable use of resources. Supply chain resilience may be in the form of two generic approaches, namely, proactive and reactive (Ponomarov & Holcomb, 2009:124; Valikangas, 2010:10; Wieland & Wallenburg, 2013:300). A proactive dimension of supply chain resilience is a system's ability to prevent or resist an event and maintain its functions in the event of both internal and external disruptions (Stonebraker, Goldhan & Nassos, 2009:161; Durach *et al.,* 2015:118; Hasani & Khosrojordi, 2016:26). Li *et al.* (2017:256) state that the main critical element suggested by proactiveness is preparedness.

Reaction is the capability to adjust quickly to unexpected market changes in a competitive, turbulent and volatile environment characterised by uncertainty (Golgeci & Ponomarov, 2013:604; Wieland & Wallenburg, 2013:301; Durach *et al.,* 2015:118l; Hohenstien *et al.,* 2015:90; Kamalahmadi & Parast, 2016:116). The critical elements of the reactive approach to supply chain resilience include alertness and agility (Boumgarden, Nickerson & Zenger, 2012:587; Cheng & Lu, 2016:3; Chowdhury & Quadddus, 2017:185). The two approaches (proactive and reactive) are not exclusive in their nature but they complement each other in building supply chain resilience (Li *et al.,* 2017:256). In view of these two perspectives, supply chain resilience may be regarded as a supply chain's capability to cope with changes, coupled with its preparedness to endure future changes, being alert to changes and being agile in response to changes (Nooraie & Parast, 2016:8). Adequate proactive and reactive dimensions of supply chain resilience in the public sector result

in adequate exploitation and exploration of resources to ensure a supply chain's current and future viability (Boumgarden *et al.,* 2012:587; Pournader, Rotaru, Kach & Hajiagha, 2016:591).

1.7 RESEARCH METHODOLOGY

All scientific research must be conducted using some relevant methodology (Neuman, 2014:8). This section discusses how the study was conducted. It outlines the research design, sampling design, procedures for data collection, data analysis and ethical considerations.

1.7.1 Research design

A research design denotes the process that one can follow to reach answers to the research questions (Hassan, Pervez & Ghauri, 2014:75). Tripathy and Tripathy (2017:27) view a research design as the logic or master plan of a research study that throws a spotlight on how the study is to be conducted. A research design can be in the form of a qualitative, quantitative or mixed methods approach in nature (Creswell, 2013:53). This study is based on the quantitative approach, which facilitates the testing of relationships in a theory using statistical procedures.

A survey design is utilised in this study. A survey research design involves the collection of data using a survey questionnaire (Creswell, 2013:155). The survey method can be a cross-sectional survey, which constitutes the collection of data over a short period of time or a longitudinal survey, which involves the collection of data over a long period of time (Hair, 2015:205). This study utilised the cross-sectional survey approach in collecting data in the South African public sector. This survey method was chosen on the basis that it enables the collection of data from respondents only once, in addition to providing an inexpensive method of collecting data over a large sample (Alan, 2015:148). The research design consists of two phases. The first phase involves a review of related literature, which is followed by an empirical study. The research design is further discussed in Chapter Five (refer to Section 5.6).

1.7.2 Literature review

A literature review of relevant concepts was conducted with the prime intention to address the theoretical objectives of the study. The literature review is mainly focused on the theoretical issues underpinning key concepts of SCM such as SCC, IS, IQ, INV, SCD, SCI, SP and SCR. In addition, a literature review of SCM in the public sector was conducted. Data were sourced from Internet-based academic search engines and other sources such as Google Scholar and Researchgate, as well as digital databases such as Emerald Insight, Science Direct, Jstore and SABINET, amongst others. Materials such as books, magazines and organisational records were also utilised as sources of literature. Chapter Five (refer to Section 5.8) provides an in-depth discussion of how the literature review was conducted in the study.

1.7.3 Empirical study

The empirical study involves the sampling design, procedures of data collection, data analysis, validity and reliability.

1.7.3.1 Sampling procedure

A sampling design is the researcher's provisional plan for a quantitative description of trends, attitudes or opinions of a population by studying a sample of that population (Creswell, 2013:235; Alison & Gass, 2015:11). Uprichard (2013:4) asserts that the main purpose of sampling is to make some inferences about a given population using the chosen sample. Based on this view, the sampling design for this study comprises the target population, sampling frame, sample size, sampling approach and sampling technique.

1.7.3.2 Target population

A target population refers to the complete collection of objects whose description is the major goal of the study (Ott & Rongnecker, 2015:26). Neil (2015:3) views it as the entire group or set of

individuals from which research data is to be collected. The target population of this study consisted of all SCM professionals in public sector organisations in the Gauteng Province.

1.7.3.3 Sampling frame

A sampling frame refers to a list or frame that identifies every member (element) of the population under consideration in a study (Sirakaya-Tuck, Uysal, Hummitt & Vaske, 2015:7). Ott and Rongnecker (2015:26) define a sampling frame as the list of units for a study such as addresses or households in the city. The sample frame used in this study were lists of the names of SCM professionals in the public sector in the Gauteng Province.

1.7.3.4 Sample size

Sample size may be defined as the number of units used in the sample (Desu & Raghuvarao, 2012:1). Singh and Masuku (2014:6) define it as the determination by the researcher of the number of respondents that can be feasibly included in a statistical sample. The sample size was determined by referring to sample sizes used in previous studies related to the current one. Additionally, sample size recommendations for SEM, as prescribed by various authors were also considered. As a result, the initial sample size was set at N=500. A more comprehensive discussion on how the sample size was determined is provided in Chapter Five (refer to Section 5.8).

1.7.3.5 Sampling approach and technique

Non-probability sampling was used in this study to select the respondents since the lists of respondents (sampling frames) were unavailable (Uprichard, 2013:3). In non-probability sampling, there is no known probability that each element of the target population has an equal chance to be included in the final sample (Neuman, 2014:248). Specifically, public sector departments that participated in the study were selected conveniently. The actual respondents (SCM professionals) were selected using the judgemental sampling technique. A more in-depth discussion on how the convenience and judgemental sampling techniques were applied in this study is provided in Chapter Five (refer to Section 5.9).

1.7.4 Data collection method and procedure

Data collection is a research process that informs how relevant information to address the research problem will be gathered (Sani, 2013:40). In this study, data were collected through a survey questionnaire, which was administered using a combination of e-mails and the drop and collect method.

The questionnaire is divided into ten sections. Section A elicited information about the demographic details of respondents whilst Section B sought information about the profile of the public sector organisation. Section C to J consisted of questions that measured the eight constructs under consideration in this study. Section C used seven questions adapted from Fawcett, Wallin, Allred, Fawcett and Magnan (2011:38) to measure SCC. Section D sought responses on INV using seven questions adapted from Lee, Lee and Sciederjans (2011:1204) and Golgeci and Ponomarov (2013:616). Section E used seven questions adapted from Frohlich and Westbrook (2001:185); Sheu *et al.* (2006:24); Li *et al.* (2006:107); Cao and Zhang (2011:177); Prajogo and Olhager (2012:514) and Riley *et al.* (2016:962) to measure IS. Section F elicited responses on IQ using seven questions adapted from Monczka *et al.* (1998:5553); Moberg (2002:755); Wiengarten *et al.* (2010:473) as well as Sundram *et al.* (2016:1469). Section G elicited responses on SCD using five questions adapted from Sezen (2008:236). Section H sought responses on SCI using seven questions drawn from Sezen (2008:236) and Liu *et al.* (2018:214). Section I elicited responses on SP using seven questions adapted from Millington *et al.* (2006:193) and Ashenbaum and Maltz (2017:336). Section J sought responses on SCR using seven questions adapted from Golgeci and Ponomarov (2013:616) and Sundram *et al.* (2016:1469). Measurement scales in Sections C through J were measured using seven-point Likert–type scales anchored by 1= strongly disagree and 7 = strongly agree. An in-depth discussion on the questionnaire design and the measurement scales used in this study is provided in Chapter Five (refer to Section 5.10).

1.7.5 Data analysis and statistical approaches

The data collected were analysed using a combination of descriptive and inferential statistics. Data from Sections A and B of the questionnaire, which sought to establish the demographic details of

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respondents and the public sector organisation were analysed using descriptive statistics. Data from Sections C to J that sought to test the hypotheses were analysed using inferential statistics. The most recent versions of the Statistical Package for the Social Sciences (SPSS Version 25.0) and the Analysis of Moment Structures (AMOS Version 25.0) software packages were used as data analysis tools. To check for the accuracy of the measurement scales, a Confirmatory Factor Analysis (CFA) was conducted. Hypotheses were tested using structural equation modelling (SEM). To check the model fit, indicators that include the Incremental Fit Index (IFI), Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Tucker Lewis Index (NFI), Goodness of Fit index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI) and the Chi-square test were used. An extensive discussion on the data analysis and statistical approaches applied in this study is presented in Chapter Five (refer to Section 5.11).

1.7.6 Reliability and validity

Reliability refers to the level of consistency or stability in the values of the scores that an instrument elicits (Franzen, 2013:15). A pilot study was conducted in which a conveniently selected sample of 50 respondents was used to test the reliability and content validity of the measurement scales, and adjustments were made accordingly. The Cronbach's alpha coefficient, Composite reliability and Total-item correlations were used for testing internal consistency. The recommended thresholds for Cronbach's alpha and Composite Reliability are 0.7 while Total-item correlations should be above 0.5 (Fraering & Minor, 2006:284).

Validity is concerned with the integrity of the conclusions that are generated from a piece of research (Bryman, 2015:50). Bryman (2015:50) further notes that validity can be ascertained by testing the instruments for face, content and construct validity. In this study, face validity was established through a review of the questionnaire by the staff of the Vaal University of Technology in South Africa whose lines of expertise are in SCM. Construct validity used included both convergent validity and discriminant validity. Factor loadings of above 0.5 were accepted for the testing of convergent validity on each of the test items. Pearson correlations were used to test for discriminant validity. More information and discussion on reliability and validity is described in Chapter Five (refer to Section 5.12).

1.8 ETHICAL CONSIDERATIONS

Research ethics refers to the code of conduct or expected societal norms of behaviour while conducting a research study (Sekaran & Bougie, 2013:11; 2016:13). Creswell (2013:92) refers to research ethics as the reasonable approaches adopted by the researcher before collecting data, during data collection and during reporting of research results to avoid violating the rights of respondents. In this study, several ethical considerations were observed. Firstly, the researcher sought the authority to conduct the research from the responsible authorities in the South African public sector. Secondly, the researcher communicated full details of the research to the respondents and made them aware that their involvement in the study was voluntary. Formal consent was also sought from respondents before data were collected from them. The identities of the respondents were not required in the questionnaire. In addition, respondents were protected from victimisation by maintaining their anonymity and by keeping all collected data securely. Further discussions on the ethical considerations followed in this study are provided in Chapter Five (refer to Section 5.13).

1.9. DEFINITION OF TERMS

Information quality- the extent to which critical and proprietary information is communicated among supply chain members with regards to the market, product and customer information (Li *et al.,* 2006:425).

Information sharing- a paradigm with a widespread belief that achieving a high degree of cooperative behaviour requires that supply chain members voluntarily share operating information and jointly plan strategies (Ding *et al.,* 2014:91).

Public procurement- the purchase by public authorities or state-owned institutions of goods, services and works using public funds (Organisation for Economic Cooperation and Development [OECD], 2015:1).

Public Supply Chain Management- the coordination of all parties involved in delivering the combination of inputs, outputs or outcomes that will meet a specified public sector requirement (Ambe, 2012:134).

Supplier performance- how well a supplier provides the required products to the buyer and is manifested as the operations outcome in terms of quality, delivery responsiveness, cost and technical support (Wu *et al.,* 2010:118).

Supply chain- a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flows of products, services, finances or information from the source to the customer (Mentzer *et al.,* 2001:4).

Supply chain collaboration (SCC)- the partnering of two or more members of a supply chain working together to create a competitive advantage by sharing information, making joint decisions and sharing benefits, which results from greater profitability gained by satisfying the needs of end customers (Salam, 2017:299).

Supply chain design- Involves the decisions about the number of suppliers, proximity to a supplier, supplier selection and evaluation, planned capacities in each facility, definition of contractual terms and reactions to the possible disagreements between channel members (Chopra & Meindle, 2003:15).

Supply chain innovation-a set of practices that are previously non-existent in organisations that will be generated, developed and deployed within supply chains to tackle different supply chain issues such as quality, cost and lead time (Lavastre *et al.,* 2011:9).

Supply chain integration- the degree to which an organisation strategically collaborates with its supply chain partners and manages intra- and inter-organisational processes to achieve effective and efficient flows of products, services, information, money and decisions with the objective of providing maximum value to customers (Zhao *et al.,* 2008:374).

Supply Chain Management (SCM)- a managerial philosophy aimed at achieving better performance, gaining competitive advantage and increasing customer satisfaction in business (Al-Shboul *et al.,* 2017:580).

Supply Chain Management (SCM) practices- a set of actions undertaken by suppliers, manufacturers, distributors and customers to improve the performance of the integrated supply chain (Barros *et al.,* 2013:1041).

Supply chain management professional- refers to a group of practitioners (personnel) in the field of logistics and supply chain management (CSCMP, 2020:1).

Supply chain resilience- the system's ability to return to its original state after facing interruptions, especially those with negative effects within a proper time span (Pereira, 2014:626).

Supply chain synergies- refers to the interaction or cooperation of two or more organisations in their operations to produce a combined effect greater than the sum of their separate efforts (Mesaric, Segetlija & Dujak, 2015:114).

1.10 CHAPTER CLASSIFICATION

The chapters of the current thesis are classified as follows:

Chapter One: Introduction and background

This chapter provides the introduction and background to the study. It also provides the statement of the problem and outlines the research objectives guiding this study. This chapter further outlines the hypotheses to be tested and provides a brief review of literature and various aspects of the research methodology such as the research design, sampling design, data collection, statistical analyses and ethical considerations.

Chapter Two: supply chain management in the public sector

This chapter focuses on the literature review of SCM in the public sector. This chapter also reviews literature on the development of SCM and its application in the public sector before and after independence. As well as the legislative framework that guides SCM in South Africa. The chapter also discusses the challenges faced by the public sector.

Chapter Three: Literature review on research constructs

This chapter provides a literature review on the research constructs. Issues discussed include SCM practices, namely, SCC, INV, IS, IQ, SCD, and SCI. Attention is directed towards the conceptualisation, the antecedents that drive the aforementioned constructs and the benefits of adopting and implementing them in public sector supply chains. The chapter also reviews literature on the research theory chosen for this study.

Chapter Four: Literature review on research constructs and hypotheses formulation

This chapter provides a literature review on the mediating and outcome variables of the study. Literature on the conceptualisation, drivers to and benefits of SP and SCR are discussed. Particular attention was also directed to how SCM best practices influence SP, which in turn influences SCR. The chapter also focuses on the formulation of both the null and alternative hypotheses.

Chapter Five: Research methodology

This chapter highlights the research methodology used in the study. It discusses the research paradigm, research design and the sampling design utilised to select the research samples. Procedures for data collection, data analysis techniques and tools as well as ethical considerations are outlined.

Chapter Six: Data analysis and interpretation

This chapter directs attention to the presentation of the research results based on the statistical analyses employed. It also deliberates on the interpretation of these results and discusses their implications.

Chapter Seven: Conclusions and recommendations

This chapter summarises the previous chapters and draw conclusions from the research results, based on the research objectives. Recommendations are also put forward on how public organisations can increase their resilience through adopting SCM best practices. It also provides some suggestions for future research and limitations of the study.

CHAPTER 2

THE HISTORY OF PUBLIC SUPPLY CHAIN MANAGEMENT IN SOUTH AFRICA

2.1 CHAPTER OVERVIEW

This chapter is a review of literature on SCM in the public sector in South Africa. The chapter commences by discussing public SCM prior to the emergence of democracy in 1994. Thereafter, the chapter provides a narrative of developments in SCM in the post-democracy period after 1994. Issues that are discussed include the establishment of a public SCM framework consisting of practices such as demand management, acquisition management, supply chain performance management and risk management, amongst others. The chapter then focusses on the legislative framework that guides public SCM. Some of the pieces of legislation that are discussed include The Public Finance Management Act No.1 of 1999, the Preferential Procurement Policy Framework Act (PPPFA) Act 5 of 2000, the Promotion of Equality and the Prevention of Unfair Discrimination Act 4 of 2000, the Municipal System Act 32 of 2000, the Promotion of Administrative Justice Act of 2000 and the Broad-Based Black Economic Empowerment Act 53 of 2003, among others. The chapter then discusses the achievements and successes in public SCM in South Africa as well as the SCM challenges faced by the public sector. The literature used in this chapter is derived from completed dissertations, academic books, official government documents and articles in scholarly journals.

2.2 PUBLIC SUPPLY CHAIN MANAGEMENT BEFORE 1994

Globally, public procurement is of paramount importance to every government and has proven to play a key role in service delivery and the performance of government departments and public entities (Dzuke & Naude, 2015:1). The OECD (2015:1) defines public procurement as the purchase by public authorities or state-owned institutions of goods, services and works using public funds. In South Africa, prior to 1994 public procurement was often used to promote aims which are arguably, secondary to the primary aim (Turpin, 1989:3; Arrowsmith, Linarelli & Wallace, 2000:6; Cane, 2004:15; Vabaza, 2015:4). The procurement system was structured in a

way that created an imbalance toward the majority of people in such a way that it was difficult for newly established businesses to enter the procurement system (Bolton, 2006:193). The government procurement system was geared towards large and established contractors (Minister of Finance, 1997:1). The procurement system in the apartheid era was governed by the State Tender Board on the national and provincial level and at the local level, it was governed by a few legislations, which only favoured a few established companies (Thai, 2009:358; PARI, 2014:7).

In this era, the price was the overriding criterion for the procurement of goods and services by the government (Bolton, 2006:201). Tenders were awarded strictly on price and the tenderer who submitted the lowest tender in terms of price was overlooked as it was regarded as evidence that he did not have the necessary experience or capacity to undertake the work and it was a clear indication that he was financially unsound (Ministry of Finance and Public Works, 1997: clause 3.4.1; Watermeyer, 2001:36; Bolton, 2006:201). The government procurement system was discriminatory in nature and favored only the minority (Ngcamphalala & Ambe, 2016:1208). This is also noted by a number of scholars who insinuated that due to the discriminatory and unfair practices of the past, a number of groups in South Africa were prevented from accessing government contracts (Bolton, 2006:193). Munzhedzi (2016:1) further notes that in the pre-democratic South Africa, the procurement system was characterised by discrimination and prejudices that favored the large established businesses and disadvantaged the small majority enterprises. This made the South African government embark on procurement modernisation soon after attaining its independence in 1994.

2.3 PUBLIC SUPPLY CHAIN MANAGEMENT AFTER 1994

Soon after attaining democracy in 1994, the government of South Africa embarked on a journey to modify its procurement policy. The modification process was characterised by the implementation of a number of policies and regulations that sought to address the social imbalances of the past. The South African government after attaining its independence in 1994, in 1995 adopted a 10-point plan to affirm and embrace the principles of the Reconstruction and Development Programme (RDP) in public procurement, while ensuring that small businesses are the main beneficiaries of these reforms (Raga & Taylor, 2010:9). The 10-point plan was an

instrument used to satisfy the equity principle of good governance in public procurement as it promoted contracting out of government work to SMEs and businesses owned by historically disadvantaged individuals (HIDs) (Vabaza, 2015:2). Arendse (2010:14) supports this by submitting that the use of public procurement as a policy tool was meant to reverse the imbalances of the past while introducing the five principles of good governance in public procurement in order to provide a framework of public rights and accountability.

Subsequently, the government issued a Green Paper on public sector procurement in South Africa, which aimed at achieving two objectives, namely, socio-economic development and good governance (The Republic of South Africa, 2003:2; Roos & De la Harpe, 2008:122; Ambe, 2016:1). The Green Paper reinforced the principle of good governance by proposing that the tender procedures should be simplified and published to encourage fairness, equity and transparency (Vabaza, 2015:3). Also, the publishing and advertising of tenders both in the tender bulletin and local newspapers was meant to ensure that the market accommodated everyone to participate in order to promote competition in the procurement arena (Mhlongo, 2004:52). Hence, Manchidi and Harmond (2002:20) note that South Africa's public sector procurement reform has focused on small business to redress skewed patterns of business ownership arising from the previous political dispensation. It was also aimed at bringing about reductions in levels of poverty by providing access to markets for small businesses and increasing the market share of those businesses that are owned, managed or controlled by PDI's through preferential procurement. Manchidi and Harmond (2002:20) further note that the procurement reform was termed at addressing the impediments to the effective and profitable participation of such business (small businesses) in government procurement through supply-side interventions, such as emerging contractor development programmes. Ambe (2012:242) is of the same view as he notes that reforms in public procurement in South Africa were initiated to promote the principles of good governance.

In 2003, the National Treasury presented and published a document entitled Policy Strategy to Guide Uniformity in Procurement Reform Processes in Government (The Policy Strategy) which succinctly defines the background to the procurement reforms post-1994. According to Vabaza (2015:29), the Policy Strategy (2003:2) states that:

"Procurement reforms in government started in 1995 and were directed at two broad areas, namely, the promotion of principles of good governance and the introduction of a preference system to address certain socio-economic objectives".

The Policy Strategy document among other things was meant to provide guidance on the interpretation of what constitutes a fair, equitable, transparent, competitive and cost-effective public procurement system. In the policy strategy (National Treasury, 2003:25), the concept of good governance as it relates to the public procurement system is presented as encompassing certain characteristics such as preserving the highest standards of honesty, integrity, impartiality and objectivity, providing clear specifications of requirements which encourage innovation and managing the bidding process so that genuine competition is preserved and discrimination is avoided. If one analyses these characteristics of good governance, it is clear that the ethics and conduct of the officials dealing with public procurement are subject to high standards.

2.4 DEVELOPMENT OF PUBLIC SUPPLY CHAIN MANAGEMENT AFTER 1994

Supply chain management has become a popular managerial philosophy in the contemporary business world (Al-Shboul *et al.,* 2017:580). In recent years, it has become an integral strategic tool for ensuring fiscal prudence in procurement activities not only in the private sector but also in public institutions (Croton, Gracia-Dastugue, Lamberti & Rogers, 2001:1; Ambe & Badenhorst-Weiss, 2012:244; Ambe, 2016:3; Maleka, 2016:1). SCM is associated with benefits such as improving financial prudence, reducing inventory cost, building new relationships through networking, improving a firm's agility and improving service delivery mention a few (Malhan, 2015:21; Dzuke & Naude, 2015:15). Due to the benefits associated with SCM, it was adopted and implemented in the South African public sector as a means to address the deficiencies of the procurement system. This is also supported by Ambe and Badenhorst-Weiss (2012:242), who note that SCM in the South African public sector was introduced through the development of procurement reforms because of deficiencies and related malpractices in the procurement system.

After gaining independence in 1994, the South African provincial treasuries, in conjunction with the National Treasury, embarked on a rigorous reform initiative to introduce best procurement

practices that would be efficient and effective (Mkhize, 2004:4). Vabaza (2015:27) also insinuates that following the democratic elections held in 1994, the new South African government used public procurement policy as a tool for socio-economic development to reverse the effects of the implementation of the previous government's procurement policies that excluded the majority of the population from meaningfully conducting business with the government. One of the most remarkable developments was the adoption and implementation of the SCM function in the public sector in 2003.

In 2004, the National Treasury issued three key policy documents to strengthen the policy framework and assist the roll-out of the SCM policy in the public sector. The three documents include the General Procurement Guidelines, Supply Chain Management: A Guide for Accounting Officers and the Framework for Supply Chain Management (National Treasury, 2016:6). It is vital to note that the purpose of these three documents was to reinforce the proper institutionalisation of good governance practice during the implementation of the revised government procurement policy. The South African government initiated SCM to support these reforms and to bring consistency in the implementation of procurement policy as well as ensuring the accountability of all parties (Ngcamphalala & Ambe, 2016:1208). This initiative is guided by the SCM framework. The SCM framework has six key linked elements that are based on flows in the supply chains from demand management, acquisition management, logistics management, disposal management, risk management and supply chain performance (National Treasury, 2004:2; Pauw *et al.,* 2009:252; Mhlongo, 2014:22). These elements are consistent with government objectives, legislative environments, and related government policies, which aim to optimise cost-effectiveness and efficiency in achieving the desired goals (Mhlongo, 2014:22). In terms of the SCM: Guide for Accounting Officers (2003:10-11), demand management is the initiation phase in the acquisition of goods and services by the government.

2.4.1. Demand management

Demand management is concerned with the cross-functional exercise that brings the supply chain practitioner closer to the user and ensures that value for money is achieved (Pauw *et al.,* 2009:252).

It may be defined as ensuring an optimum inflow of quantity, quality, and timeliness into a supply chain. The Republic of South Africa's National Treasury (2004:2) states that demand management is the first stage of SCM and Sehgal (2009:31) describes it as the initial step in the SCM process where demand forecasting is done. It is where needs are assessed in order to ensure that goods and services are there to deliver assistance. The specification should also be determined by understanding future needs, identifying critical delivery dates, establishing the frequency of needs, linking the requirements to the budget, doing an expenditure analysis based on past experience, determining the specifications, doing a commodity analysis and industry analysis.

2.4.2. Acquisition management

Acquisition management is concerned with the identification of preferential procurement policy objectives that could be met through specific contracts (Malinga, 2007:4). Tshamaano (2012:15) posits that it is where the strategy is identified of how the market is to be approached. In acquisition management, depreciation rates should be determined, and the total cost of ownership should be applied, that is the life cycle cost and the inventory cost.

2.4.3. Logistics management

This aspect of SCM addresses issues which entail among other things, the coding of items, setting of inventory levels, placing of orders, as well as the receiving and distribution of materials. Ismay (2008:8) states that logistics management is the most significant element of SCM, which plans, implements and controls the effective storage of goods and services and related information between the point of origin to the point of consumption in order to meet the customer requirements.

2.4.4. Disposal management

Disposal management refers to the process of decision making in respect of doing away with redundant, obsolete and unserviceable goods (National Treasury, 2003:2). The main function of disposal management is obsolescence planning, maintaining a database of redundant materials, inspecting materials for reuse, determining a disposal strategy and executing the physical disposal

process (National Treasury, 2004:3). Disposal management is the final stage in which the public institution needs to do away with unserviceable, redundant, movable assets (National Treasury, 2004:3; Tshamaano, 2012:16).

2.4.5. Supply chain performance management

Supply chain performance management is the monitoring process undertaking a retrospective analysis to determine whether the proper processes have been followed and whether the desired objectives have been achieved (Lambert, 2015:5). It relates to issues such as the achievement of goal compliance with norms, and that standard supply chain objectives are consistent with broader government policy.

2.4.6. Risk management

Risk management can be explained as a measure of uncertainty and comprises those factors that can facilitate or prevent the achievement of the department goals (Fourie, 2014:210). To Tshamaano (2012:16), risk management can be viewed as the underlying of department's goals and objectives, identifying risks associated with the hindering of those objectives and developing and implementing programmes to minimise identified risks and monitoring and evaluating risk programmes. Figure 2.1 presents the SCM framework.
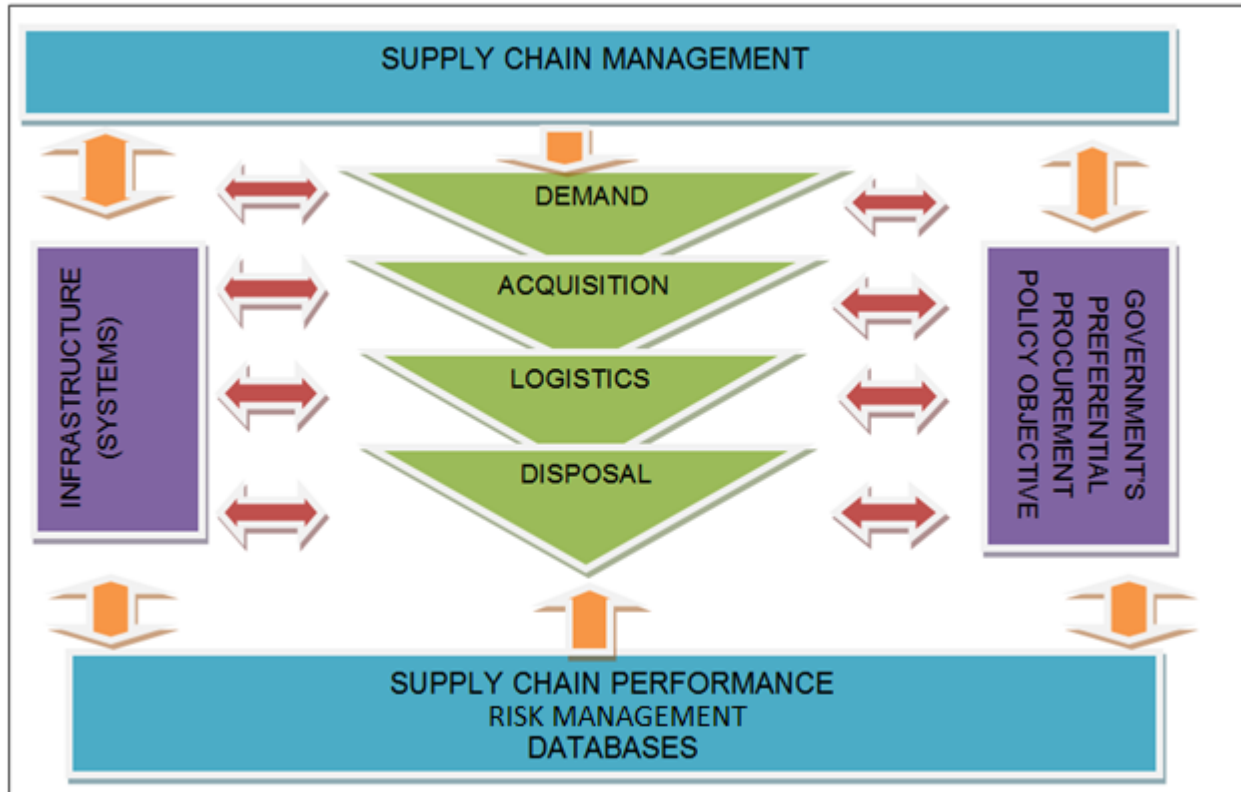
Figure 2.1: Public supply chain management framework
Source: National Treasury (2004:10)

2.5 THE LEGISLATIVE FRAMEWORK FOR PUBLIC SUPPLY CHAIN MANAGEMENT IN SOUTH AFRICA

Public procurement in South Africa has historically been regulated at the national level and provincial level through the State Tender Board Act and at the local level through the Local Government Ordinance of 1939. However, with the attainment of democracy in 1994, these legislative frameworks were repelled for promoting discrimination and unfairness with regards to awarding of government tenders. This compelled the South African government immediately after taking office to initiate a series of budgetary and financial reforms to modernise the management of the public sector (Ambe & Badenhorst-Weiss, 2012:245). One of the major reforms is that of procurement, which is directed at two broad focus areas, namely, the promotion of principles of good governance and the introduction of a preference system to address certain socio-economic

objectives (McCrudden, 2007:245; Harpe, 2009:5; Ambe & Badenhorst-Weiss, 2012:245; Motuba, 2014:2).

The procurement system in the South African government is still undergoing modernisation through policy developments, and legislative and regulatory processes in order to introduce the concept of SCM to the public sector (Ismay, 2008:1). Vabaza (2015:2) concurs with Ambe and Badenhorst-Weiss (2012:245) as he notes that soon after South Africa became a constitutional state in April 1994, it embarked on a process of elevating SCM philosophy as a management function. The elevation process was done through the enactment and implementation of a raft of policy interventions and strategies, which were implemented through various pieces of legislation (Harpe, 2009:5; Fourie, 2014:205; Ambe, 2016:4).

2.5.1 Frameworks for supply chain management in South Africa

Public SCM in South Africa is guided by a cocktail of legal frameworks. These legal frameworks define responsibilities and aim at creating a level playing field for all actors, both at the macro and micro level echelons of the government (Bolton, 2008). This is supported by Ababio, Vyas-Doorgapersad and Mzini (2008:3) who purport that the legislative framework underpinning public sector procurement aims at empowering the previously disadvantaged and provides flexibility to individual public institutions to facilitate service delivery both at the macro and micro level of the government. The term legislative framework covers both the constitutional provisions and legislative frameworks.

2.5.1.1 Constitutional framework

The Constitution forms the bedrock of SCM in South Africa. It has specific provisions related to public SCM. Public procurement has been granted Constitutional status in South Africa and is recognised as a means of addressing past discriminatory policies and practices (Bolton, 2006:193). Other scholars also allude to the premise that SCM in South Africa is embedded in the constitution, which specifically regulates public procurement (Bolton, 2006:194; Harpe, 2009:5194; Vabaza, 2015:2). It is the basis upon which all SCM practices within the public sector are developed and

their application to all spheres of government (Mhlongo, 2014:47). The Constitution of the Republic of South Africa, Act 108 0f 1996 Chapter 13 underpins a move from the traditional rule-based concept of procurement to the modernised concept of SCM in the public sector (Watermeyer, 2011:2). The most important provision in the Constitution that deals with government procurement and specifically its use as a policy tool is Chapter 13, Section 217, which provides the values for procurement in the government. Subsection (1) provides for government departments or state organs to conclude contracts for goods and services in accordance with a system that is fair, equitable, transparent, competitive and cost-effective (Constitution of South Africa Act 108 of 1996; Ambe, 2012; Ambe & Badenhorst-Weiss, 2012:256; Mnguni, 2012:31). Subsection (2) provides that "subsection (1) does not prevent state organs from implementing a procurement policy providing for (a) categories of preference in the allocation of contracts, and (b) the protection or advancement of persons, or categories of persons, disadvantaged by unfair discrimination". Subsection (3) then provides that national legislation must prescribe a framework within which preference policies must be implemented.

Broadly speaking, Section 217 of the Constitution makes provision for the use of procurement as a policy tool and it also reflects the broader notion of equality in the provision of contracts. Other scholars note that both these principles are concerned with the attainment of value for money (De la Harpe, 2009:287; Sewpersadh & Mubangizi, 2017:6). De la Harpe (2009:287) further notes that the constitutional principle of competitiveness is interconnected and interrelated with the principle of cost-effectiveness). However, Vabaza (2015:1) posits that despite the strides being made in addressing and assisting in the implementation of the SCM processes, it seems that there are still challenges in the full implementation of these five constitutional principles underpinning government procurement policy.

2.5.1.2 Legal frameworks

To support and fully operationalise the provisions of the national constitution, the South African government enacted and passed a raft of legislative frameworks and instruments that include the Public Finance Management Act, the Preferential Procurement Policy Framework Act, and the Broad-Based Black Economic Empowerment Act, among others (Vabaza, 2015:2; Bolton,

2006:194; Harpe, 2009:4; Ambe & Badenhorst-Weiss, 2012:248). In 1997, the government of South Africa published a Green Paper on Public Sector Procurement Reform. The reform objectives of the Green Paper were aimed at transforming the public sector procurement process so that it could be used to achieve government's socio-economic objectives within the ambit of good governance (Ismay, 2008:1). The socio-economic objectives included seeking value for money, combatting corruption, an accessible procurement process to all, creating an enabling environment for small, medium and macro enterprises and encouraging competition as well as achieving uniformity in the procurement system and compliance with the constitution (Ismay, 2008:2). According to Bolton (2006:207), some of the main principles and proposals of the Green Paper included easier access to tendering information, the simplification of the tender documents and awarding of tenders in terms of a development objective.

2.5.1.3 The Public Finance Management Act No. 1 of 1999

In 1999, the government subsequently enacted the Public Finance Management Act (Act No.1 of 1999) which is one of the pieces of legislation that promotes the objectives of good financial management in the national and provisional levels of government (Tshamaano, 2012:11). The Public Finance Management Act (1999) marks the transition to a decentralised procurement system, managed by accounting officers in national and provincial departments; it also governs the timing and content of public budgets (Turley & Perera, 2014:9). The PFMA gives effect to the majority of issues referred to in Chapter 13 of the constitution such as setting out broadly the requirements and imposing the responsibility on the Heads of Departments to implement procurement systems that are fair, equitable, transparent, competitive and cost-effective (Sentech, 2009:14; Watermeyer, 2011:3; Fourie, 2014:8). Ismay (2008:3) elaborates on the PFMA by stating that it reinforces the constitution by prescribing that accounting officers of government departments must ensure that their departments have and maintain appropriate procurement systems, which are fair, equitable, transparent, competitive and cost-effective. Tshamaano (2012:11) posits that the main aims of the PFMA are to modernise the system of financial management in the public sector, in order to enable public sector management to manage and be more accountable, to ensure timely provision of quality information and elimination of waste and corruption in the use of public assets. Ambe and Badenhorst-Weiss (2012:248) argue that the

PFMA establishes a regulatory framework for SCM, which includes procurement in national and provincial departments and state-owned enterprises.

However, the PFMA does not make provisions for tenders, but the design of the Act as a whole is aimed at promoting effectiveness, efficient, economic and appropriate use of public money (Tshamaano, 2012:11; Mhlongo, 2014:53). The Act obliges public officials in SCM to manage tenders in such a way that public money is spent for the benefit of everybody. Therefore, the PFMA is one of the legislative reforms whose aims are to protect state financial resources and prevent losses due to the stringent controls that have to be put in place and at the same time prevent misappropriation of funds by applying sanctions on those officials found to be in contravention of prescripts of the legislation.

2.5.1.4 Preferential Procurement Policy Framework Act (PPPFA) Act 5 of 2000

In 2000, the government promulgated into law the Preferential Procurement Policy Framework Act (PPPFA No. 5 of 2000). According to Ngobeni (2016:35), the PPPFA was promulgated to give effect to Section 217 (3) of the Constitution by providing a framework for the implementation of the procurement policy contemplated in Section 217(2) of the Constitution. In terms of Section 2(1) of the Act, an organ of state must determine and implement its own preferential procurement policy within a prescribed framework. The PPPFA provides for the granting of preferences in the procurement process to historically disadvantaged individuals (HDIs) by means of a point scoring system (Tshamaano, 2012:12; Turley & Perera, 2014:9; Vabaza, 2015:2; Ngobeni, 2016:35). Ngobeni (2016:35) further elaborates that the main aim of the Act is to advance the development of small, medium and micro enterprises and historically disadvantaged individuals (HDIs), promote women and physically handicapped people, and promote local enterprise, in a particular region, specific local authority, or in rural areas.

Later the National Treasury issued the PPPFA Regulations in 2001, which set out the formulae for the point-scoring system and stipulated the rules and procedures governing the preferences that might be claimed in terms of the PPPFA (Bolton, 2007:8; Harpe, 2009:238). The Act proposes that tenders with a Rand value up to R50 000 are to employ the 80/20 preference point system and tenders with a Rand value over R500 000 are to employ the 90/10 preference point system. The 80

or 90 points are awarded for price, while the 20 or 10 points are awarded to a tender on the basis of his/her being a historically disadvantaged individual (HDI), or for achieving certain specified goals, which could include implementing programmes forming part of the Reconstruction and Development Programme; the promotion of South African owned enterprises; the promotion of small, micro and medium-sized enterprises (SMMEs); job creation; and certain other goals (Ngobeni, 2016:36). Tshamaano (2012:12) adds that only the tender with the highest number of points scored may be selected.

2.5.1.5 Promotion of Equality and the Prevention of Unfair Discrimination Act 4 of 2000

Public SCM in South Africa is also guided by the Promotion of Equality and the Prevention of Unfair Discrimination Act 4 of 2000 (Ambe & Badenhorst-Weiss, 2012:249). The Prevention of Unfair Discrimination Act 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. Thus, it upholds the constitutional principles of fairness, equity and competitiveness in the tendering process.

2.5.1.6 Municipal System Act 2000 (Act No. 32 of 2000)

SCM in South Africa is also guided by the Municipal Systems Act (Maleka, 2016:40). Maleka (2016:40) further indicates that Section 83 of the Municipal System Act 2000 was promulgated to allow municipalities to provide municipal services themselves or by way of service delivery agreements. The Act stipulates the requirements for service delivery agreements through selection and pre-qualification processes that are competitive, fair, transparent, equitable and cost-effective and it allows all prospective services providers to have equal and simultaneous access to information relevant to the bidding process (National Treasury, 2004:2). The Act also seeks to minimise the possibility of fraud and corruption and makes the municipality accountable to communities, residents and role players about the processes used when selecting service providers.

2.5.1.7 Promotion of Administrative Justice Act 2000 (Act 3 of 2000)

The Promotion of Administrative Justice Act 2000 gives effect to Section 33 of the Constitution which stipulates that everyone has the right to administrative action that is lawful, reasonable and procedurally fair. According to Ismay (2008:54), the Act deals with general administrative law and therefore binds the entire administration at all levels of government. Ismay (2008:54) further notes that the Promotion of Administrative Justice Act comprises rules, principles and policies that have been developed in specific areas of administration such as those relating to procurement or SCM. The PAJA 2000, further provides a set of general rules and principles for the proper performance of administrative action in all areas and requires the giving of reasons for administrative action in certain circumstances. In addition, it sets out the remedies that are available if these rules are not complied with.

2.5.1.8 The Construction Industry Development Board Act (Act No. 38 of 2000)

The Construction Industry Development Board Act is one of the pillars that guide public procurement in the South African public sector. The Act establishes the Construction Industry Development Board (CIDB) which seeks to develop and improve service delivery of infrastructure to the South African public (Act 38 of 2000). The Board works with all stakeholders for the sustainable growth of construction enterprises and best practice among employers, contractors and the professions (Maleka, 2016:42). The CIDB identifies best practices, sets national standards, and creates common ethical standards for construction delivery contracts. The Act also mandates the Board to establish a code of conduct for all role players in construction processes, standards of uniformity in construction procurement, a national register of projects and a national register of contractors (National Treasury, 2005:2; Turley & Perera, 2014:9).

2.5.1.9 The Promotion of Equality and the Prevention of Unfair Discrimination Act

The Act prohibits the state or any persons from discriminating unfairly against any person on the grounds of race or gender through the denial of access to contractual opportunities for the rendering of services or by failing to take steps to reasonably accommodate the needs of such people

(Maleka, 2016:37). The Act upholds the principle of fairness in the awarding of tenders for equal opportunities.

2.5.1.10 The Broad-Based Black Economic Empowerment Act 53 of 2003

The Broad-Based Black Economic Empowerment Act forms the niche of legislative frameworks that are aimed at regulating public procurement in South Africa. In 2003, the government enacted the Broad-Based Black Economic Empowerment Act 53 of 2003. The BBBEEA establishes a code of good practice to inform the development of qualification criteria for the issuing of licenses or concessions, the sale of state-owned enterprises and for entering into partnerships with the private sector (Watermeyer, 2011:3). The Act also provides for the development and implementation of a preferential procurement policy (Ambe & Badenhorst- Weiss, 2012:250). Maleka (2016:40) underscores that the BBBEE Act expands the framework provided in the PPPFA to consider and apply codes of good practice for black economic empowerment. Malela (2016:40) further insinuates that the provisions of the BBBEEA seek to redress the inequalities of the past so that they will in future be in a position to address the needs of society. Many scholars describe the implementation of this Act by the government as a fundamental good and wise move as it creates a stable economy in which all individuals can contribute to the GDP of the country (Mhlongo, 2014:59; Maleka, 2016:40). Previously, before the implementation of regulations governing SCM, only a few people believed that the regulations were based on redress and did not perceive themselves as a group with responsibilities to make sacrifices to atone for inequalities in the past (National Treasury, 2005:6).

However, despite the fact that the BBBEEA was passed to expand the framework provided in the PPPFA their principles were not aligned to complement each other (Beukes, 2011:41). However, inconsistency in policy application, the definition of Historically Disadvantaged Individuals that was too broad leading to extensive fronting, and the BBBEE not synchronised with the PPPFA are some of the ambiguities identified as setbacks in achieving their objectives (Maleka, 2016:40). A work group was established between the National Treasury and the BEE unit in the Department of Trade and Industry to deal with the alignment and the government approved the revised version of the Preferential Procurement Policy Regulations (Turley & Perera, 2014:15).

2. 5. 1.11 Municipal Finance Management Act No. 56 of 2003

The Municipal Finance Management Act (Act No. 56 of 2003) also forms part of the legislation that seeks to regulate public SCM. It is an extension of the PFMA, and it aims to assist municipalities to maximise their capacity to provide services as planned (Tshamaano, 2012:11; Maleka, 2016:39). Mhlongo (2014:60) concurs with Tshamaano (2012:11) and Maleka (2016:39) as he notes that the MFMA Act is superficially similar to the PFMA but provides a much simpler application in enforcing a number of provisions relating to SCM. The Municipal Finance Management Act clearly outlines measures for combating fraud, corruption, favoritism and unfair and irregular practices, and seeks to promote ethical behavior among officials and other role players involved in SCM (Tshamaano, 2012:11; Maleka; 2016:39). The main aim of the MFMA is to maximise the municipality's capacity to deliver services (Tshamaano, 2012:11). Broadly speaking, the MFMA ensures that local government finances are managed in a sustainable manner so as to enable municipalities to deliver the best possible service to communities (Turley & Perera, 2014:15). Thus, the Act emphasises efficiency in the provision of services and achieving financial value for money and seeks to buttress with a strong code of conduct for municipal officials to combat corruption (Tshamaano, 2012:12).

2.5.1.12 Prevention and Combating of Corrupt Activities Act (Act No. 12 of 2004)

The Prevention and Combating of Corruption Activities Act (Act No. 12) makes corruption and related activities an offense (Maleka, 2016:41). It has established a register in order to place certain restrictions on persons and enterprises convicted of corrupt activities relating to tenders and contracts. The Prevention and Combating of Corruption Activities Act places a duty on certain persons holding positions of authority to report corrupt transactions (Tshamaano, 2012:13). Ngobeni (2016:36) further elaborates that Chapter 7, Section 34 of the Prevention and Combating of Corrupt Activities Act compels any person who holds a position of authority to report any offence of theft, fraud, extortion, or forgery involving an amount of R100 000 or more. Such suspicion or cause of such knowledge or suspicion must be reported to any police official. A failure by an official holding a position to report such can lead to incrimination on the side of such official.

According to the Corruption Watch (2013:1), using power illegally, gratification, illegal giving or receiving are some of the elements of corruption which are specifically condemned by the law.

However, the application of this Act in the public service is more effective in instances where the appointment of personnel is not corrupted but in the instance where the appointment of personnel is compromised for either political loyalty or nepotism, such cases of corruption of the public finances are not properly reported (Mle & Maclean, 2011:1364; Manyaka & Sebola, 2013:75; Bruce, 2014:54; Manyaka & Nkuna, 2014:1572). Or rather, instead of those in authority reporting it to the judicial system, they prefer a political cover-up of the financial misconduct and such is a recipe for a continuous public financially corrupt system.

2.2.2 Treasury regulations

The aim of treasury regulations is to give effect to National Treasury's mandate pertaining to the establishment of a framework for an appropriate procurement and provision system (Tshamaano, 2012:13). Chapter 16A, for the framework for SCM, was developed and promulgated for this purpose. It deals with aspects such as accounting officers or accounting authority of institutions in the development and implementation of an effective and efficient SCM system in her or his institution, the establishment of SCM units, training of SCM management officials, procurement of goods and services, disposal and letting of state assets and compliance standards (Tshamaano, 2012:13).

2.6 ACHIEVEMENTS AND SUCCESSES IN PUBLIC SUPPLY CHAIN MANAGEMENT IN SOUTH AFRICA

Since the adoption and integration of SCM in the South African public sector several successful developments (achievements) such as the decentralisation of the SCM function to the provincial and local government, the establishment of the office of the chief procurement officer, improvements in inventory management, launching of the central database among others, have been realised.

2.6.1 Establishment of the office of the chief procurement officer

SCM in South Africa has led to the establishment of the office of the chief procurement officer. The primary purpose of establishing the office of the chief procurement officer was to modernise and oversee the South African public sector SCM system, to ensure that the procurement of goods, services and construction works is fair, equitable, transparent, competitive and cost-effective in line with the Constitution and all relevant legislation (Ambe, 2016:288; Munzhedzi, 2016:6; Okojie, 2017:46). To Gordhan (2014:28), the government established the office with a particular view of reviewing high-value and strategic contracts to ensure that value for money is derived and that all contracts adhere to the relevant legislative prescripts. Gordhan (2014:28) further alludes to the notion that the review contributes to the efforts to ensure that government's service delivery objectives are supported by appropriate purchases of goods and services. Munzhedzi (2016:6) adds that the foregoing objectives of the chief procurement officer are a positive initiative by the government. The main reason the office was introduced is owing to the enormous challenges experienced by individual government departments, municipalities and public entities, including corruption, lack of skills and capacity. However, the effectiveness of the office of the chief procurement officer as to whether it can address some of the anomalies associated with public sector procurement such as corruption still has to be seen (Munzhedzi, 2016:8).

2.6.2 Improved inventory management

The adoption and implementation of SCM in the South African public sector has benefited public organisations in improving inventory management and reducing costs (Essig & Dorobek, 2006:82). Smith (2011:4) indicates that effective inventory management is another private sector best practice that has been brought to public organisations through SCM in South Africa. This is also noted by Mbugua and Katuse (2016:1) who point out that many public sector supply operations utilise a "buy and hold" strategy where the material is purchased in large quantities and held until needed. However, with the adoption of SCM, the strategy has been since dropped after considering costs of carrying out inventory including the cost of obsolescence, damage, shrinkage, and taxes. SCM has brought up a comprehensive inventory management program that makes use

of the concepts of inventory visibility, inventory accuracy and warehousing optimisation that help them to avoid the unnecessary cost associated with carrying the cost.

2.6.3 Improved service delivery

The adoption of SCM in the South African public sector has contributed to the wider agenda of improving efficiency in service delivery and value for money (Ngobeni, 2016:16). Ngobeni (2016:16) further notes that today both the government and community want to see efficient financial management and are aiming at benefiting much from their monies. However, recently, service delivery has been an issue as people feel they are not receiving adequate services due to embezzlement of public funds and misappropriation by public officials.

2.6.4 Launching of a central database and a central e-tender portal

The implementation of SCM in the public sector has led to the launching of a central database and a central e-tender portal in 2015 (Ambe, 2016:288). The launching of these two systems (central supplier database and central e-tender portal) was aimed at fighting corruption and making government procurement more efficient and cost-effective. In 2013-2014, the public sector spent some R500-billion on goods, services and construction, of which at least R30-billion was lost due to corruption (Ambe, 2016:287). The central supplier database is meant to oversee the way in which government does business with the private sector. Suppliers will be required to register once when they do business with the state. The objective is to reduce the administrative burden on business, especially small and medium-sized enterprises. This intervention will also reduce the administrative burden for SCM practitioners (Mail & Guardian, 2015:1).

2.6.5 Introduction of the Central Supplier Database (CSD)

In 2015, the South African government introduced the Central Supplier Database (CSD) where all suppliers register once to do business with the government (National Treasury, 2016:6). The CSD automates the verification of tax clearance certificates, company registration information, BEE status and personal identification information. The introduction of the CSD has reduced the cost

of doing business significantly as suppliers no longer have to incur costs of acquiring these administrative documents and register on the databases of each department, municipality, and public entity (Kramer, 2016:9; National Treasury, 2016:7). On the other hand, this resulted in a reduction in tender documents required for submission when responding to a tender; reduced the possibility for corruption; and addressed the administrative failures which were repeatedly identified by the Auditor-General (Kramer, 2016:10).

2.6.7 Decentralisation of the supply chain management function

The integration of SCM in the public sector has provided a platform for decentralising the procurement system from the central government to provincial and local governments and public entities (Ambe, 2009:427; Nurmandi & Kim, 2015:119; Ambe, 2016:282). Ambe (2016:282) further notes that the rolling out of SCM in 2003 helped in decentralising the process as institutions are now allowed and responsible for their own procurement processes within the framework of published rules and regulations. This helped in reducing red tape and administrative burden from the central government (Kramer, 2016:27). The decentralisation of the procurement activities provides a platform for greater innovation to local institutions and government departments as they exercise their authority (Turley & Perera, 2014:15; Nurmandi & Kim, 2015:119; Bolton, 2016:1).

2.7 CHALLENGES IN THE PUBLIC SUPPLY CHAIN MANAGEMENT IN SOUTH AFRICA

Despite the strides made in reforming public procurement and the employment of SCM as a strategic tool, there are still predicaments being faced in South African public procurement practices (Smart Procurement, 2011:1; Business Day, 2011:1). It remains a misconstrued and unappreciated domain in many circles, to the degree that its strategic importance is yet to be acknowledged (Hawkins, Gravier & Powley, 2011:576). Such challenges include non-compliance with policies and regulations, corruption, fraud and accountability, lack of proper knowledge, skills and capacity, inadequate measures for monitoring and evaluation of SCM, over-decentralisation of the procurement system, among others.

2.7.1 Non-compliance with the policies and regulations

SCM is guided by a number of related policies and regulations from the National Treasury (Boshomane, 2014:1). Compliance with these policies and regulations is a problem (National Treasury, 2005). Some of the practices relating to non-compliance with rules and procedures relate to the tendency not to utilise a competitive process for both the quotation and bids and incorrect utilisation of the preference point system (Matthee, 2006:45; Ambe & Badenhorst-Weiss, 2012:250; Zitha, 2016:67). There is a lack of appropriate bid committees, use of unqualified suppliers, passing over of bids for incorrect reasons and extensions of validity periods (Van Zyl, 2006:35; Zitha, 2016:67). Ambe and Badenhorst-Weiss (2011:126) also posit that there are inadequate controls and procedures for the handling of bids, an appointment of bid committee members not aligned to policy requirements and insufficient motivations for deviations from SCM procedures.

2.7.2 Inadequate planning and linking demand to the budget

Demand management is integral to the SCM process as it defines the decision-making process that allows departments to procure at the right time, at the right place and at the right cost (Ambe & Badenhorst-Weiss, 2011:126). However, many government entities are still faced with the challenges of improper planning and linking demand to budget (Ambe & Badenhorst-Weiss, 2011:126). Cost-effective procurement depends on a specialist's skills to ensure that buying requirements are reliably determined, appropriate contract strategies are developed, contracts are well managed and opportunities are seized to secure the best deals at the right time and at the right price. The importance of drawing up accurate and realistic strategic plans cannot be overestimated. Some government entities cannot properly quantify the needs of those requiring their services or properly estimate costs, nor can they accurately track, control or report on expenditure (Luyt, 2008:5; Ambe, 2012:251). Luyt (2008:5) and Zitha (2016:69) indicate that there is a need to monitor the delivery of services properly to ensure that scarce resources are efficiently and effectively procured. Poor planning and budgeting have also affected the implementation of SCM.

2.7.3 Too much decentralisation of the procurement system

In South Africa, government procurement of own local requirements is to a large extent decentralised to departments, provinces, and municipalities (Ambe & Badenhorst-Weiss, 2012:253). If one takes into account the number of cases of tender fraud and lack of services on all levels of government, one should ask whether these parties have the knowledge or the intention to get the best value for taxpayers' money, arguments for a centralised system could be brought forward. Centralisation offers leverages such as reduction of duplication of purchasing effort, an; + better responsiveness to purchasing needs (Handfield, Monczka, Guinipero & Patterson, 2011:160-161).

2.7.4 Lack of proper knowledge, skills, and capacity

To fully achieve SCM objectives, the National Treasury provides support by facilitating the development of appropriate training materials to government departments, municipalities and municipal entities (National Treasury, 2005:1). However, the shortage of skills has been a re-concurrent theme in public discussion. Skills and capacity shortages have been identified as the single greatest impediment to the success of public procurement in South Africa (Sheoraj, 2007:22; Nengwekhulu, 2009:351; Livhuwani, 2012:44; Ngobeni, 2016:25). Adequate capacity in the form of appropriate structures with fully skilled and professional SCM personnel is a key success factor for proper SCM implementation (Ambe & Badenhorst-Weiss, 2012:454). In some government entities, the quality of SCM personnel's skills and ability are well below standard. Migiro and Ambe (2008:230) assert that many SCM actors in the South African public sphere have attended a number of training workshops on SCM, but they still lack the appropriate knowledge for proper implementation. McCarthy (2006:4) contends that there is a lack of capacity and knowledge by SCM actors to handle procurement processes that have led to bad governance. The South African government embarked on programmes that educate practitioners, but the implementation of its programmes always falls short (Matshego, 2007:41).

2.7.5 Inadequate measures for monitoring and evaluation

Effective policymaking requires information on whether governments are doing things right and whether they achieve the intended results (Acevedo, Rivera, Lima & Hwang, 2010:41; Tukamuhabwa, 2012:34; Ambe, 2016:6). Strong monitoring and evaluation systems provide the means to compile and integrate this valuable information into the policy cycle, thus providing the basis for sound governance and accountable public policies (Acevedo *et al*, 2010:41). Inadequate monitoring and evaluation are linked to the absence or the poor presence of a controlled environment, and the three spheres of government are placed in a difficult position to give effect to or implement SCM as required by the policy (Zitha & Mathebula, 2015:16). Hence, deviations or non-compliance goes undetected or is identified after the fact. Procuring outside the legislated framework has seen government spending millions of rand in ways that contravened laws and regulations.

2.7.6 Corruption, fraud and accountability

Accountability and transparency constitute a central pillar to public procurement (Boshomane, 2014:1; Osei-Afoakwa, 2014:140; Mazibuko & Fourie, 2017:114). Without these two systems, the vast resources channeled through public procurement systems run the danger of being involved with increased corruption and misuse of funds (Jeppesen, 2010:2; Munzhedzi, 2016:5; Ogol & Moronge, 2017:788). A number of scholars have indicated that fraud and corruption cost South African taxpayers hundreds of millions of rand each year (Mahlaba, 2004:84; Boshomane, 2014:1). Boateng (2008:1) posits that since 1994, South Africa has enjoyed unprecedented social and infrastructural programs. Yet the majority of people who had hoped freedom would bring them relative socio-economic liberation and improvement are feeling increasingly bitter towards government over issues that include lack of perceived quality of governance, service delivery failure, fraud and corruption in some spheres of the economy, and disillusionment with empowerment policies (Boateng, 2008:1). Government service delivery lies in SCM, not centralised procurement (Ambe, 2016:3; Okojie, 2017:42). According to Mahlaba (2004:85), the impact of fraud has led to the promulgation of special legislation and improvement in existing legislation that led to the creation, among others, of the Directorate of Special Operations,

commonly known as the Scorpions, the Asset Forfeiture Unit, the Public Protector, the Special Investigation Unit, Commercial Crime Units, Internal Audit Units, Special Investigation Units within departments, and the appointment of forensic consultants.

2.7.7 Ineffectiveness of broad-based black economic empowerment

The South African government adopted the provision of BEE to empower all historically disadvantaged people rather than only a small group of black investors. To this end, it adopted the Broad-Based Black Economic Empowerment Act (BBBEEA), which calls for expanded opportunities for workers and smaller enterprises as well as more representative ownership and management. However, the current BEE provisions have in many instances failed to ensure a broad-based approach, instead, is they are imposing significant costs on the economy without supporting employment creation or growth (Ambe & Badenhorst-Weiss, 2012:253). Ambe and Badenhorst-Weiss (2012:253) went on, further inciting that the present BEE model remains excessively focused on transactions that involve existing assets and which benefit a relatively small number of individuals. The following shortcomings have emerged in the implementation of BEE: Firstly, ownership and senior management issues receive disproportionate emphasis (Kleynhans & Kruger, 2014:2). The unintended consequences of this trend include 'fronting', speculation and tender abuse. Secondly, the regulations do not adequately incentivise employment creation, support for small enterprises and local procurement (Ambe, 2012:253). The preferential procurement regulations aggravate this situation by privileging ownership over local production. Finally, the BBBEE regulations penalise public entities as suppliers. The democratic state owns public entities on behalf of its people, yet the regulations do not count them as 'black empowered' (Zuma, 2009:1).

Subsequent to the discussion presented above, it is evident that there are constraints in procurement practices in the South African public sector. These predicaments can to a large extent be attributed to lack of proper knowledge, skills, and capacity. Therefore, the South African government will need to address these dilemmas in order to fully achieve the policy objective of public procurement.

2.8 CHAPTER SUMMARY

The purpose of this chapter was to analyse literature focusing on SCM in the South African public sector. The study first discussed SCM in the pre-independence South Africa. it can be concluded that SCM in pre-independence South Africa was biased towards a few established institutions and disregarded the majority of the small institutions. Secondly, the study examined public SCM in the post-independence era. The analyses revealed that SCM in the South African public sector since 1994 has and is still going through different developments that are aiming at improving service delivery and financial management in the public sector. Thirdly, the study addressed the legislative framework that guides public SCM in South Africa. It can be concluded that SCM in South Africa is guided by a myriad of legislative frameworks that branches from the National Constitution to Acts of Parliaments and Treasury Regulations. The study also revealed that certain developments have been made towards achieving the goals and objective of public SCM such as improved inventory management, and decentralisation of the procurement function to provincial and local governments and public enterprises. Fourthly, the study discussed the challenges of public SCM. Regarding this aspect, it can be concluded that despite the strides made in SCM, the South African public sector is still facing a raft of challenges that are threatening its implementation, effectiveness, and efficiency. Overall, it can be concluded that SCM is an important function that must be prioritised not only in the private sector but also in the public sector. The next chapter will focus on literature pertaining to the SCM practices under consideration in the study.

CHAPTER 3

A THEORETICAL REVIEW OF SUPPLY CHAIN MANAGEMENT PRACTICES

3.1 INTRODUCTION

The aim of this chapter is to analyse literature on SCM and its best practices. The discussion takes a bias towards the public sector context and presupposes that SCM practices are also best suited for public organisations and they can help in improving organisational performance and SCR. The chapter will start with the contextualisation of SCM and its best practices. The chapter also discusses the drivers (antecedents) of SCM practices and barriers that hamper the establishment of each practice. Benefits of adopting and implementing SCM practices will also be outlined. The last segment of the chapter concentrates on the SCM practices in the public sector in general. The chapter will also narrow down the study to SCM practices in the South African public sector. As such, this chapter will focus only on six SCM practices indicated in the conceptual framework.

3.2 RESEARCH THEORY

This section discusses the research theory, which is the institutional theory. The section provides information on the background and emergence of the theory, its suggestions and assumptions as well as its application and relevance to this study.

3.2.1 Institutional theory

Organisations are not only production systems, they are also social and cultural systems (Scott, 2001:8). Owing to their socio-cultural characteristics, scholars such as Meyer and Rowan (1977:340) as well as DiMaggio and Powell (1983:147) suggest that firms have the desire and need to adopt and adhere to the rules and practices as created by their external environment. Hatch (1997:5) suggests that the external environmental demands induce organisations to adopt roles in society and create appearances which may not be the original intent of the organisation. As such, organisational choices and actions are constrained and influenced by social behaviours, norms and

values in their external environment (Selznick, 1957:9). This led to the emergence of the institutional theory which puts organisations at the core of organisational design and analysis. The institutional theory is used by researchers to understand how environmental pressures impact organisations. This section explores information on the institutional theory regarding its development, its suggestions and applications in this study.

There is no general consensus regarding the exact period in which the institutional theory emerged. Lammers and Garcia (2017:197) argue that the theory found its emergence in the works of Selznick (1949:17), when he set forth a sociology school of thought on institutions with his observation that "the important thing about organisations is that though they are tools, each nevertheless has a life of its own…., they are infused with values beyond the technical requirements of the task at hand". However, Eisenhardt (1989:492) suggests that the theory originated in the 1970s, whereas, Suddaby (2015:12) is of the view that the theory traces its philosophical antecedents to the German idealism and that its assumptions are a reaction against the Kantian assumptions of objectivity which dominated the 19th century. The theory suggests that the world is largely a product of subjective interpretation. Zucker (1977:728) suggests that the institutional theory is defined by two elements, namely (1) a rule-like, social quality of an organised pattern of action (exterior) and (2) an embedding of informal structures, such as formal aspects of organisations that are not tied to particular actors or situations (nonpersonal/objective).

The institutional theory puts institutions at the core of the analysis of organisations' design and conduct. The theory examines how external pressures influence organisations to adopt certain practices. This is noted by Pfeffer (1982:462) and Eisenhardt (1988:492) who advocate that the key idea behind the institutional theory is that much organisational action reflects a pattern of doing things that evolve over time and becomes legitimised within an organisation and an environment. Ingram and Simons (1995:1467) state that the main thrust of the theory is that organisations operate in a social network whereby practices are caused by and influenced through social rules and rules of thumb and that a social reality is created and defined by the environment in which organisations operate. Likewise, a number of scholars (Meyer & Rowan, 1977:340; Zucker, 1987:443; Kauppi, 2013:1119; Palthe, 2014:60) advocate that the central thesis of the institutional approach is that many structures, programmes, and practices in organisations seek to

achieve economic efficiency as well as legitimacy through desired constructs of reality. The adoption and the institutionalisation of these rules and standards (norms, values, and activities) are known as the search for legitimacy in the environment (Zucker, 1987:727).

In the view of Suchman (1995:574), legitimacy can be defined as a perception that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions. DiMaggio and Powell (1983:147) state that the process of becoming legitimate is the result of an organisation conforming to pressures in the external environment. Some scholars (DiMaggio & Powell, 1983:147; Meyer & Rowan, 1977:340) opine that legitimacy is important for organisations as it creates the perception of credibility, persistence, and meaningfulness within the environment and may increase their possibility of survival. Rezaee (2017:71) suggests that the theory primarily focuses on the rationalisation, legitimacy, practicality, and aspects of social structure and related processes in establishing guidelines and best practices in compliance with applicable laws, rules, standards and norms. However, the well-established sociological version of the perspective suggests that organisations are driven by legitimacy motives (DiMaggio & Powell, 1983:147; Suchman, 1995:571; Rogers, Purdy, Safayen & Duimering, 2007:556).

The prominent argument of the institutional theory is the hypothesis that organisations operating in similar fields tend to have the same practices and structures for them to survive external pressures (Palthe, 2014:60). DiMaggio and Powell (1983:148) refer to the process by which organisations begin to adopt similarities and create a homogenous set of organisations, which is known as isomorphism. The institutional theory examines the causes of isomorphism, that is, factors leading organisations to adopt similar structures, strategies, and processes (Deephouse, 1996:4). Fennell and Alexander (1983:667) opine that isomorphic actions are developed from the set of environmental standards which force organisations to mirror one another. This is also pointed out by Zucker (1987:730) who submits that firms operating in the same environment tend to abide by similar norms, values, and rules. DiMaggio and Powell (1983:150) affirm that isomorphism is the result of three types of external pressures, namely, coercive, mimetic and normative.

Coercive pressure results from force, persuasions, and invitations to participate with other external environment members. Coercive institutional pressures often take the form of governmental regulations or laws. Scott (1995:3) and Grewal and Dharwadkar (2002:82) underscore that organisations adopt these standards as they develop the fear of and try to avoid sanctions. However, coercive pressure emanates from other stakeholders such as customers and suppliers who can apply formal and informal pressure (Slack & Hinings, 1994:803; Teo, Wei & Benbasat, 2003:19; Khalifa & Davison, 2006:275). Normative pressure emerges from cultural expectations in which norms and standards of the operating environment are formed and which in turn guide decision-making (Khalifa & Davison, 2006:15). With normative pressures, organisational choices are influenced by values and norms. Scott (1995:5) mentions that organisations conform with normative pressures because of moral and ethical obligations and it is what is expected of them. These pressures usually result in rules of thumb, educational curricula, standards of operating procedures and occupational standards (Hoffman, 1999:351). Normative pressure stems from a variety of sources such as educational organisations, trade associations, industry groups, interest groups and public opinion (DiMaggio & Powell, 1983:150). These groups can create pressures for organisations to accept norms and behaviours (Selznick, 1984:32). However, society can also create normative pressure for organisations as they are the most affected by the actions of many institutions.

Mimetic pressure originates from the desire to look like other prosperous organisations. In other words, organisations model themselves after organisations in their external environment that they see to be similar but also legitimate and successful (DiMaggio & Powell, 1983:151). Wu, Daniel and Quintas (2013:161) underscore that mimetic pressures are often the result of environmental uncertainty, ambiguity in the achievement of organisational goals, or technological complexity. Wu *et al*. (2013:161) further explain that when new or problematic situations arise in the environment, organisations model themselves after others that they perceive to be adequately managing their business to survive environmental conditions. Also, adopting practices that are deemed acceptable by the external environment may insulate the organisation from criticism from competitors so the organisations do not serve as models, rather they are viewed by other organisations as a convenient source (DiMaggio & Powell, 1983:151; King & Lenox, 2001:27).

To provide an informed discussion on the use of the institutional perspective in SCM in the past, a review of several key journals in the field was conducted. Williams, Lueg, Taylor and Cook (2009:595) applied the institutional theory to explore the drivers of supply chain security. Kauppi (2013:1318) used the perspective to justify why organisations in operations and SCM adopt certain activities and practices. Wu *et al*. (2013:161) utilised the institutional theory to demonstrate the varied mechanisms through which supply chain practices in indigenous organisations are adopted. The institutional theory provides a relevant foundation for this study and was identified for its potential value in SCM. The study rationalises that the relationship between SCM practices, SP, and SCR can be managed to achieve efficiencies in both social and economic areas of the organisation. The institutional theory also offers important insights into the adoption and implementation of tools and practices within public sector SCM, which will enhance SP, leading to improved SCR.

This section discussed literature on the institutional perspective. From the literature, it became clear that there is no general consensus as to the actual origins of the theory. The literature also revealed that the perspective places organisations at the core of its analysis and that organisations operating in the same environment tend to adopt similar norms, values and standards. From the literature, it also emerged that three external forces, namely, coercive, mimetic and normative factors compel organisations to survive and be efficient. The section also revealed that the institutional theory is relevant to this study and provides motivation for this link. The next section reviews literature on SCM practices.

3.3 CONCEPTUALISATION OF SUPPLY CHAIN MANAGEMENT PRACTICES

This section reviews literature on SCM and its practices. To fully understand what SCM practices entail, there is a need to understand the nature of SCM first. Hence this section explores literature on SCM. This section also examines the definitions of SCM practices as provided by many scholars.

3.3.1 Supply chain management

The concept of SCM has received extensive interest from researchers as well as practitioners in the field, and it has become a governing element in companies' strategies to enhance organisational productivity and profitability (Du Toit & Vlok, 2014:26). Ambe and Badenhorst-Weiss (2012:246) suggest that SCM now occupies centre stage in the context of ongoing financial management not only in the private sector but also in the public sector. In the view of Marshall (2015:10), SCM can be viewed as the evolutionary product of traditional purchasing, operations, and logistics functions in an organisation. In other words, it is now regarded as a global issue aimed at bringing effectiveness and efficiency in the procurement and provision of goods and services as well as ensuring fiscal prudence in the procurement activities of businesses and organisations.

Typically, SCM consists of a network of entities that includes manufacturers, distributors, wholesalers, and retailers. It is designed to create a linkage between various suppliers in the supply chain, the customers, and a firm's internal functions (Elmuti, 2002:49). Miao, Xi and Yu (2010:31) view SCM as a set of practices aimed at managing and coordinating the entire chain from raw material suppliers to end customers. Leenders and Fearon (2008:18) suggest it as an approach to managing the entire chain flow of information, materials, and services from the raw material suppliers through factories and warehouses to the end customer. Other scholars such as Fantazy, Kumar and Kumar (2010:1) opine SCM as an integrated approach beginning with planning and control of materials, logistics services, and information from suppliers to manufacturers or service providers to end clients. Christopher (2005:4) sums it up as the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole. Thus, SCM relates to the nodes and connections of a supply chain in the designing and management of all activities involved in sourcing, purchasing and coordination as well as partnerships with network partners from suppliers to consumers.

SCM is one of the most active ways for firms to improve their performance (Ou, Liu, Hung & Yen, 2010:526). The activity of SCM can provide organisations with strategies to build long-term competitiveness (Azadi, Saen & Zoroufchi, 2014:314; Zhang, Gunasekaran & Wang, 2015:114; Sundram & Bhatti, 2016:1445). This may be achieved with the aid of implementing SCM

practices, which are portrayed from a different perspective with a common aim of improving organisational performance. Within the areas of SCM, literature highlights the need to understand SCM practices which have become an essential prerequisite to remain competitive in the global race with profitable growth (Sezen, 2008:233; Okongwu, Brulhart & Moncef, 2015:678). This then indicates that SCM is a fundamental concept and function that can propel organisations to operate effectively and efficiently to achieve growth.

The next section discusses the conceptualisation of SCM practices as well as their drivers and the benefits associated with their application in the public sector.

3.3.2 Supply chain management practices

There is no consensus regarding the definition of SCM practices. A number of scholars have defined SCM practices as those managerial actions undertaken to improve the performance of the integrated supply chain (Sundram *et al.,* 2011:837; Hemister, 2012:429). Sandhu *et al*. (2013:45) and Sundram and Bhatti (2016:1447) perceive them as operational functions or activities of an organisation which determine the effectiveness and efficiency of its supply chain. Other scholars conceptualise them as the set of activities undertaken by an organisation to promote effective management of its supply chain (Li *et al.,* 2005:618; 2006:107; Koh *et al.,* 2007:103; Gawankar, Kamble & Raut, 2017:257). Wong *et al*. (2005:367) describe them as approaches applied in integration, managing, and coordination of supply, demand, and relationships to satisfy clients effectively.

SCM practices have been described by van der Vaart and van Donk (2008:42) as tangible activities or technologies that have a relevant role in the collaboration of a focal firm with its suppliers and clients. Other scholars (Barros *et al.,* 2013:1041; Al-Shboul *et al.,* 2017:367) affirm them as a set of actions undertaken by suppliers, manufacturers, distributors, and customers to improve the performance of the integrated supply chain. Deducing from all the above mentioned definitions, a shared feature they possess is being portrayed with the common aim of improving organisational performance. Therefore, one may view SCM practices as a set of activities undertaken by an

organisation to promote the effective and efficient management of its supply chain and improve its performance.

SCM practices consider the internal processes of an organisation and link them with the external operations of members in the entire supply chain. Kannan and Tan (2010:207) stress that SCM practices are implemented to achieve and enhance performance throughout the supply chain by integrating both the internal cross-functional activities and external integration with suppliers and customers. Some authors (Kayakutlu & Buyukozkan, 2010:129; Gorane & Kant, 2015:657) emphasise that SCM practices have been regarded as a perfect recipe for the success of several firms from various industries.

3.4 SUPPLY CHAIN COLLABORATION

This section analyses literature pertaining to SCC. As mentioned by Boyce, Mano and Kent (2016:1), globally, effectively managing resources and collaborations across firms in a supply chain has become a common practice to achieve shared objectives. The section also discusses antecedents that drive organisations to form collaborative partnerships with each other. The section further highlights the benefits of forming collaborative partnerships.

3.4.1 Conceptualisation of supply chain collaboration

In today's world, more and more firms have begun to coordinate their production and distribution networks and collaborate with supply chain partners rather than manage their internal resources alone (Baraldi, Gressetvold & Harrison, 2012:97; Qu & Yang, 2015:911). Collaboration is defined as the cooperation of two or more members based on working together to create a competitive advantage through information sharing, joint decision making, and sharing the benefits from greater profits by satisfying customer needs rather than acting alone (Simatupang & Sridharan, 2002:15). Anthony (2000:119) defines the term collaboration as two or more companies sharing the responsibility to exchange the spreading, management, implementation, and performance measurement of information plans. Collaboration appears as enterprises recognise cases, where working and operating alone, is not sufficient to resolve common problems and to achieve the

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desired goals (Barratt & Oliveira, 2001:266; Wagner *et al.,* 2002:253). The aforementioned definitions commonly depict that collaboration is the partnering of two or more organisations in working towards achieving a common goal.

SCC has been defined as two or more members of a supply chain working together to create a competitive advantage by sharing information, making joint decisions and sharing benefits, which results from greater profitability gained by satisfying end customer needs (Simatupang *et al.,* 2002:289; Fantazy, 2010:685; Autry, 2013:298; Autry *et al.,* 2014:275; Gumboh & Gichira, 2015:224; Salam, 2017:299). Other scholars (Cao *et al.,* 2010:613; Yasushi, 2013:11) view SCC as a variety of concepts such as information sharing, goal congruence, decision synchronisation, incentive alignment, resource sharing, collaborative communication, joint knowledge creation. In analysing the aforesaid definitions, one may describe SCC as a best practice where supply chain member's partner with each other in the quest to improve supply chain performance and satisfy customer needs.

The notion behind SCC implies that the chain members become involved and actively work together in coordinating activities which span the boundaries of their organisations in order to fulfil and satisfy customer needs (Mentzer *et al.,* 2000:52; Cao & Zhang, 2011:163; Wankmuller & Reiner, 2019:239). Autry (2013:298) affirms this by stating that SCC is identified as one of the leading game-changing trends for future supply chains. Based on existing literature, a general research framework for SCC has been suggested by Matopoulos, Vlachopoulou, Manthou and Manos (2007:179). In the framework, two pillars dealing with the design and the governance of supply chain activities, and the establishment and the maintenance of supply chain relationships are distinguished respectively. Figure 3.1 shows the three pillars of SCC as presented by Matopoulos *et al*. (2007:179).
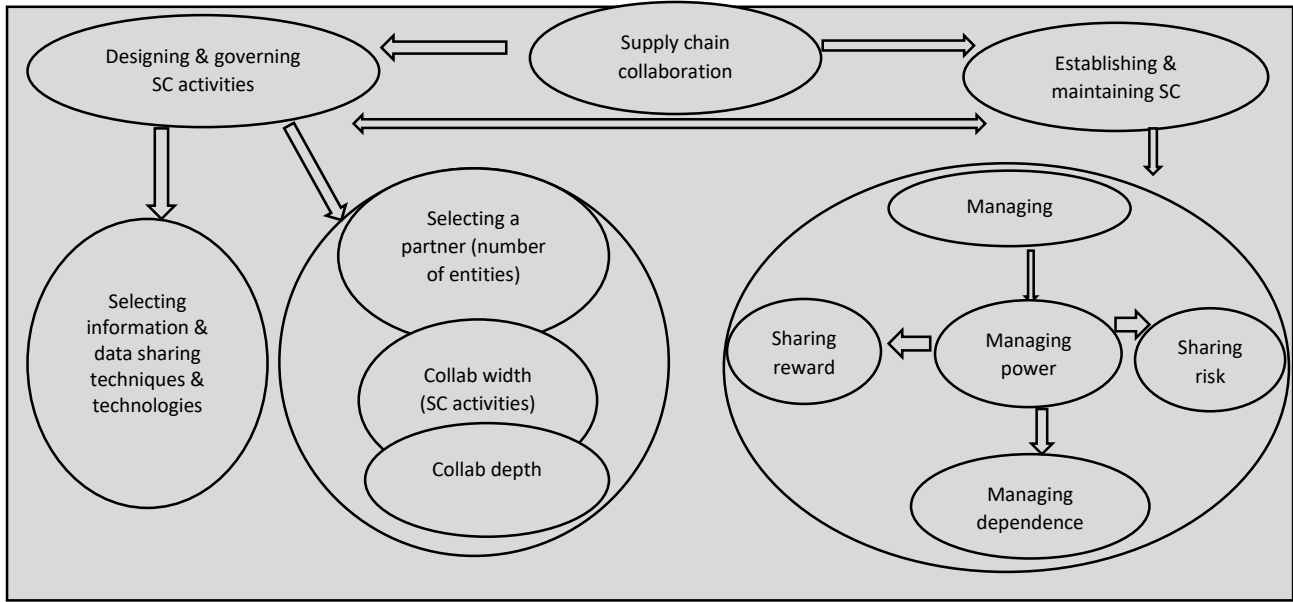
Figure 3.1: An overall framework of supply chain collaboration
Source: Matopoulos *et al*. (2007:180)

As shown in Figure 3.1, the first pillar in the framework is related to the design and governance of supply chain activities consisting of three elements. The first element is about selecting the appropriate partner. Matopoulos *et al*. (2007:180) opine that not all players in the business arena become close collaborators, and under this prism, a selection is needed, based on the expectation, perceived benefits and drawbacks, and the business fit of companies. The second element involves selecting the activities upon which collaboration will be established. Sahay (2003:76) proposes that not all the activities require the same amount of involvement and close relationship from supply chain partners; hence firms need to determine the specific activities upon which they will collaborate. Identifying at what level companies will collaborate is the third element (Matopoulos *et al*., 2007:180). The combination of these three elements comprises the intensity of collaboration, the more the depth, the width and the number of entities, the more intense the collaboration is. Another principal element for the design and governing of supply chain activities includes the decision of selecting the appropriate technique and technology to facilitate information sharing. However, it is an overly complicated decision since not all potential collaborators can meet the requirements of collaboration in terms of technology and techniques.

The second pillar concerns the establishment and maintenance of supply chain relationships (Matopoulos *et al.,* 2007:180). The critical elements that have been cited most in the literature include mutuality of benefits, risk, managing of power and reward sharing (Stank *et al.,* 1999; Barrat & Oliveira, 2001:266). In support of this, Matopoulos *et al*. (2007:181) put forward that the risk and reward sharing balance will be crucial factors, which will guide companies towards close collaboration. Thus, firms (organisations) have to agree on reward sharing, power and risk sharing before putting the collaboration into motion.

Another model of SCC was developed by Min, Roath, Genchev and Chen (2005:242), which covers the progression of such relationships including antecedents, collaboration, and consequences as shown in Figure 3.2.

Antecedents

Strategic intent

Internal alignments

Relationship-specific investment

Free flow of information and heightened communication

Formalization

Collaboration

Information sharing

Joint planning

Joint problem solving

Joint performance measurement

Leveraging resources and skills

Consequences

Efficiency

Effectiveness

Profitability

Reinforcement and expansion of the relationship

Figure 3.2: A conceptual model of supply chain collaboration
Source: Min, Roath, Genchev and Chen (2005:242)

As depicted in Figure 3.2, collaborative relationships are centred on antecedents such as strategic intent, internal alignments, relationship orientation, investments, free flow of information/heightened communication and formalisation. Min *et al*. (2005:242) opine that the antecedents are essential ingredients for a collaboration receipt, which assists the organisation to

form pacts with others. Min *et al*. (2005:245) further state that the type of collaboration differs from one organisation to another. The study of Min *et al*. (2005:242) reveals that collaborations could be in the form of information sharing, joint planning, joint problem solving, joint performance measurement and leveraging resources and skills. IS is deemed an imperative ingredient of day-to-day operations as well as more strategic collaborative activities. SCC results in consequences such as efficiency, effectiveness, profitability, reinforcement and expansion (Min *et al.,* 2005:242). However, it is imperative to note also that if not properly instituted SCC might result in severe negative consequences.

3.4.2 Factors influencing supply chain collaboration

The practice of SCC is influenced by a number of factors (drivers) that emanate from both the external and internal environment of the organisation. These drivers sometimes clarify supply chain goals (Min & Zhou, 2002:231; Lambert, 2008:255; Lambert & Schwieterman, 2012:337). Chin, Tummala, Leung and Tang (2004:505) found five primary reasons for firms to enter into SCC and these include reducing costs of operation, improving customer satisfaction, improving inventory and lead time and remaining competitive. This is supported by Rajagopal *et al*. (2009:649) who considered cost reduction, effective procurement, and inventory management as drivers for firms to enter into partnership deals. In addition to cost reduction, customer satisfaction, and inventory management, Rezaei, Ortt and Trott (2017:632) added other SCC drivers such as demand optimisation, growth, innovation, and inventory optimisation as drivers to SCC drivers. Moreover, Min *et al*. (2005:242) laid down drivers such as strategic intent, internal alignments, relationship orientation, relationship-specific investment free flow and heightened communication as well as formalisation as antecedents for collaboration between supply chain partners. Other scholars such as Verdecho, Alfaro-Saiz and Rodriguez-Rodriguez (2011:535) added market characteristics, product characteristics, partner characteristics, changes in the environment as well as relationship orientation.

Furthermore, factors such as relationship characteristics, organisational characteristics and information technology characteristics have been named as categories of antecedents that propel organisations to collaborate (Lee, Kim, Hong & Lee, 2010:660). Relationship characteristics

include factors such as trust, commitment, interdependency and length of the relationship. Trust entails the extent to which firms believe that supply chains partners will fulfil their responsibility to each other in good faith. Firms share information based on the belief that the supply chain partner will forego opportunistic behaviour and use shared information in a mutually beneficial way (Monczka *et al.,* 1998:553; Kwon & Suh, 2004:4; Morton *et al.,* 2006:3227; Lee *et al.,* 2010:660). Commitment entails the extent to which supply chain partners will maintain and strengthen their business relationship. Morgan and Hunt (1994:20) define commitment as an exchange partner's belief that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it. It is central to all of the information exchange and collaboration between trading partners (Moberg *et al.,* 2002:755; Yeh, 2005:327). Interdependency denotes the extent to which supply chain partners believe that their business relationship is necessary while the length of relationship is the period for which chain partners have a business relationship (Mentzer *et al.,* 2001:1).

Organisational characteristics encompass top management support, cultural similarity, goal compatibility. Andraski (1998:3) underscores that collaboration among partners requires leadership of the top management. SCC involves cultural similarities, which explains the extent to which supply chain partners share or have similar values, beliefs, and management practices. Organisational culture facilitates communication flow both within and between business partners by ensuring continuity of norms (McAfee, Glassman & Honeycutt, 2002:1; McIvor & Humphreys, 2002:192). On the other hand, goal compatibility depicts the extent to which supply chain partners have clear and agreed-upon transactional goals (Mentzer *et al.,* 2001:2). Sharing common goals will guide cooperative activities between partners and facilitate resource integration and utilisation. If supply chain partners have compatible goals, they will understand partner activities better and increase IS and collaboration (Wathne & Heide, 2000:36).

Information and technology characteristics include enablers such as IQ and the rate of technological change. IQ pertains to the value of information shared by supply chain partners. Petersen *et al*. (2005:14) further postulate that information shared must be accurate, current and reliable. The rate of technology change also facilitates SCC. Mentzer *et al*. (2000:549) suggest

that technological changes cannot be dealt with by a single firm, hence firms try to build a close business relationship to develop new technologies and products jointly.

Despite the importance and benefits associated with SCC, certain factors militate against its success. Ramanathan (2014:211) observes that barriers to SCC can be classified under two categories, namely, organisational and operational. Organisational barriers include lack of integration, behavioural issues within the organisation, lack of trust, lack of internal forecasting, and fear of collusion (Kim & Mahoney, 2010:403; Ramanathan, 2014:211; Hollmann, Scavarda & Thome, 2015:971).

3.4.3 Benefits of supply chain collaboration

It has been confirmed in the literature that practising SCC yields numerous benefits to the organisation. The practice of SCC has been commended by a number of scholars for delivering substantial benefits and advantages to supply chain partners (Cao & Zhang, 2011:162). It is often seen as a powerful instrument in achieving effective and efficient SCM (Mentzer *et al.,* 2000:549; Fu & Piplani, 2004:256). Cao and Zhang (2011:163) confirm this by stating that firms often look outside their organisations for opportunities to collaborate with supply chain partners to ensure that the supply chain is efficient and responsive to dynamic market needs. Some common benefits of SCC are identified as cost saving, inventory reduction, timely replenishment and forecast accuracy (Barrat, 2004:28; Niemann, Kotze & Jacobs, 2017:1). Also, SCC helps a business organisation's coordinating and operating efficiency including SCM, reducing costs and inventory, and increasing the level of customer's satisfaction (Holweg, Disney, Holmström & Småros, 2005:170; Soosay, 2008:8; Suong, 2012:4; Whipple *et al.,* 2007:174; Rezaei, Ortt & Trott, 2015:1527). Other benefits include improved service, gaining competitive advantage and production performance (Rezaei *et al.,* 2017:633).

In this section, SCC was discussed. From the literature, it is clear that SCC is an imperative SCM practice that propels and catapults organisations to success. It is associated with many benefits that lead the organisation (both private and public) to success. From the literature, it is evident that there are various definitions to what exactly SCC really is. However, all the definitions attest to

the notion that SCC pertains to two or more organisations working together to achieve a common objective. Factors such as organisational, information, technology and relationship characteristics among others have been identified as propellers that drive organisations to collaborate. The literature reviews also indicate that SCC, if implemented effectively will benefit organisations immensely. The next section analyses INV as an SCM practice.

3.5 SUPPLY CHAIN INNOVATION

This section analyses the literature on INV. The section will discuss the definitions of INV. Antecedents to INV are also discussed as well as the benefits to organisations.

3.5.1 Conceptualisation of supply chain innovation

Innovation generation is increasingly seen as a collaborative process carried out with the participation of different actors within or outside companies (Berghman *et al.,* 2012:27; Arlbjorn & Paulraj, 2013:3; Zimmermann, 2016:289). INV refers to the tools that can improve organisational processes needed for effective SCM through interactions with suppliers, manufacturers, distributors, and customers (Lee *et al.,* 2011:1195). To Lavastre *et al.* (2011:9), INV can be conceptualised as a set of practices that were previously non-existent in organisations that will be generated, developed and deployed within supply chains to tackle different supply chain issues such as quality, cost and lead time. INV to Kwak, Seo and Mason (2018:8), refers to a continual process whereby procedures and processes in the outbound supply chain are technologically enhanced, alongside the improvement of any product, process, or service that boosts efficiency or customer satisfaction. Lin (2008:19) describes INV as a tool that can improve the organisational processes needed for effective SCM through seamless interactions with suppliers, manufacturers, distributors, and customers. Specifically, INV involves technology-improved processes and procedures in the outbound supply chain as well as changes in product, process or service that either enhance efficiency or improve final customer's satisfaction (Roy *et al.,* 2004:61; Seo *et al.,* 2014:668; Kim *et al.,* 2015:318). Therefore, it appears that INV is a multi-dimensional process that uses technological inventions to improve organisational processes with the aim of satisfying customer needs.

INV is a multi-dimensional construct which can be categorised into technology innovation and process innovation (Flint, Larsson & Gammelgaard, 2008:257; Paton & McLaughlin, 2008:77; Hazen, Overstreet & Cegielski, 2012:119). This is also noted by other scholars who note that INV as a construct can be divided into technological innovation and process innovation (Kwak *et al.,* 2018:7). Technological innovation typically involves the enhancement of integrated information systems often using real-time tracking with the aim of boosting labour and capital productivity as well as adaptations to technological changes and boosting organisations on how best can they exploit economies of scale (Lee *et al.,* 2018:15). Process innovation, on the other hand, functions to effectively redesign and re-engineer a supply chain by boosting efficiency and other facets of organisations such as enhanced management practices, networking, and procurement (Marchi & Zanoni, 2017:2). Technology innovation aims to enhance the integrated information system, real-time tracking technology, and innovative logistics equipment across global SCs. It helps firms to heighten labour and capital productivity and offer real-time visibility regarding the flow of cargoes, information and sales data so that they can enhance inventory management and enlarge their value proposition for final customers (Christopher, 2005:7). Technology innovation also plays a crucial role in exploiting economies of scale in purchasing, logistics, and central distribution centre (Rao & Goldsby, 2009:97; Ghadge, Dani & Kalawsky, 2012:313). Process innovation denotes the implementation of new improved techniques, methods, and procedures with the goal to continually improve the quality of service or reduce the cost of providing a service (Wagner, 2010:222). It focuses on operational issues and processes that enhance management practices, networking, distribution, and procurement (Chapman *et al.,* 2003:358). Figure 3.3 illustrates how INV works according to Arbjorn *et al*. (2011:12).
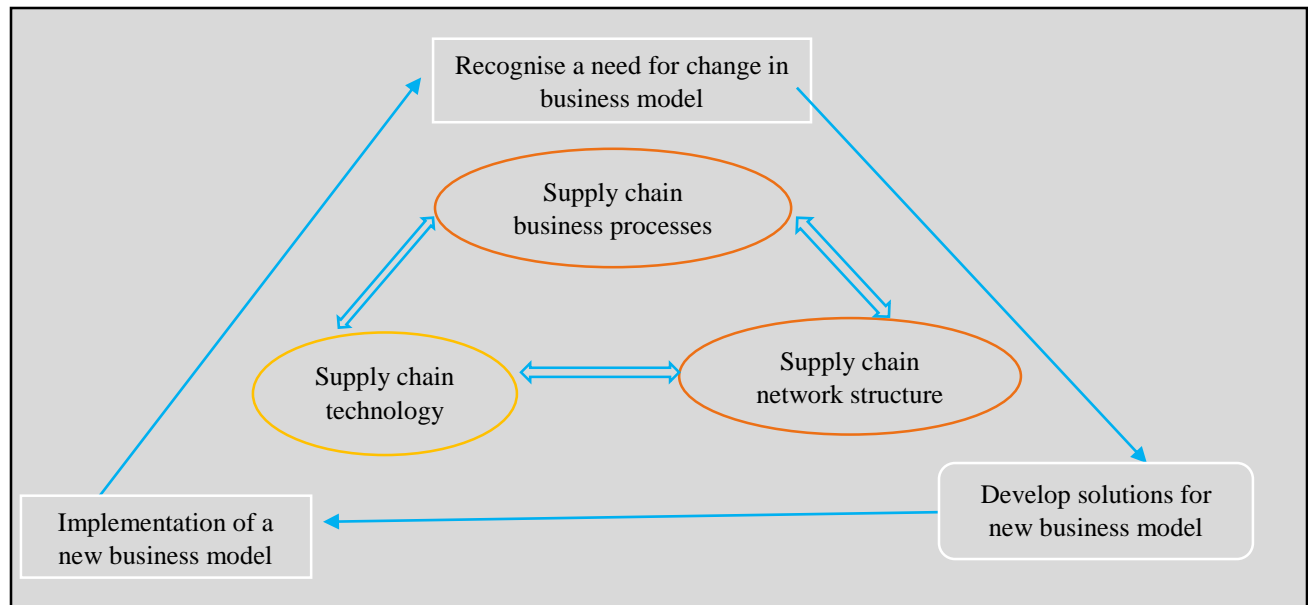
Figure 3.3: Framework for supply chain innovation
Source: Arbjorn *et al.* (2011:12)

As illustrated in Figure 3.3, INV is cyclical in nature; it starts by recognising a change in the business model (Arbjon *et al.,* 2012:12). The need for change may be triggered through technological advancements, customer demands and a need to respond to competition from other service providers to mention a few. Secondly, there is a need to develop solutions to remedy and cover the gap for organisations to remain competitive in the market and to survive. Arbjon *et al.* (2012:12) further mention that once solutions have been developed, they need to be implemented and monitored to ensure businesses remain competitive. However, factors such as lack of skills, lack of motivation and lack of management support hamper organisations from effectively implementing new strategies and solutions.

3.5.2 Factors influencing (drivers or antecedents) supply chain innovation

A number of antecedents trigger the initiation of INV in organisations. Roy and Sivakumar (2010:1356) and Bello *et al.* (2004:57) opine that these antecedents can be grouped into three categories, namely, market domain, business domain, and external domain. Market domain drivers include antecedents that are motivated by local, regional and global market changes such as

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unpredictable changes in customer requirements, technological developments and behaviour of competitors (Li & Atuahene-Gima, 2002:469; Bello, Ritu-Lohtia & Sangtani, 2004:57). Business domain drivers consider the product variety of the company and serve as a proxy for the level of complexity that the company must be able to handle to be competitive in the marketplace (Roy & Sivakumar, 2010:1356; Caridi, Moretto & Caridi, 2014:945). On the other hand, the external domain element entails the external elements such as government support and stakeholder pressures. This is also noted by Stentoft and Mikkelsen (2017:55) who state that innovation is influenced by internal demands to improve performance, external requirements from customers and changes in legislation.

Other drivers of INV include external requirements from customers, demands from top management, demands from marketing, opportunities from suppliers, and responses to competitors as well (Arlbjorn & Mikkelsen, 2012:22; Stentoft & Thoms, 2014:10; Stentoft & Mikkelsen, 2017:55). However, factors such as lack of a skilled workforce, lack of time, silo mentality, high supply chain complexities and lack of internal development-oriented capabilities militate against SCINs in firms (Arlbjorn & Mikkelsen, 2012:22; Stentoft & Thoms, 2014:2; Stentoft & Mikkelsen, 2017:55).

3.5.3 Benefits of supply chain innovation

The practice of INV is associated with many benefits such as the reduction in costs and lead time, the creation of new operational strategies, provision of consistent quality, and development of flexibility for dealing with rapid changes in the business environment (Stundza, 2009:1). This is supported by a number of scholars who argue that INV empowers organisations to be resilient and ensures their agility and continuity (Swafford *et al.,* 2006:170; Ponomarov & Holcomb, 2009:124; Coombs, 2012:2). Effective INV ensures the efficient supply of products and services to customers (Lee *et al.,* 2011:1196). This is also noted by Butner (2010:22) who alludes to the premise that INV improves customer responsiveness. Other benefits include cost reduction (Stank, Dittmann & Autry, 2011:940), reduction in the bullwhip effect (Barros *et al.,* 2013:1040), improved competitive advantage and supply chain performance (Tan, Zhan, Ji, Ye & Chang, 2015:223) as well as improved market performance (Stank *et al.,* 2011:940; Singhry, 2015:43).

In this section, literature concerning INV was discussed, and it became clear that innovation in supply chains is imperative. It has benefits such as reducing cost, enhancing of product quality and improving the efficient supply of goods and services to customers. The section also revealed that drivers to innovation in supply chains range from the market domain, business and the external domain, as well as technological developments, among others. The next section analyses the literature on information sharing.

3.6 INFORMATION SHARING

The understanding and practice of IS in organisations is becoming increasingly essential for organisations to stay competitive and boost profitability. It is considered an important approach to increase organisational efficiency and performance. Moberg et al. (2002:755) observe that IS is a key ingredient for organisations seeking to remain competitive. This section analyses literature on IS, and further discusses literature on the benefits of sharing information both within and outside the organisation in the supply chain.

3.6.1 Conceptualisation of information sharing

Information is vital for the effective functioning of any business; it has been described as the lifeblood of the organisation (Pooe, Mafini & Loury-Okoumba, 2015:3). IS refers to the extent to which information is communicated effectively among supply chain members (Li *et al.,* 2006:1641; Sundram *et al.,* 2016:1451). Ding, Jie, Parton and Matanda (2014:91) describe IS as a paradigm with a widespread belief that achieving a high degree of cooperative behaviour requires that supply chain members voluntarily share operating information and jointly plan strategies. In accordance with Barratt and Oke (2007:266), IS may be perceived as an activity in which information is shared between supply chain actors. Other scholars view IS as an inter-organisational sharing of data, information, and knowledge in supply chains (Kembro & Naslund, 2014:181; Jonsson & Holmstrom, 2016:62). IS refers to knowledge interactions and information exchanges that enable better transactional collaboration (Lee & Ha, 2018:325).

Other scholars view IS as the extent to which a firm shares a variety of relevant, accurate, complete and confidential ideas, plans and procedures with its supply partners in a timely manner (Wadhwa & Saxena, 2007:436; Cao *et al.,* 2010:6613; Wiengarten *et al.,* 2010:463). Others conceptualise it as the extent to which crucial and proprietary information on the tactical and strategic level is willingly availed to members of the supply chain (Mentzer *et al.,* 2001:1; Moinzadeh, 2002:414; Rai *et al.,* 2006:225; Hsu *et al.,* 2008:269; Olorunniwo & Xioming, 2010:454). It refers to the extent to which non-public information is communicated along the supply chain (Hamister, 2012:431). As such, IS orbits around the voluntary sharing of crucial data and information by supply chain members.

Several scholars (Durugbo, 2014:1207; Handfiel *et al.,* 2015:3; Song, Yu, Ganguly & Turson, 2016:741) suggest that IS is considered a principal contributor to integrated information flow for two-way communication between downstream and upstream organisations and facilitates the streamlining of inter- and intra-organisational processes. It has been regarded as an effective predictor factor of supply's chain effectiveness (Zhang & Cheng, 2013:181). To Prajogo and Olhager (2012:514), IS requires firms to voluntary exchange not only transacted data such as materials and product orders but also strategic supply chain information. There is a wide range of information that could be shared within and across the supply chain (Omar *et al.,* 2010:2489). A number of scholars have put forward that such information could be related to market sales, product design, demand information, inventory and scheduling, as well as sales forecasting (Lee, So & Tang, 2000:626; Yu, Yan & Cheng, 2001:1; Moberg *et al.,* 2002:755; Disney & Towill, 2003:199; Eisman, 2008:29; Ramayah & Omar, 2010:35). The sharing of such information enables organisations to operate and manage their activities effectively and efficiently. Hence IS is regarded as one of the best practices that organisations, both private and public, could implement.

However, factors such as absence of communication standards, lack of trust, weak supply chain relationships, confidentiality concerns, insufficient top management support, unequal distribution of risks/costs/benefits, opportunistic information leakage/misuse and uncontrollable supply chain dynamism (Fawcett *et al.,* 2006:2; Zhou & Benton, 2007:1348; Manatsa & McLaren, 2008:18; Lotfi *et al.,* 2013:298; Lee & Ha, 2018:325). Paulraj *et al*. (2008:45) suggest that effective IS in a supply chain can be achieved through the adoption of advanced information technology and

financial support. This is supported by Li *et al*. (2014:1440) who note that the effect of IS is not limited simply to the issue of whether the information is shared or not but it embraces even the issues of what type of information is shared and when and how the information is shared.

3.6.2 Types of information

There are many different types of information that can be shared within a supply chain, spanning from inventory information, sales data, sales forecasting, order information, and product ability information, to exploitation information of new products (Lotfi *et al.,* 2013:300). In many organisations, IS begins by establishing the motivation to share information which may be driven by the internal or external environment (Marshall, 2015:12). Marshall (2015:12) provides a framework of IS in SCM classification as shown in Figure 3.4.

The framework presented in Figure 3.4 is designed to frame the classification scheme of IS in SCM. The framework assumes that in many organisations IS begins by establishing the motivation to share information, which may be driven by suppliers or customers (Maschall, 2015:12). Next, the information is shared with other members of the supply chain. The synthesis of IS covers four categories, or themes of IS, namely, information quality, information mechanisms, IS investment, and IS type. Typically, IQ focuses on the overall quality of information shared, access to information, level of shared information and the effects of inaccurate IS (Omar *et al.,* 2010:2487; Kembro *et al.,* 2017:79). The category of information mechanisms is generally concerned with the technology or device that facilitates the IS process as well as the organisation's view and usage of the device (Giuipero, Hooker & Denslow, 2012:258). Moreover, Maschall (2015:12) stresses that all information shared in the supply chain impacts organisational performance, and the outcomes normally include customer satisfaction, cost reduction, and improved competitiveness.
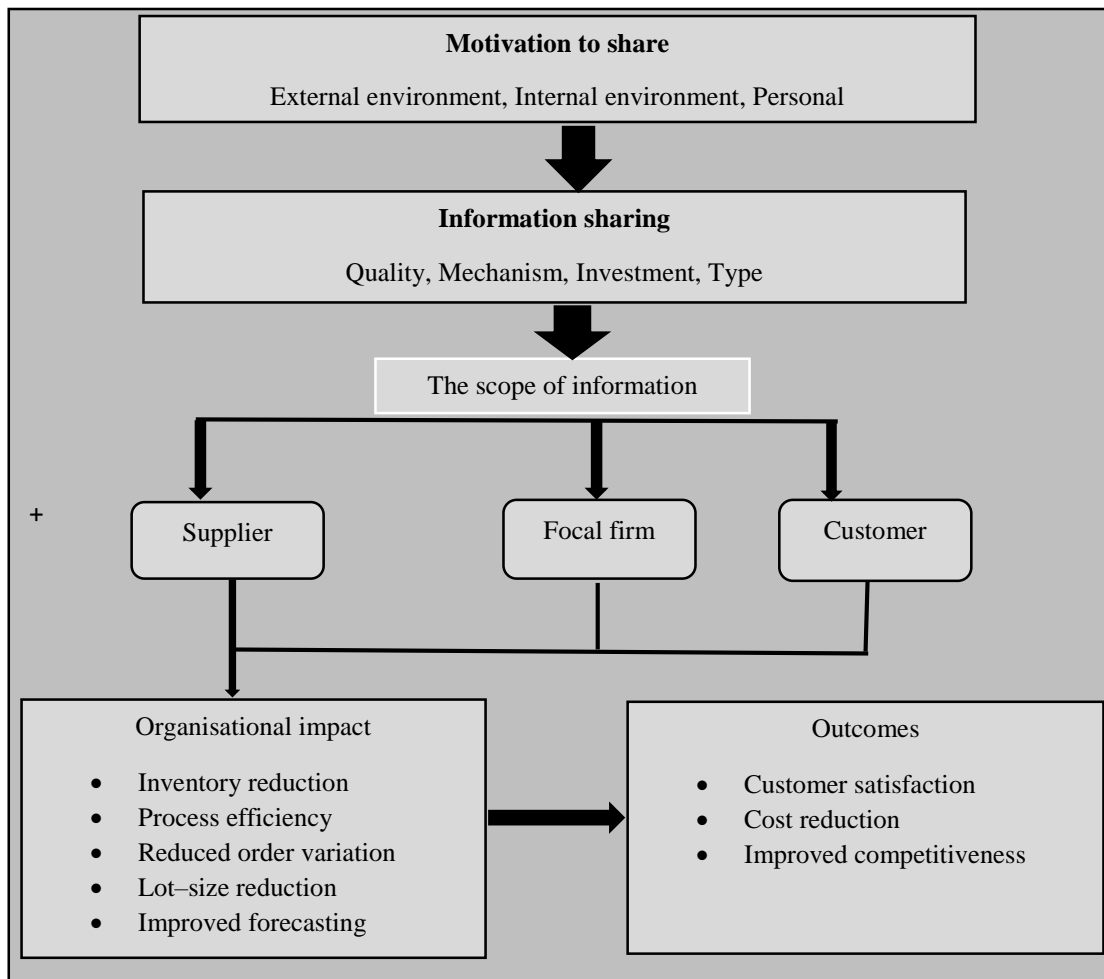
Figure 3.4: Information sharing in SCM classification framework
Source: Marshall (2015:12)

Partners like to share inventory information because they want to avoid being out of stock and stock repetition. By sharing sales, data organisations can eliminate order blow-ups, represent true customer demand, and decrease the loss caused by shortage or excess of innovative products, whereas by sharing sales forecasts better predictions are made which may enhance the competitive advantage of the supply chain. Sharing order information would lead to a quick determination of the bottleneck in a supply chain, enhancing the quality of customer's services. The flow of product ability information may assist the deceleration of the possible shortage of gaming behaviour and avoid potential causes of the bullwhip effect.

3.6.3 Factors influencing information sharing

The impact of IS in supply chains has become more significant in this era of excessive competition (Lofti *et al.,* 2013:300). Antecedents such as the advancement in technologies, inventory management, coordination and integration of supply chains have been advanced as enablers for sharing information in organisations (Lofti *et al.,* 2013:300. This is supported by a number of scholars who note that to survive in today's volatile economy; supply chain partners need to improve their competitive advantages by IS (Tsung, 2000:211; Zha & Ding, 2005:787). Other antecedents alluded to by other scholars include trust, commitment, and the quality of information (Morton *et al.,* 2006:3227; Lee *et al.,* 2010:660). It is affected by factors such as technology usage in the supply chain, trust between supply chain members and willingness as well as connectedness of supply chain actors (Cai, Jun & Yang, 2010:257; Cheng, 2011:374). Other barriers identified include confidentiality of the information shared, incentive issues, reliability and cost of information technology as well as inefficient and non-user-friendly systems (Fawcett *et al.,* 2008:318; Pandey, Garg & Shankar, 2010:226; Khurana, Mishra & Singh, 2011:9; Sharma & Kumar, 2017:1).

However, factors such as managerial, organisational, financial, technological, individual and socio-cultural barriers militate against IS in organisations. Managerial barriers arise because the managers dealing with the supply chain do not realise the real benefits of sharing information, and they act as gatekeepers as they do not have confidence in the IS system (Marsh & Flanagan, 2000:22). Zipf (2000:55) is of the same view as he concludes that the lack of leadership and managerial direction for IS renders the implementation of IS extremely difficult. Curry and Moore (2003:72) are of the view that to achieve an IS culture, support from senior management is required.

Fawcett *et al*. (2008:222) conclude that lack of trust makes it difficult to share information in the supply chain because managers feel that they cannot afford to share sensitive proprietary information without ensuring how other supply chain members will protect it from misuse.

Organisational barriers, on the other hand, are categorised as those barriers that originated from attitudes towards the implementation of IS. These barriers are due to the organisational structure and the groups involved in IS. IS initiatives require radical changes in process and behaviour of individuals as well as the organisation. Normally organisations and individuals resist the changes because of structural conflicts and managerial practices of a different organisation in the supply chain. Tsai (2002:15) reports that organisations with centralised, hierarchal structures have a significant negative impact on sharing information in a supply chain. This view is supported by Fawcett *et al*. (2008:222) who note that organisations with a high level of bureaucracy and strict administrative rules lack the IS spirit in the supply chain (Bures, 2003:2). Top management support has consistently been found to play an important role in the adoption and implementation of an IS system.

Financial constraints are an additional barrier as they are a key barrier to IS in supply chains. Cost considerations are the prime challenges to support the infrastructure and human resource requirements of the information system. Information and technology systems require more funds because without this, efficient IS cannot take place in supply chains. Cragg *et al*. (2002:18) report that a lack of resources inhibits organisations in adopting IS systems.

Moreover, there are also technological barriers affecting the implementation of IS. The advancement of info-technology has increased the ease of IS and has provided better methods to share and integrate information (Skarma & Kumar, 2017:1). Technological linkages across organisational units, as well as up and down the supply chain, are particularly critical to sharing information. However, the complexity of technology is a critical factor that affects the adoption of IS. Different organisations in the supply chain may use various types of hardware, software, data standards, and definitions, as well as programming languages and the task of integrating them could be particularly challenging. Additionally, poor information and technology (IT) infrastructure has been cited as a barrier to effective IS (Skarma & Kumar, 2017:1).

Furthermore, barriers which originate from the behaviour and actions of either individuals or groups within or between various business functions are considered individual barriers. Constant

et al. (1994:3) conclude that individual efforts sometimes shutter the organisation's efforts to encourage and facilitate IS.

3.6.4 Benefits of information sharing in supply chains

The practice of IS has attracted significant attention from a number of scholars who stress its role and influence in the effective and efficient functioning of a supply chain (Jraisat, Gotsi & Bourlakis, 2013:323; Kembro & Naslund, 2014:179; Leung, Choy & Kwong, 2010:64). Sharing information amongst supply chain members may bring a number of benefits to businesses, among these benefits is inventory reduction and efficient inventory management (Mourtzis, 2011:1; Lotfi *et al.,* 2013:301). It enables companies to access and share data along the supply chain, making the fulfilment of supply chain processes more efficient and cost-effective (Ding *et al.,* 2014:91). The sharing of information in the supply chain allows for faster and more accurate business decisions that translate as a source of competitive advantage, it is regarded as a terminator of the bullwhip effect that reduces the total cost of the supply chain delivery (Yu, Yan & Cheng, 2001:114; Du *et al.,* 2012; Khan *et al.,* 2016). This view is also noted by Kelepouris, Miliotis and Pramatari (2008:3657) who denote that effective sharing of information between supply chain members has been determined to be a crucial antecedent aspect in mitigating the negative impact of the bullwhip effect.

It also enables supply chain partners to work as a single entity by exchanging information and taking care of problems affecting partners thereby improving their operational performance (Gimenez & Lourenco, 2008:309; Prajogo & Olhager, 2012:515; Ding *et al.,* 2014:91; Sundram, Chandran & Bhatti, 2016:1451). Similarly, Fawcett et al. (2007:359) note that to respond productively to rapid changes, companies must be aware of new information generated in its environment and adopt structures that enable fast decision making and practices that reduce information overload.

Some authors (Collin, Eloranta & Holmstrom, 2009:411; Yang & Maxwell, 2011:164) advocate that IS enables supply chain members or partners to understand each other better and accurately respond to ever-changing customer requirements. In support, Hsu *et al*. (2008:279) mention that

IS contributes largely to improved relationships between suppliers by facilitating efficient coordination and responsiveness as well as an integration of the partner's information systems. Li and Gao (2011:1) also ascertain that sharing information between business partner's builds and strengthens relationships and social ties among the information receivers and givers.

Additionally, through effective and efficient dissemination and exchange of information, the supply chain is hastened, accurate decision making is made possible, and this in turn leads organisations towards competitive advantage (Sundram, Chandran & Bhatti, 2016:1451). This is supported by other scholars who note that the ability of firms to gain competitive advantage and ensure product availability in the supply chain is being determined by how information is used in the supply chain (Mason-Jones & Towill, 1997:137; Ramayah & Omar, 2010:35). In addition, IS impacts heavily on operational performance, inventory cost and new product development as well as commercialisation (Liu *et al.,* 2011:325; Moshkdanian & Molahosseini, 2013:188). Moshkdanian and Molahosseini (2013:189) further add that customer value creation could only be realised when organisations share more than just transactional data.

In this section, literature concerning IS was analysed. From the literature, it can be established that IS plays a significant role in the performance of both organisations and the entire supply chain. It was affirmed that factors such as technologies, inventory management, trust and commitment, to mention a few, spur organisations on to share information in the supply chain. The literature review also established that supply chains tend to benefit and work efficiently if correct and critical information is shared amongst supply chain members. The next section analyses the literature on IQ.

3.7 INFORMATION QUALITY

While IS is supreme, the significance of its impact on supply chain performance also depends on the quality of information being shared (Li & Lin, 2006:1641). This section discusses literature on IQ, which is one of the SCM practices under consideration in this study. Information pertaining to what it actually is, will be discussed, and the antecedents that drive organisations to share quality information will be deliberated. This section also discusses the benefits of sharing quality information in supply chains.

3.7.1 Conceptualisation of information quality

IQ can be defined as the ability to satisfy stated and implied needs of information users (Gutavsson & Wanstrom, 2009:155). It includes all aspects of managing information and communicating effectively and efficiently in terms of accuracy, timeliness, adequacy, and credibility (Li *et al.,* 2006:1641; Nagarajan *et al.,* 2013:788; Jonsson & Myrelid, 2016:1771). Other authors (Zhou & Benton, 2007; Song, Yu, Ganguly & Turson, 2016:742) advocate that IQ refers to the degree to which the information exchanged suffices the organisation's requirements. To Hamister (2012:432), IQ can be viewed as the accuracy and credibility of information shared between trading partners. Others refer to it as the extent to which critical and proprietary information is communicated among supply chain members with regards to the market, product and customer information (Mentzer *et al.,* 2001:2; Li *et al.,* 2006:425). Thus, IQ deals with the type of information shared in supply chains.

A number of scholars suggest accuracy, timeliness and proper formatting of information as determinants of IQ (Closs, Goldsby & Clinton, 1997:4; Gustin, Daugherty & Stank, 1995:1). Other scholars support that there are five criteria of IQ, including accuracy, timeliness, adequacy, credibility, and reliability of the information being shared (Moberg *et al.,* 2002:755; Monczka *et al.,* 1998:5553; Li *et al.,* 2006:425). According to Ding *et al*. (2014:92), literature reveals that the dysfunctional effects of inaccurate or delayed information can be a detriment on operational effectiveness. Moberg *et al*. (2002:755) add elements such as completeness, adequacy, and credibility while Miller (2005:93) adds believability, objectivity, precision and reliability of the information, relevancy, comprehensibility, interpretability, consistency, conciseness, format, security and availability as determinates to measures of IQ. However, supplier uncertainty and inter-organisational relationships such as lack of trust, commitment, and shared vision are the most critical factors in determining the level of IQ in a supply chain (Li & Lin, 2006:1641).

3.7.2 Factors influencing (drivers or antecedents) information quality

The importance of IQ has been discussed in many studies (Li *et al*., 2006:1641; Rabren, 2010:42; Ramayah & Omar, 2010:35) and it was established that exchanging quality information between

supply chain partners is a vital component for organisational success. The quality of information is influenced by a myriad of factors. Zellal and Zaouia (2017:162) put forward that factors such as top management commitment, teamwork, data management quality practices, schedule, and technology influence the quality of information shared in a supply chain. Zellal and Zaouia (2017:162) are of the view that although most companies delegate authority for managing IQ to other internal departments, it is top management's duty to set up policies for quality information and to allocate resources to achieve it. Shankaranarayanan and Cai (2006:302) are of the same view as they suggest that a strong commitment from top management is a key factor to achieve enhanced IQ in organisations. Therefore, top management commitment is crucial to achieving the sharing of quality information in a supply chain.

Teamwork is another IQ enabler mentioned by Zellal & Zaouia (2017:162). They, Zellal and Zaouia (2017:162) opine that teamwork between stakeholders in a supply chain is vital for the achievement of quality information in organisations. Xu (2008:48), and Cheng and Choy (2007:234) are of the same view as they note that teamwork influences IQ in organisations. In addition there is also a technology factor, which encompasses ELT tools that are dedicated to extract, transform and load data in an organisation. The tools allow data quality improvement as they impact on the freshness and timeliness dimension of data quality. The schedule is also another driver of IQ mentioned by Zellal and Zaouia (2017:162). The schedule dimension pertains to the planning, freshness and the life span of the information to be shared. Thus, it relates to accuracy, completeness, and relevance of the information. So is data quality management practices, which according to Weber, Otto and Osterle (2009:7), are the quality-oriented management of data as an asset, that is, the planning, provisioning, organisation, usage, and disposal of data that supports both decision making and operational business processes as well as the design of the appropriate context with the aim to improve IQ.

3.7.3. Benefits of sharing quality information

Exchanging quality information between customers and suppliers is a vital component for organisational success (Mason-Jones, 1997:137; Monzcka *et al.,* 1998:553; Holmberg, 2000:847; Miller, 2005:93; Li *et al.,* 2006:107; Forslund & Jonsson, 2007:90). Every organisation requires

quality information to cope with the uncertainties in the business environment and improve their decision-making process (Song *et al.,* 2016:742). Access to the right information enables firms to reduce uncertainty and improve planning which in turn improves their profitability. Firms that have access to the right information would be more proactive in responding to changes in market conditions thereby becoming more focused on meeting customer needs (Daugherty *et al.,* 1995:4). This is supported by other scholars who note that the quality of information shared in supply chains impacts the quality of decision making in the organisation and product development (Rabren, 2010:42).

IQ exchange and practices among partners in a supply chain enable them to coordinate supply chain activities effectively well (Forslund & Johnson, 2007:90). Gustavsson and Wänström (2008:1) add that organisations should view IQ practices as an integrative strategic tool and guarantee there will be no distortion or manipulation in the information flow. This will not only improve the decision-making process but also helps obtain the best supply chain operational solution (Sundram, Chandran & Bhatti, 2016:1451). Customer dissatisfaction, increased cost and low employee morale, ineffective decision making and inability to implement effective strategy are related to poor data quality. Additionally, the increase in cost is attributed to correcting errors that have been incurred due to poor data quality. Poor IQ does affect not only the performance of the firm but also the rate of responsiveness as well as mismatched inventory (Rossin, 2007:151). Moreover, the sharing of IQ in a supply chain improves organisational performance, increases competitive advantage and increases market share (Miller, 2005:93; Omar *et al.,* 2010:2491).

The discussion above indicates that IQ is an SCM practice that plays a critical role in the effectiveness of supply chains. From the literature, it can be affirmed that IQ enables organisations and supply chains enable firms to reduce uncertainty and improve proper planning as well as increase competitive advantage. The next section explores literature on SCD.

3.8. SUPPLY CHAIN DESIGN

The ability to design an effective supply chain is an important core capability of an organisation because it enables or limits the organisation's competitiveness. As competition shifts from

competition between organisations towards competition between supply chains, SCD will become a key source of competitive advantage and will be a critical factor in determining the efficiency and effectiveness of a supply chain (Reeve & Srinivasan, 2005:50; Sezen, 2008: 234). This section will explore literature focusing on SCD.

3.8.1. Conceptualisation of supply chain design

SCD entails the task of determining the basic, long-term structure of the supply chain by defining its elements, objectives, locations and key organisations (Leukel & Sugumaran, 2013:288). In the view of Chopra and Meindle (2003:15), SCD involves the decisions about the number of suppliers, proximity to a supplier, supplier selection and evaluation, planned capacities in each facility, definition of contractual terms and reactions to the possible disagreements between channel members. It is a complex task which involves aligning the capabilities of the supply chain with customer needs, thus creating value for the end customer and profitability for all supply chain partners (Fawcett *et al.,* 2007:216).

SCD is one of the critical factors determining the efficiency and effectiveness of a supply chain (Sezen, 2008:234). It includes decisions regarding transportation, inventory, operating facilities, and information flow in the supply chain to maximise the overall value generated (Prasad, Subbaiah & Rao, 2014:712). Consequently, SCD has several dimensional constructs, which include location factors, manufacturing performance, capacity planning, supplier selection and evaluation of capabilities as well as the sufficiency of distribution channels between supply chain partners (Sezen, 2008:234).

SCM design faces two critical difficulties, namely, design space and that of incorporating stakeholders (Leukel & Sugumaran, 2013:288). The design space contains a vast number of alternatives, which makes it hard for designers to evaluate and select the best alternative. The second difficulty is that of designing a supply chain that incorporates stakeholders from the supply and demand side, which requires sharing and understanding design information by various parties. Some scholars (Taylor, 2004:259; Christopher, 2005:15; Sharifi *et al.,* 2006:1078; Fawcett *et al.,* 2007:222) suggest that SCD has three broad phases. The first phase involves understanding the

nature of the needs of their end customers and how these needs can be met by some value propositions (Taylor, 2004:259; Christopher, 2005:57). Christopher (2005:57) and Fawcett *et al.* (2007:222) are of the view that organisations must understand that SCD can contribute value to meet the demands of the end customers of its supply chain. In the second phase, organisations must select a supply chain strategy to be able to deliver value to their customers (Taylor, 2004:279). Thirdly, is configuring the supply chain structure (Sharifi *et al.,* 2006:1078; Fawcett *et al.,* 2007:222). Configuring the supply chain structure includes deciding on supply chain partners, assigning roles and responsibilities to each supply chain member, deciding how supply chain drivers should be utilised and establishing key performance indicators. To Taylor (2004:284) and Fawcett (2007:335), the third phase is referred to as scoping the supply chain structure. Phase two and three have to be aligned towards meeting the first phase which is meeting the end customer's needs (Sharifi *et al.,* 2006:1078). These three phases are illustrated in Figure 3.5.
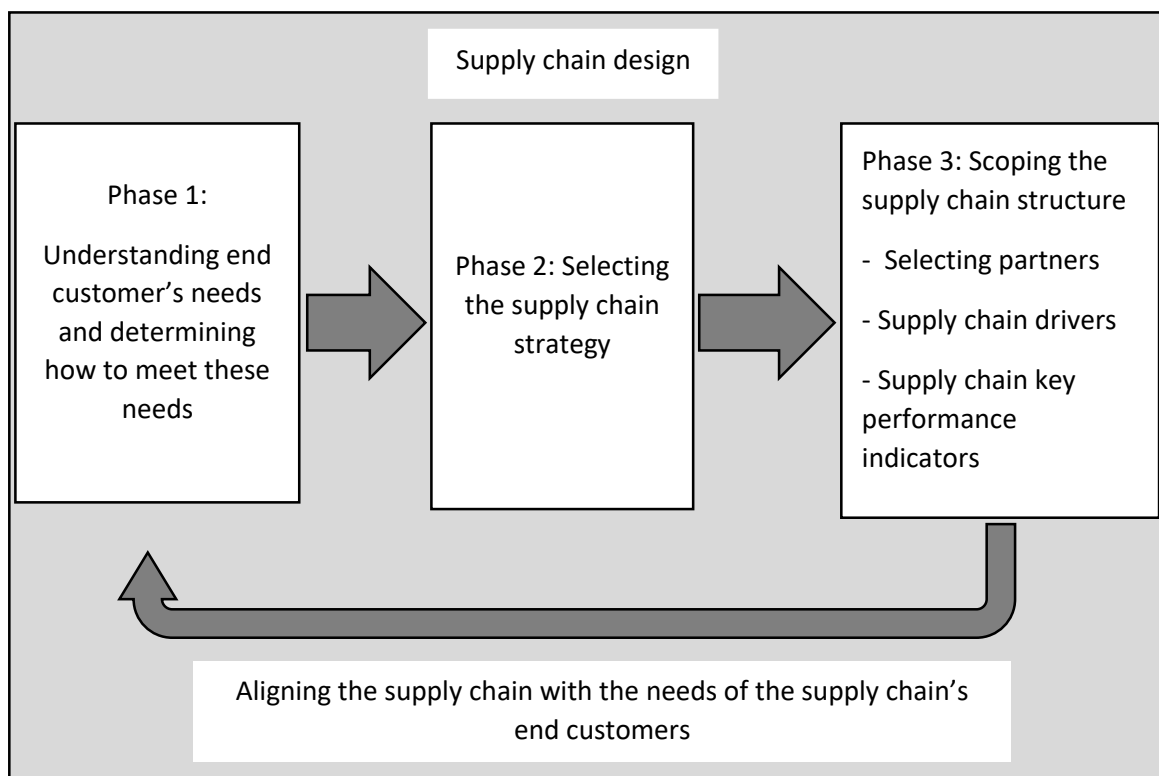
Figure 3.5: Phases of supply chain design
Source: Nel and Badenhorst-Weiss (2010:5)

3.8.1.1 Phase One of the supply chain design: end customer's needs

The supply chain's end customer is the person at the end of the supply chain who decides whether or not to buy the product or service offered by the supply chain (Harrison, 2001:18). Jeong and Hong (2007:657) are of the view that the customer is the ultimate judge of supply chain performance. The customer should be the starting point of any supply chain's design. Christopher (2005:57) highlights that the challenge in many supply chains is to design supply chains with the end customers' needs in mind. Therefore, for organisations to design a world-class supply chain they need to understand and know their end customer's real needs (Fawcett *et al.,* 2007; Badenhorst-Weiss & Nel, 2011:2). Badenhorst-Weiss and Nel (2011:3) further note that Phase One of the SCD can be divided into two sections, namely, understanding end customer's needs and how to meet these needs.

3.8.1.2 Phase Two of supply chain design: selecting a supply chain strategy

Once organisations understand their end customer's needs and have determined how to meet these needs they can select a supply chain strategy (Christopher & Peck, 2004:57; Taylor, 2004:259; Raturi & Evans, 2005:8). Hines (2004:2), and Badenhorst-Weiss and Nel (2011:3) define supply chain strategies as approaches required to manage the integration of all the supply chain activities through improved supply chain relationships to achieve a competitive advantage for the supply chain. The supply chain strategy starts with the business value proposition to customers, based on core competencies and identified market winners and shows how the supply chain contributes to achieving business goals (Tang & Gattorna, 2003:4). Organisations need to understand the nature of their products and must be able to devise a supply chain strategy that best fits their customer's demands. Badenhorst-Weiss and Nel (2011:3) underscores that supply chains may be distinguished into two broad categories, namely, agile (responsive) and lean (efficient).

3.8.1.3 Phase Three of supply chain design: structuring the supply chain

The supply chain structure implies the integration of the focal organisation and the links between supply chain members and must support the supply chain strategy (Defee & Stank, 2005:34). The

structure embodies the configuration of the supply chain's processes and operations. Organisations have to identify supply chain partners they would want to build collaborative relationships with and the extent to which they would want to manage these relationships (Taylor, 2004:259; Raturi & Evans, 2005:8).

Melnyk, Narasimhan and DeCampos (2014:1890) advance that SCD as a process is shaped by three salient dimensions that have a hierarchical relationship, namely, influencers, design decisions, and building blocks. Figure 3.6 summarises the three levels of factors influencing SCD.
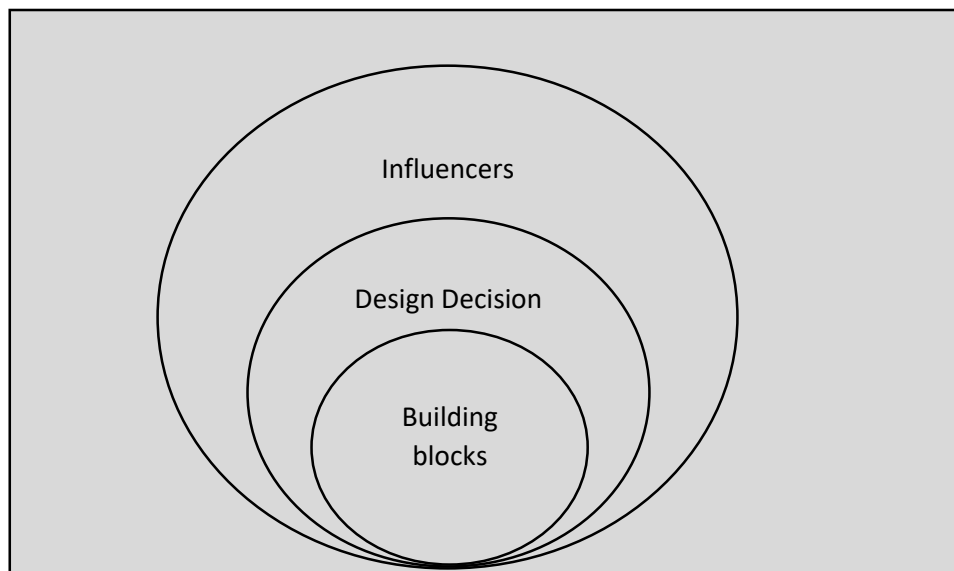
Figure 3.6: Three levels of factors influencing supply chain design
Source: Melnyk, Narasimhan and DeCampos (2014:1892)

Figure 3.6 shows that the three levels of factors influencing SCD comprise of influencers, design decisions and building blocks. Influencers are broad-based environmental factors that constrain and significantly influence the overall nature of the resulting supply chain (Melnyk *et al*., 2014:1892). Included are the life-cycle consideration, desired supply chain outcomes, business models/critical customers and the overall environment (Melnyk *et al.,* 2014:1892). Design decisions are specific decisions that must be made regarding the overall structure and design of the supply chain. Also included are decisions regarding physical network design (capacity

positioning, transportation network and geographic dispensation of sites), sourcing strategies, social network design, relationship governance mechanisms, and behavioural management strategies (Melnyk *et al.,* 2014:1890). On the other hand, building blocks are specific investments required to implement the above-listed design decisions and are the necessary inputs into building the desired supply chain. These building blocks include investments such as physical structures, models of transportation, Enterprise Resource Planning systems, sourcing decision tools and procedures, contracts, inter-firm process development and investments in social capital (Melnyk *et al.,* 2014:1890). Melnyk *et al*. (2014:1890) further note that each of these three dimensions must be explored and understood in concept to appreciate and manage the richness and complexity inherent in SCD.

3.8.2 Factors influencing (drivers or antecedents) supply chain design

Various factors such as market structure, procurement cost overheads, inventory holding cost, procurement cost, and market segment typically influence SCD. The supply chain is considered to be designed according to product characteristics or customer requirements (Godsell *et al.,* 2011:296).

Analysing product-related drivers, Pashaei and Olhagre (2015:98) suggest that a specific stream of research proposes that SCD should be driven by and thus designed in accordance with the product that is going to be delivered. Originally this idea was introduced by Fisher (1997) who suggests that functional products match an efficient SCD whereas innovative products would match a responsive SCD. Noori and Geogescu (2008:2765) are also of the view that a redesign of supply chains can be triggered by demand for a new product design such as customers' needs evaluation, market segments targeting and product architecture decisions. This includes new products, complaints about performance and malfunction of existing products (Seuring, 2009:221; Gokhan, Needy & Norman, 2010:20). Moreover, it relates to the trade-off between supply chain cost, sales profit and product design complexities (Yadav *et al.,* 2011:56).

Customer-related drivers focus on end customer satisfaction with either the product or the service (Godsell *et al.,* 2011:296). Usually, SCD activities such as strategy development must be based on

customer needs so that the supply chain choices are customised correspondingly with the voice of the customer (Hwang & Rau, 2007:23; Macchion, Fornasiero & Vinelli, 2017:1386). More so, Christopher and Towill (2002:1) point out that SCD must match the requirements of the marketplace. They further elaborate that marketplaces are volatile and extremely price sensitive in which the drivers, "cost" and "availability", are the winners of the market.

However, the effectiveness of SCD is hindered by barriers such as policies, people related barriers, and complexity barriers as well as cost related barriers (Kraegpoth, Stentoft & Jensen, 2017:6849). As supply chains cross many borders, some issues may have different regulations, and therefore government policies can create constraints upon how to develop the supply chain (Lee & Wilhelm, 2010:225; Weiler *et al.,* 2011:265). Further clarity and stability of the regulations could create hesitation upon making a change as companies may not feel safe in creating sustainable changes to the supply chain (Kraegpoth, Stentoft & Jensen, 2017:6849). A number of scholars put forward that barriers across borders, such as trade barriers caused by globalisation, are constraints as well as increased focus on stricter environmental regulation (Kodali & Routroy, 2006:86; Lee & Wilhelm, 2010:225; Bogataj, Grubbström & Bogataj, 2011:243).

People-related barriers relate to lack of skills and qualifications in organisations, which can further lead to a lack of innovation and change. (Weiler *et al.,* 2011:265; Baud-Lavigne, Agard & Penz, 2012:50). People-related barriers include factors such as personal beliefs, preconceptions or just a lack of will to adopt changes (Weiler *et al.,* 2011:265). Other scholars add culture and language differences as problems that can act as barriers to SCD (Craighead, Blackhurst, Rungtusanatham & Handfield, 2007:131; Weiler *et al.,* 2011:265). Other issues include poor communication among supply chain partners (Childerhouse & Towill, 2002:3499) and lack of mutual trust when information is to be shared (Huang, Lau & Mak, 2003:123).

Moreover, complexity-related barriers take into consideration various factors when designing the optimal SCD (Reiner & Trcka, 2004:1). The factors vary from the infrastructure of the country, facility location, excessive inventory holding, and product design issues (Bogataj, Grubbström & Bogataj, 2011:453; Weiler *et al.,* 2011:265; Baud-Lavigne, Agard & Penz, 2012:50*;* Lorentz, Kittipanya-Ngam & Srai, 2013:220). Other complexity-related barriers include a coordinated

selection of stakeholders and coordination efforts over long distances (Weiler *et al.,* 2011:265; Lorentz, Kittipanya-Ngam & Srai, 2013:220).

Moreover, Kraegpoth, Stentoft and Jensen (2017:6849) add cost-related barriers to SCD. Kraegpoth *et al*. (2017:6849) further indicate that cost is a major challenge for any company in developing the SCD. Cost-related barriers include transfer prizes, currency fluctuations, wages, and taxation regulations, all which can hamper SCDs (Goetschalckx, Vidal & Dogan, 2002:1; Lee & Wilhelm, 2010:225; Weiler *et al.,* 2011:265).

3.8.3 Benefits of supply chain design

A well-designed supply chain in terms of locations, distances, capacities, and planning has many benefits to firms in a particular supply chain (Sezen, 2008:238). The benefits include providing firms with a competitive advantage and flexibility (Sezen, 2008:238; Leeukel & Sugumaran, 2013:288). This is supported by Lee (2002:660), Jacobs and Chae (2008:3), and Badenhorst-Weiss and Nel (2011:3) who note that agile supply chain designs improve the responsiveness of organisations to customer needs as well as flexibility.

In addition, Leeukel and Sugumaran (2013:288) further note that a well-organised SCD also impacts significantly on the firm's resources and performance. This is supported by other scholars who tout that well-structured and designed supply chains drive cost savings as inventory costs are reduced (Llamasoft, 2018:1). Vitasek, Manrodt and Abbott (2005:22) are of the same view as they note that SCDs work at reducing cost and waste of resources. Besides, it is generally accepted that supply chain performance is influenced by the supply chain structure (Moon, 2004:20). This is also supported by Person and Olhager (2002:231) who put forward that changes in the structural design of the supply chain may improve the performance of the supply chain (Chopra & Meindl, 2010:15).

3.9 SUPPLY CHAIN INTEGRATION

A well-integrated supply chain is one of the primary business strategies to improve supply chain performance. Although there is an extensive body of research on SCI, its conceptual vagueness has remained for than a decade (Lau *et al.,* 2010:20; Tsinopoulos & Mena, 2015:1437). In this section, SCI is defined, the factors or drivers for integration are identified, and the benefits of integrating are also outlined.

3.9.1 Conceptualising supply chain integration

By definition, SCI refers to the degree to which an organisation strategically collaborates with its supply chain partners and manages intra- and inter-organisational processes to achieve effective flow of products, services, information, money and decisions with the objective of providing maximum value to its customers (Zhao *et al.,* 2008:374; Kamal & Irani, 2014:526; Cao, Huo, Li & Zhao, 2015:928; Wang, Chiderhouse, Kang, Huo & Mathrani, 2016:840). Other scholars depict SCI as the extent to which all the activities within an organisation and the activities of its suppliers, customers, and other supply chain members are integrated (Narasimhan & Kim, 2002:303; Rai *et al.,* 2006:225; Stonebraker & Liao, 2006:34; Sundram & Bhatti, 2016:1448; Uwamahoro, 2018:1). Flynn *et al*. (2010:58) conceptualise SCI as the degree to which a manufacturer strategically collaborates with partners within its supply chain and collaboratively manages inter- and intra-organisational processes. Moreover, it measures the degree to which a firm collaboratively manages intra- and inter-organisational processes and activities to accomplish efficient flows of products, services, information and money (Lee, Seo & Dinwoodie, 2016:670; Zhu, Krikke & Caniels, 2018:212; Wang, Kang, Childerhouse & Huo, 2018:830).

In the view of Stevens and Johnson (2016:19), SCI is the collaboration of all partners across the supply chain to enhance performance while Huo (2012:596) describes SCI as an efficient and effective approach to improving the performance of supply chains. Rokonuzzaman (2018:5) conceptualises it as the extent to which the manufacturers and marketers strategically cooperate with their supply chain partners and collaboratively manage the intra- and inter-organisational processes. Other authors (O'Leary-Kelly & Flores, 2002:221; Seo, Dinwoodie & Kwak, 2014:733)

describe SCI as the strategic integration of both intra- and inter-organisational process that gauge the extent to which supply chain partners work collaboratively together to gain reciprocally beneficial outcomes. It links a firm with its customers, suppliers and other channel members by integrating their relationships, activities, functions, processes, and locations (Naslund & Hulthen, 2012:481). It includes two stages of internal integration between functions and external integration with trading partners (Sundram, Chandran & Bhatti, 2016:1148). From the aforementioned definitions, it can be deduced that SCI involves the collaboration of supply chain members with the aim of working together to improve supply chain performance.

3.9.2 The four classes of supply chain integration

SCI can be classified into four groups, which are supplier, customer, internal, and information integration (Kumar *et al.,* 2017:3). Naslund and Hulthen (2012:15) are of the view that SCI links a firm with its customers, suppliers and other channel members by integrating their relationships, activities, functions, processes, and locations. SCI is multi-dimensional as it involves two main types, namely, external and internal integration (Trkman & Groznik, 2006:37; Flynn *et al.,* 2010:251; Vijayasarathy, 2010:679; Yu *et al.,* 2013:114; Wong *et al.,* 2013:67; Sundram & Bhatti, 2016:1448). External integration involves the integration of suppliers and customers through various activities such as strategic alliances, information sharing, communication, process coordination, joint product development and working together (Swink *et al.,* 2007:148; Flynn *et al.,* 2010:250; Droge *et al.,* 2012:523). This is supported by other scholars who note that external integration is also referred to as customer and supplier integration, which is the degree to which a manufacturer partners with its external partners to structure inter-organisational strategies, practices, and procedures into collaborative, synchronised processes to fulfil its customers' requirements (Danese *et al.,* 2013:125; Uwamahoro, 2018:5). External integration includes forward integration for physical flow of deliveries between suppliers, manufacturers and customers and backward coordination of information technologies and the flow of data from customers, to manufacturers, to suppliers (Schoenherra & Swink, 2012:99).

Customer integration involves core competencies derived from coordination with critical suppliers (Kim, 2006:241; Flynn *et al.,* 2010:58). Customer integration occurs when firms work closely with

customers and consider them as a crucial part of the supply chain (Zailani & Rajagopal, 2005:379; Quesada *et al.,* 2008:296; Danese & Romano, 2013:372). The integration of customers in the supply chain gives the opportunity for firms to have an overview of the requirements and their specific needs giving them the advantage of serving them better. Integrating customers in the supply chain is centred on drawing information from customers such as their patterns, their preferences for products and their ability to purchase products, which would be used in making better decisions during the manufacturing process or sales to customers (Lotfi *et al.,* 2013:36). When firms collaborate with their customers, they can respond quickly and efficiently with their customers improving their order fulfilment as well as improving visibility (Kumar *et al.,* 2017:817).

On the other hand, supplier integration refers to a state of syncretism among the supplier, purchasing and manufacturing constituents of an organisation (Das *et al.,* 2006:563). Supplier integration represents a situation where suppliers are involved in the key decision-making processes of the firm with information regarding demand forecasts, production and inventory levels being shared between them. It involves focal firms working in partnership with their key suppliers to maximise the benefits of the relationship such as the lead times, innovation and quality (Thun, 2010:30). The customer-supplier integration process should be one that focuses on solidifying the relationships between both parties for their collective benefits (Furlan, Romano & Camuffo, 2006:633). The major drive of supplier integration with customers should be on how to improve the customer experience or serve them better (Kumar *et al.,* 2017:817).

In contrast, internal integration focuses on activities within a firm. It is the degree to which a manufacturer structures its own organisational strategies, practices, and processes into collaborative, synchronised procedures to fulfil its customers' requirements and effectively interact with its suppliers (Cespedes, 1996:25; Uwamahoro, 2018:5). Other scholars propose that, while internal integration recognises that the departments and functions within the firm should function as part of an integrated process, external integration recognises the importance of establishing close, interactive relationships with customers and suppliers (Qi, Zhao & Sheu, 2011:371; Kim, 2013:74; Uwamahoro, 2018:5). Ralston *et al.* (2015:47) posit that internal integration improves the firm's performance by reducing costs and limiting the ability of

departments within the organisation from taking steps that would distort the overall goals of the organisation.

Other scholars have added information integration as another dimension of SCI (Sadler, 2007:288; Amue & Ozuru, 2014:129; Kumar *et al.,* 2017:818). They argue that information integration has been found to be a necessity for firms looking to integrate with their customers and suppliers. Supply chain information integration has been defined as the extent to which a manufacturer strategically shares information within organisational functions and across supply chain partners to collaboratively manage intra- and inter-organisational processes (Flynn *et al*., 2010; Huo, Han & Prajogo, 2016:662). However, it is not just restrained to the efficiency and application of technology but requires them to be at the designated location at the right time for an effectual decision-making process (Sadler, 2007:288). When information is shared across the supply chain, data can be collected from real time inputs and role-playing of people. Technological systems further originate, sort, process and disperse information as closer communications are then created with other members in the supply chain, which will lead to improved service and improved demand forecasting (Amue & Ozuru, 2014:129). However, both perspectives are crucial in allowing supply chain members to act in a concerted way so as to maximise the value of the supply chain. Figure 3.7 shows the types of SCI, namely, supplier integration, customer integration, internal integration and information integration.
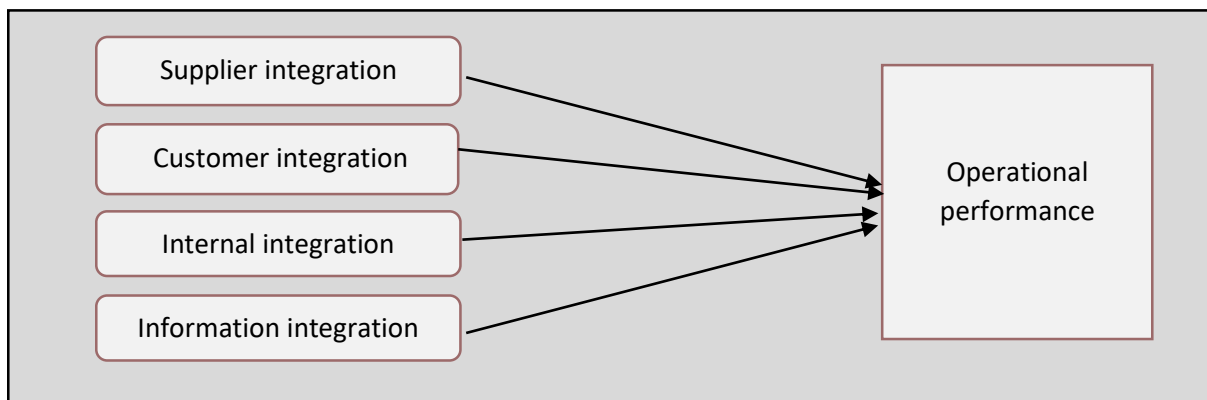
Figure 3.7: Supply chain integration
Source: Kumar *et al*. (2017:818)

3.9.3 Antecedents to supply chain integration

SCI is enabled through social interactions, mutual adaptation and relation-specific investments (Wu *et al.,* 2004:322; Cao *et al.,* 2015:24). Other scholars note that social interaction as an integration enabler is not limited to economic factors only but also to social interaction behaviour of supply chain actors such as exchange, obligation, and beliefs (Zhao *et al.,* 2008:17; Wu, Chuang & Hsu, 2014:123). Other scholars add factors such as trust, commitment, power and mutuality (reciprocity) as enablers for SCI (Sabir & Iefan, 2014:52). Information and communication technology (ICT) is an essential enabler of efficient SCI, and many ICT applications have recently gained popularity. ICT enablers facilitate, coordinate and integrate the flow of information across the supply chain as well as helping supply chain members to establish partnerships for better performance (Jharkharia & Shanker, 2005:8; Georgise, Klause-Dieter & Seifert, 2014:180).

However, a number of scholars identified lack of information and technology, lack of information sharing, lack of trust, demand distortion-bullwhip, system incompatibility, lack of knowledge and cost of integration as barriers to SCI (Sammuel & Kashif, 2013:52; Sabir & Irfan, 2014:56). Ellinger *et al*. (2006:2) add factors such as insufficient knowledge of other functions, lack of communication, poor working relationships, conflicting goals and lack of direction from senior management as other impediments to effective integration in supply chains. Moberg *et al*. (2003:34) also include factors such as internal politics, misaligned goals and objectives, weak management information systems, short-term orientation to goals, and supply chain complex issues.

3.9.4 Benefits of supply chain integration

Integration between suppliers, customers and manufacturers (internal integration) offers opportunities for improving the accuracy of demand information, which reduces the manufacturer's product design and product planning time and inventory obsolescence, allowing it to be more responsive to customer needs (Danese & Romano, 2011:220). Sezen (2008:233) perceives that an increase in the level of SCI will provide rapid access to a required source of information, more sensitivity towards the needs of customers and enable faster response time

creating a competitive edge among competitors. SCI also generates opportunities for leveraging the intelligence embedded in collaborative processes, reduces costs to create greater value and detects demand changes more quickly (van der Vaart & van Donk, 2012:583). This is also noted by Lee (2000:30) who suggests that well-integrated supply chains create value for shareholders by decreasing costs and increasing market share. Integration also results in improved decision making, enhanced knowledge sharing, aligned capabilities, built learning routines and increased performance of supply chain partners (Echtelt *et al.,* 2008:180; Zhao *et al.,* 2011:17; Tarifa-Fernandez & De Burgos-Jiménez, 2017:1244; Uwamahoro, 2018:7). SCI benefits organisations by helping to decrease time-to-market, quality problems, costs and leads to customer satisfaction as well as increases competitive advantage for the organisation (Danese & Romano, 2010:221; Lee, Seo & Dinwoodie, 2016:671).

This section analysed information on SCI. The literature made it clear that there are many benefits associated with supplying SCI to supply chains. This section also explored literature on the antecedents that lead organisations to integrate. This section further established that there are four types of integration, namely, internal integration, supplier integration, customer integration, and information integration. The next section discusses previous literature on SCM practices in the public sector.

3.10 SUPPLY CHAIN MANAGEMENT PRACTICES IN THE SOUTH AFRICAN PUBLIC SECTOR

In the past two decades, SCM has gained significant recognition as a source of a firm's competitive advantage (Hugo, Badenhorst-Weiss & Biljon, 2011:8; Sanders, 2012:39). Competitive advantage in public-sector organisations reduces inefficiencies and waste, improves the quality of services and brings about better service delivery (Matthews & Shulman, 2005:13; Popa, Dobrin, Popsecu & Draghici, 2011:4). The significant role of SCM in public organisations and entities fosters strategic thinking and planning (Lysons & Farrington, 2013:42). The introduction of SCM in the South African public sector was meant to address the challenges and gaps originating from the previous procurement policy and to replace the previous procurement practices and policies altogether (Mkhize, 2004:3; Setino *et al.*, 2016:380). In South Africa, SCM forms an integrated

financial management process which promotes uniform application of procurement Acts and regulations and standardisation of documents (Setino *et al.*, 2016:380). The government's integrated SCM policy applies to all departments, municipalities and state-owned enterprises.

Public-sector SCM is that part of the government process that deals with the provision, procurement, delivery and allocation of goods and services to and by the government or its citizens. As an international best practice, SCM in the public sector aims at enhancing efficiency (Abede, 2008:54). Most public sector institutions have realised the importance of developing strategic partnerships with their suppliers, customers, and other stakeholders to achieve the efficiencies gained from collaborating with major role players (Starks, 2006:37). It is widely acknowledged that collaborative relationships create an environment for leveraging skills, expertise and resources, IS and complementary strength, thereby saving time and cost.

In South Africa, various SCM practices have been implemented in the public sector. Thatte (2007:10) identifies SCM practices such as supplier development, strategic supplier relationship management, strategic sourcing, and private-public partnerships procurement as practices being implemented in the South African public sector. Other practices that have been identified include, SCI, IS, the Just-in-time delivery system, strategic partnerships with suppliers, relationships with customers, quality of information and lean internal practices (Koh, Demirbag, Baryraktar, Tatoglu & Zaim, 2007:103).

3.11 CHAPTER SUMMARY

The aim of this chapter was to conduct an in-depth literature review on SCM practices in the public sector. The first section of the chapter analysed literature on the definition and conceptualisation of what exactly SCM is. The major theme emerging from the literature is that SCM is a recent concept that aims at integrating supply chain activities from the producer of raw materials to the end user and is meant to improve the efficiency and effective functioning of organisations. The second section discussed what SCM best practices are, and it emerged that they are activities and strategies employed by organisations to ensure the effective and efficient functioning of organisations in order to satisfy customer needs. The chapter also reviewed literature on SCM

best practices under consideration in this study, such as SCC, INV, IS, IQ, SCD and SCI. The literature explored information on the definitions of the SCM best practices identified in the study, the antecedents or drivers behind them and the benefits associated with them. The study also examined the SCM practices that have been employed in the South African public sector and it emerged that various practices such as IS, SP, SCI and SCD have been employed to boost the functioning of public sector institutions. After analysing the literature reviewed, this chapter concludes that SCM practices are important initiatives and activities that enable organisations to function effectively and efficiently if employed suitably. The next chapter discusses the research theories, supply chain performance and resilience, as well as the formulation of hypotheses.

CHAPTER 4

CONCEPTUAL FRAMEWORK AND HYPOTHESES FORMULATION

4.1 CHAPTER OVERVIEW

This chapter aims to examine the mediating and outcome constructs of the study, namely SP and SCR. The chapter will focus on the conceptualisation of these constructs, their benefits and antecedents. Thereafter, the chapter also purposes to formulate hypotheses derived from the theory and constructs of the study. The relevance of the present study is that the stated hypotheses provide a suggestion of the causal relationships between constructs. In order to capture the essence and significance of the purpose of the study, this chapter will depict the conceptual framework of the study, which highlights the predicting constructs identified as SCC, INV, IS, IQ, SCD, and SCI. Thereafter, the chapter directs its attention to the mediating variable, which is SP and the outcome variable, which is SCR. After that, the discussion focuses on developing hypotheses of possible relationships that exist between the various constructs and concludes with an analysis of the relationship between SP and SCR.

4.2 SUPPLIER PERFORMANCE

This section analyses literature relating to SP. The section will discuss the conceptualisation of SP, the benefits of measuring SP as well as the enablers that empower them to perform as expected.

4.2.1 Conceptualisation of supplier performance

Selection of the appropriate supplier is one of the keys to be successful in the procurement process. A supplier selection criterion is not only focused on the cost of the least expensive supplier, but also on other criteria supporting the achievement of procurement objectives. In the modern procurement system view, a supplier is seen as a partner participating in the achievement of corporate goals. The task of procurement is to assess the performance of suppliers objectively and

comprehensively by considering all existing criteria (van Weele & van Raaiji, 2014:56; Huang & Lui, 2014:64).

SP refers to how well a supplier provides the required products to the buyer and is manifested as the operation's outcome in terms of quality, delivery, responsiveness, cost and technical support (Wu *et al*., 2010:115). Other scholars (Ahimbisebwe, Muhwezi & Nangoli, 2012:435; Murat & Ana, 2013:226) conceptualise it as a range of supplier activities in terms of actions or policies taken by suppliers. These actions or policies include providing complete instructions in accordance with the needs, supplier delivery speed, providing goods/services according to their specifications, consistency in receiving orders and providing products/services as needed. Also included are activities such as making deliveries properly without any mistakes, charging a reasonable price compared to their competitors and decreasing the number of consumer complaints after using certain suppliers. Yilmaz, Sezen and Kabadayi (2004:854) emphasise that SP can be described as a major predictor of reseller satisfaction.

4.2.2 Antecedents of supplier performance

In order to achieve long-term sustainable competitive advantages, organisations need to have vibrant and well-performing suppliers (Millington, Eberhardt & Wilkinson, 2006:185). Stouthuysen, Slabbinck and Roodhooft (2012:423) propose that suppliers perform a strategic role in influencing the overall performance of supply chains, particularly in competitive business environments. Hence without an effective and efficient supplier base, the mandate of organisations to provide and satisfy the needs of customers is compromised.

SP is triggered by certain activities and initiatives. In accordance with Mafini, Pooe and Loury-Okoumba (2016:260), factors such as information sharing, information quality, institutional trust, and buyer-supplier collaboration influence suppliers to perform well. Adequate sharing of critical information between businesses and their suppliers forms the niche and backbone of operational efficiency and success (Whipple & Russel, 2007:174; Mafini *et al*., 2016:265). Besides, supply chain systems that are characterised by the effective exchange of sensitive and up-to-date information are widely regarded as efficient in achieving proper collaboration attributes which in

turn triggers better performance (Sandberg, 2007:274; Mashiloane, Mafini & Pooe, 2018:3). Thus, sharing of up-to-date information enhances institutional trust and collaboration between suppliers and their customers, and this improves their performance.

IQ has also been cited as an enabler of SP. Chen, Yen, Rajkumar and Tomochko (2011:262) put forward that organisations that are engaged in collaborative supply chain activities and strategies require a significant level of quality information to be processed across each unit of activities. Nicolaou *et al.* (2013;986) suggest that an increase in the quality of information exchanged between supply chain partners has a positive effect on enhancing the level of trust that business associates have with one another. Mafini *et al.* (2016:265) support this as they note that the ability of business partners to build and establish an acceptable degree of a trust resides in their willingness to share critical, sensitive and significant strategic information. Hence, IQ plays an imperative role in influencing suppliers to perform well.

Also, organisations that demonstrate effective, trusting behaviour are able to improve their overall supply chain's activities and performance (Mashiloane *et al.,* 2018:3). Al-Abdallah, Abdallah and Hamdan (2014:192) suggest that supply chain partners' abilities and willingness to collaborate in a trusting environment are regarded as a key factor that enables them to maintain and enhance their performance through sound and effective supplier integration. The level of trust between organisations and their suppliers has a psychological effect on the suppliers as they feel a sense of ownership and prompts them to provide quality goods and services to their customers. In addition, effective partnerships characterised by mutual trust between organisations and their partners may facilitate more open communication, IS, conflict management and flexibility, which are essential for organisational success (Seppanen & Blomqvist, 2007:249).

4.2.3 Benefits of measuring supplier performance

Measuring the performance of suppliers is vital to ensuring a well-functioning supply chain. Scholars such as Gordon (2006:1), and Charlse and Omwenga (2018:22) note that organisations who evaluate their suppliers find that they have better visibility into SP, can uncover and remove hidden cost drivers, and reduce risk. In addition, Kivite (2015:1) provides that measuring SP

increases competitive advantage by reducing order cycle times and inventory, gains insight on how to best leverage their supply base and align practices between themselves and their suppliers.

Measuring SP can further help to improve performance (Teli, Jagtap, Raikar & Deshmukh, 2017:2). Krause, Handfield and Tyler (2007:528) are of the same view as they suggest that a supplier performing at an optimal level is crucial in enabling the buying firm to reach its performance outcomes in terms of serving its customers efficiently. However, most organisations do not know the facts about how their suppliers are performing, supplier management tends to be based on guesses (Hasan, Zulkifli & Nizaroyani, 2014:96).

In addition, measuring SP helps organisations to uncover and remove hidden waste and cost drivers in the supply chain (Teli *et al.,* 2012:3). Thrulogachantar and Zailani (2011:641) are of the opinion that the supply chain is full of inefficiencies, and better communications between customers and suppliers can improve some of these inefficiencies. Thrulogachantar and Zailani (2011:641-642) went further, pointing out that other inefficiencies are a result of poor business practices at the supplier that can result in increased inventory loss, quality problems, higher costs, and slow deliveries. Therefore, by measuring the performance of their suppliers, organisations can reduce wasteful costs and activities, typically caused by supplier glitches, such as additional inspections, extra freight charges, overtime (to catch up), safety stocks, obsolete inventory, buying from multiple sources, to mention a few (Yeung *et al.,* 2013:546).

Additionally, Zeng *et al*. (2013:9) put forward that measuring SP helps businesses to align themselves with supplier business practices. Zheng *et al*. (2013:10) further note that suppliers should run their businesses in alignment with their customers, share the same business ethics, expect similar standards of excellence and show commitment to continuous improvement. It also helps suppliers to keep up with the pace of their customers. A supplier who is unaccustomed to pursuing continuous improvement may be unable to keep up with its customers' increasing requirements for better, cheaper, faster goods and services (Gordon, 2006:2).

Besides, Botes, Niemann and Kotze (2017:183) add that measuring SP helps organisations to mitigate risks. Insight into SP and business practices helps reduce business risk, particularly given

companies' increasing dependence on its key suppliers (Botes *et al.,* 2017:184). Botes *et al.* (2017:184) further add, that by better understanding SP and supplier business practices and processes, customers can help suppliers drive waste and inefficiency out of the business, resulting in higher-quality suppliers and lower costs. Also, by measuring SP, an organisation can set a threshold for its suppliers that can lead to higher-quality results.

Measuring SP also leads to improved performance. The goal of supplier evaluation should be SP improvement (Pikousova & Prusa, 2013:1). Gordon (2006:2) is of the same view, as he notes that while simply measuring performance has a positive effect, supplier evaluation can be most effective when it leads to continuous improvement activities and actual SP improvement. Indicators such as quality, delivery, and cost management, as well as the underlying qualitative factors, can be used to measure SP (Pikousova & Prusa, 2013:2). However, Gordon (2006:3) suggests that the root causes of performance difficulties can be hard to uncover and require understanding of business practices, cultural factors and the leadership of the supplier.

In this section, SP was discussed. From the literature, it became clear that SP is an important SCM practice that enables organisations to meet the needs of their customers. The study has revealed that supply chains with well-functioning, vibrant and wide supplier bases are effective and efficient in meeting their customers' demands. The study also established that factors such as trust, commitment, IS and sharing of quality information enables suppliers to perform as expected. From the literature, it also became clear that organisations need to constantly measure the performance of their suppliers to ascertain if they can still meet their demands. The next section discusses SCR as another construct of SCM practices.

4.3 SUPPLY CHAIN RESILIENCE

Strong competition and a fast-changing business environment as well as natural disasters can leave firms within supply chains being exposed to higher internal and external risks and disruptions (Lavastre, Gunasekaran & Spalanzani, 2014:3381). These disruptions and risks can be solved when organisations assume a resilience stance to mitigate these troubles. SCR has ultimately become enormously predominant in the supply chain domain because of increased disruptions in

the global supply chain. In recent years, there have been a number of high-profile events and persistent problems that have severely disrupted the ability of firms to produce and distribute their products (Sodhi, Son & Tang, 2012:2; Chen, Sohal & Prajogo, 2013:2186; Sawik, 2013:259). This section analyses the conceptualisation, antecedents, and benefits of SCR.

4.3.1 Conceptualisation of supply chain resilience

SCR has become an issue of strategic importance in supply chains. Holling (1973:1), who is one of the pioneering researchers of resilience as cited by Chowdhury and Quaddus (2017:186) defines it as the ability of a system to absorb changes. Many other scholars echo it as a system's ability to recover and return to its original state (Mitroff & Alpasan, 2003:109; Christopher & Peck, 2004:1; Chowdhury & Quaddus, 2017:186). The concept refers to an organisation's capacity to survive, adapt and grow when confronted with change and uncertainty (Knemeyer *et al.,* 2009:141; Ates & Bititci, 2011:5601). Other scholars have defined SCR as the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structures and functions (Ponomarov & Holcomb, 2009:131; Wallance & Choi, 2011:284).

SCR is the system's ability to return to its original state after facing interruptions, especially those with negative effects, within a proper span (Christopher & Peck, 2004:1; Day, 2013:1970; Pereira, Christopher & Silva, 2014:626; Heckmann *et al.,* 2015:119). Reyes, Levalle and Nof (2015:83) view resilience within a supply chain network as the emergency capability to anticipate errors and conflict, prevent them from creating disruptions to normal operations and overcome disruptions within minimum losses in quality service and within sustainable use of resources. SCR is based on the underlying assumption that not all risks can be prevented (Juttner & Maklan, 2011:246; Scholten, Scott & Fynes, 2014:212). Resilience enables the supply chain to be prepared for events, reduce the impact of a disruption and strengthens the ability to recover quickly from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function (Ponomarov & Holcomb, 2009:131; Scholten & Schilder, 2015:472). Similarly, Takamuhabwa *et al*. (2015:8) suggest that SRC can be gauged on four aspects, namely, preparation for a disruptive event, response to an event, recovery from an event and growth after

an event. Thus, SRC can be viewed as the adaptive capability of a supply chain to prepare for, respond to disruption, make timely and cost-effective recovery and progress to a post-disruption state.

It is an initiative aimed at providing the stability motive for manufacturing firms to cope with interruptions using two generic response alternatives, namely, proactive and reactive (Panomarov & Holcomb, 2009:124; Wieland & Wallenburg, 2013:300; Durach *et al.,* 2015:118). Valikangas (2010:19) is of the same view as he notes that resilience can be conceptualised, both as the proactive capacity to "take action before it is a final necessity" and the reactive capacity to "recover after experiencing a crisis". The proactive and reactive concepts of resilience are also interchangeably defined according to the notions of pre-disaster resilient actions and post-disaster actions (Wieland & Wallenburg, 2013:300; Aigbogun, Ghazali & Razali, 2018:3).

A proactive dimension of SCR is a system's ability to maintain its function, including internal and external interruptions (Pettit, Croxton & Fiksel, 2013:46; Cheng & Lu, 2017:329). A proactive strategy allows for continued operation despite disruption (Kitano, 2004:826; Stonebraker, Goldhar & Nassos, 2009:161). A number of scholars have conceptualised that a proactive dimension of SCR is a system's ability to prevent or resist and maintain its functions in the event of both internal and external disruptions (Stonebraker, Goldhan & Nassos, 2009:161; Durach *et al.,* 2015:118; Hasani & Khosrojordi, 2016:26). In the view of Gunasekaran, Subramanian and Rahman (2015:6809), the proactive resilience capability of a system is the capability to recognise, anticipate and defend against the changing shape of risk before adverse consequences occur. A number of scholars have put forward that for an organisation to be proactive it needs to have proactive capabilities such as flexibility, redundancy, robustness, adaptability, collaboration, integration, visibility, market strength, financial strength, diversity, and efficiency to measure resilience (Sheffi & Rice, 2005:41; Pettit *et al.,* 2010:3; 2013:46; Juttner & Maklan, 2011:246; Ponomarov & Hollcomb, 2009:124; Pal *et al.,* 2014:410). The main critical element suggested by the resilience-proactive approach is preparedness (Li *et al.,* 2017:256).

On the other hand, reactive resilience is the capability to adjust quickly to unexpected market changes in a competitive, turbulent and volatile environment characterised by uncertainty

(Wieland & Wallenburg, 2013:301; Golgeci & Ponomarov, 2013:604; Durach *et al.,* 2015:118l; Hohenstien *et al.,* 2015:90; Kumalahmadi & Parast, 2016:116). The critical elements of the reactive approach to SCR include alertness and agility (Boumgarden, Nickerson & Zenger, 2012:587; Cheng & Lui, 2016:3; Chowdhury & Quadddus, 2017:185). Other scholars provide that the reactive facets of SCR can be established based on the response and recovery abilities of organisations (Sheffi & Rice, 2005:43; Ponomarov & Holcomb, 2009:132). Supply chain response concerns mitigating disruptions in the shortest possible time and with the smallest impact.

The two approaches (proactive and reactive) are not exclusive in their nature, but they complement each other in building SCR (Li *et al.,* 2017:256). In view of these two perspectives, SCR may be regarded as a supply chain's capability to cope with changes formed with its preparedness to endure future changes, being alert to changes and being agile in responding to changes (Nooraie & Parast, 2016:8). Adequate proactive and reactive dimensions of SCR in the public sector result in adequate exploitation and exploration of resources to ensure a supply chain's current and future viability (Boumgarden, Nickerson & Zenge, 2012:587; Pournader, Rotaru, Kach & Hajiagha, 2016:591).

4.3.2 Antecedents of supply chain resilience

There are various antecedents of SCR. Juttner and Maklan (2011:247) propose three antecedents to SCR based on the coordination and integration of resources. The three enablers include flexibility, velocity, and visibility. Flexibility in the context of SCR refers to a supply chain's existing structure and the ease with which it could be reconfigured (Manders, Caniels & Ghijsen, 2016:181). Flexibility enables the supply chain to deal with high levels of uncertainty by allowing it to adapt effectively to the disruption caused by changing needs and environmental uncertainty (Yi, Ngai & Moon, 2011:271; Grigor, 2014:181; Tiwari, Tiwari & Samuel, 2015:767). Flexibility allows the system to change and adapt to change with minimal time, effort and performance implications (Mandal, 2015:206). Flexibility allows for some extent of supply chain re-configurability and short-term adjustments (Botes, Niemann & Kotze, 2017:185).

Supply chain velocity refers to the speed of a supply chain network's response to a disruptive event (Narasimhan, Kim & Tan, 2014:269). SCR velocity concerns the speed at which a supply chain

responds to changing needs after being disrupted. It prioritises the timelines of a supply chain's response to disruption over the ability to withstand changing and adverse conditions.

Supply chain visibility can be described as the extent to which actors within a supply chain have access to or share the information which they consider as key or useful to their operations and which they consider will be of mutual benefit (Botes, Niemann & Kotze, 2017:185). Mandal (2014:427) adds that the ability to view the entire end-to-end pipeline is critical in managing supply chains that span multiple firms effectively and efficiently. To gain visibility, there is a need for data standardisation between supply chain members, and information in a timely manner (Caridi, *et al.,* 2014:10; Lam & Bai, 2016:16). However, having access to timely and accurate information in a modern supply chain is challenging, given the spatially dispersed and operationally disconnected nature that often typifies such networks (Jüttner & Maklan, 2011:246). Supply chain visibility is thus regarded as a critical and crucial requirement for timely and robust responses to supply chain disruptions making it an important antecedent to SCR. Therefore, having visibility in a timely and accurate manner throughout the entire supply chain enables firms to receive early warnings of potential disruptions, further enabling effective response and recovery.

Another most cited enabler of SCR is collaboration, which is regarded as a process where two or more companies formally undertake to share responsibility for sharing information, planning, and managing process execution to enable the formation of synergies between all supply chain members (Scholten & Schilder, 2015:471). It entails the commitment of multiple supply chain members to align interface processes according to their mutual strategic objectives, thereby leveraging their respective core competencies to adapt to change (Botes, Niemann & Kotze, 2017:185). Collaborative partnerships help to manage risks effectively and keep organisations together in catastrophic situations. Collaborations amongst supply chain partnerships also help in mitigating risks.

Moreover, trust is regarded as an enabler of SCR in supply chains. Trust is the willingness to rely on an exchange partner in whom one has confidence (Shoji, 2018:3). Trust is generally seen as a precondition for risk sharing (Chiappori & Reny, 2016:227). Sillanpaa, Shahzad and Saillanpaa (2015:231) add that the chain of trust from suppliers to producers through to the end user is a major

topic in the general literature on buyer-supplier relationships. Sillanpaa, Shahzad and Saillanpaa (2015:231) further note that the foundation to develop an organisation in general and supply management, in particular, is trust. Trust nurtures superior cooperation lessens functional conflict and increases integration, which leads to efficient decision-making under conditions of uncertainty and vagueness (Mafini & Loury-Okoumba, 2016:617). Hence, trust is a necessary requisite enabler of SCR as it fosters cooperation and synergises relationships between supply chain members.

4.3.3 Benefits of supply chain resilience

It is the dream and goal of every supply chain network and organisation to be able to bounce back into full-scale operation after disruptive events or hardship. SCR has increasingly become an issue of strategic importance in supply chains because of the benefits associated with it (Cheng & Lu, 2017:329). SCR provides a sustainability motive to organisations to cope with interruptions (Weiland & Wallenburg, 2013:300; Durach *et al*., 2015:118). SCR gives firms capabilities and strategies to adjust quickly to unexpected changes. These strategies result in sufficient exploitation and exploration to ensure a supply chain's current and future viability (Bourmgarden *et al.,* 2012:587; Durach *et al.,* 2015:118). A number of scholars (Ageron, 2013:266; Kembro, Kostas & Naslund, 2014:609; Jonsson & Holmstrom, 2016:62) also add that SCR leads to competitive advantage, cost reduction, improved service delivery, and supply chain flexibility.

This section analysed literature on SCR as a construct of SCM practice. From the discussion, it can be established that for organisations to survive, they need to be resilient in their operations. A literature review revealed that SCR, as a construct of SCM practice, enables organisations to deal with disruptions that are posed to the supply chain from the environment. Also, the study revealed that organisations in dealing with disruptions could be proactive or reactive in nature. The literature reviews further indicated that factors such as flexibility, visibility, information sharing, velocity, trust and collaboration influence organisations and supply chains to be resilient in nature. The literature review also established that supply chains that are resilient lead to benefits such as improved service delivery, cost reduction, and bouncing back to full-scale operation after disruptions and risk avoidance. Thus, it can be established that SCR is a key practice in SCM.

4.4 CONCEPTUAL FRAMEWORK

This section presents the conceptual framework of the study. Figure 4.1 outlines the predictor constructs, which are SCC, INV, IS, IQ, SCD, and SCI. These constructs lead to SP, which is the mediator variable and SCR which is the outcome variable.
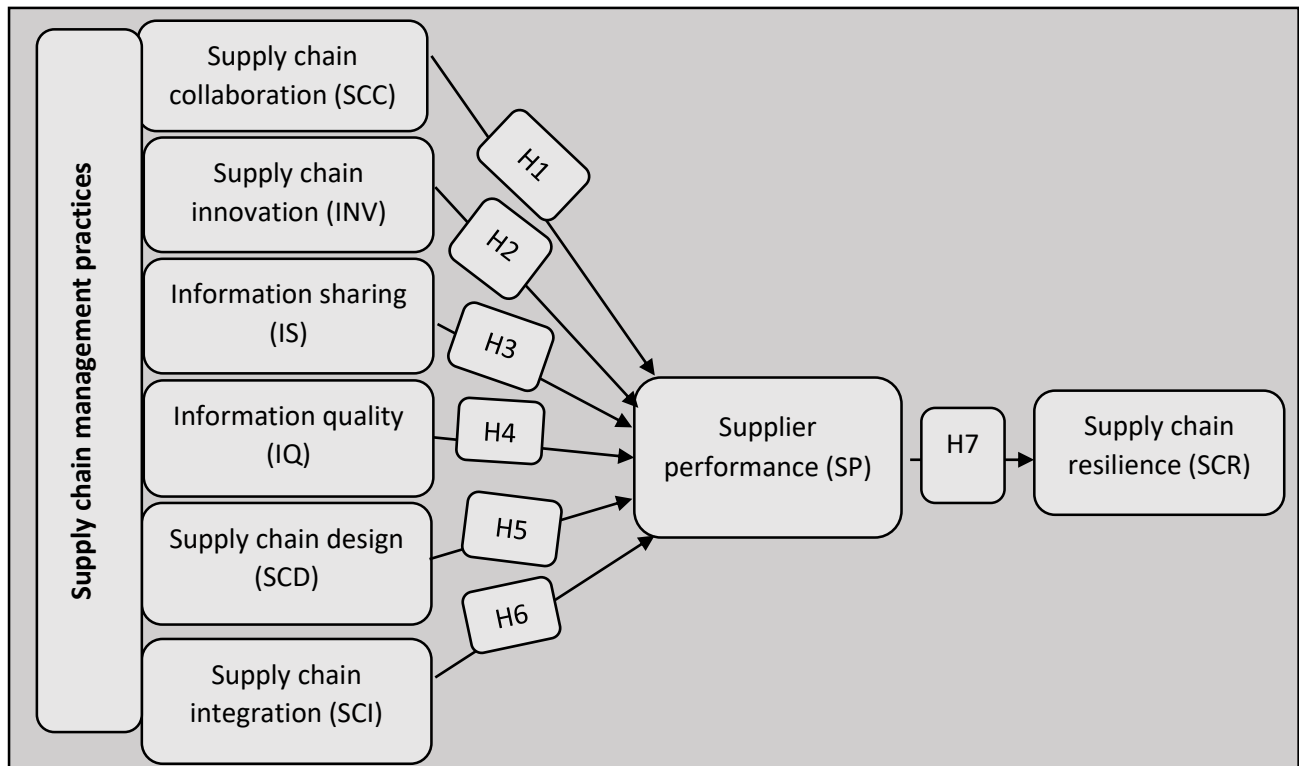
Figure 4.1: Conceptual framework for SCM practices, supplier performance and supply chain resilience
Source: Author's own compilation

4.5 HYPOTHESES DEVELOPMENT

The study is intended to test seven hypotheses, which are based on the conceptual framework in Figure 4.1, which are delineated as follows:

4.5.1 Supply chain collaboration and supplier performance

In today's business environment, characterised by hyper levels of competitiveness, achieving a competitive edge is viewed as an imperative and essential strategic tool to ensure business success and survival. A number of scholars (Holcomb & Hitt, 2007:464; Narasimhan & Schoenherr, 2015:140) posit that in the context of modern markets, no organisation can operate and compete successfully in isolation, instead, it must operate as part of supply chain networks. These scholars propose the need for organisations to collaborate with their supply chain partners to enhance their performance.

Effective collaborative practices among business partners has a significant impact on increasing profitability, reducing costs, improving technical cooperation and increasing performance of both the supplier and the customer (Carvalho, Barroso, Machado, Azevedo & Cruz-Machado, 2012:471). In addition, Botes, Niemann and Kotze (2017:183) coined that sound and efficient SCC between buyer-supplier parties results in better inventory reduction, improved quality, and delivery, cost and lead time reduction, higher flexibility, faster product-to-market cycle times, increased responsiveness to market demands and customer service. Supply chain collaboration has a major influence on improving buyer-supplier relationships (Sheu, Yen & Chae, 2006:24). In light of the above discussion, one may pose that SCC has a major influence on improving SP and relationships.

Moreover, a collaboration of buyers and suppliers calls for a mutual sharing of problems and challenges that cannot be tackled in isolation of each other. This is also noted by Zacharia, Nix and Lusch (2009:101), who propose that buyer-supplier collaborations call for good comprehension of each party's deficiencies and operational challenges threatening their success. Cao and Zhang (2011:163) posit that efficient and effective collaborative practices between buyers and their suppliers are a fundamental determinant of performance enhancement among suppliers. In light of the discussion above, the following hypothesis was formulated:

Ha$_1$: There is a significant relationship between supply chain collaboration and supplier performance.

4.5.2 Supply chain innovation and supplier performance

Globally the need for innovation is widely recognised by organisations, as the business environment is always changing and volatile (Lisboa, Skarmeas & Lages, 2011:1274). Innovation is viewed as a worthwhile source of advantage and of competitiveness for companies, oriented to improve the company's performance and reduce risks (Berghman *et al.,* 2013:39). Lavastre, Ageron & Spalanzani (2011:9) conceptualise INV as a set of practices that are previously non-existent in organisations that will be generated, developed and deployed within supply chains to tackle different supply chain issues such as quality, cost and lead time. It relies on logistics network reconfigurations, information technology, stock outsourcing and information systems development (Ageron, Lavastre & Spalanzani, 2013:266).

Supply chain innovation spans from smaller incremental changes to large and more radical changes (Ageron *et al.,* 2013:266). Innovations in supply chains aim at increasing collaborative relationships within the chain (Wagner, 2010:135). Lee *et al*. (2011:1193) posit that effective INV facilitates a reduction of cost and a development of flexibility for dealing with rapid changes in the business environment. Kim and Chai (2017:43) allude to the notion that the purpose of INV is to facilitate the efficient supply of goods and services, accuracy in service delivery and improved quality of products as well as the creation of value for customers. In addition, Coombs (2012:2) mentions that innovations in supply chains empower organisations and their partners to be resilient and ensure their agility and continuity in dealing with rapid changes in the business environment. In the web of organisations that deal with changes are suppliers. Therefore, employing INV practices in the supply chain allows suppliers to be flexible and agile in dealing with the ever-changing business milieu. As such, the following hypothesis was formulated:

Ha$_2$: There is a significant relationship between supply chain innovation and supplier performance.

4.5.3 Information sharing and supplier performance

IS is vital for the effective functioning of any business (Pooe, Mafini, & Loury-Okoumba, 2015:5). It has been described as the lifeblood of organisations. IS refers to the extent to which a firm openly communicates important and sensitive information to its partners (Shou *et al.,* 2012:2). A number of scholars have stressed its role and influence in the supply chain environment (Leung, Choy & Kwong, 2010:64; Jraisat, Gotsi & Bourlakis, 2013:323; Kembro & Naslund, 2014:179). Hence, it has received much attention from scholars who praise its influence and contributions in the business environment.

Information has been regarded as an effective predictor of a supply chain's effectiveness (Zhang & Cheng, 2013:181). IS in supply chains has been applauded for its benefits such as improved coordination between supply chain partners, enhanced responsiveness and elimination of the bullwhip effect (Hsu *et al*., 2008:297; Zhang & Chen, 2013:181). Other benefits include reduction of unwarranted wastages and costs in a supply chain, and increased profitability (Chinomona & Pooe, 2013:8). Other scholars suggest benefits such as increased trust among supply chain partners and fostering of collaborations (Luo, Sha & Huang, 2013:1945; Mafini, Pooe & Loury-Okoumba, 2016:261).

It is proposed that sharing information in supply chains contributes largely to improved relationships between suppliers and their customers (Mostert, Niemann & Kotze, 2017:5). Information sharing facilitates efficient coordination and responsiveness as well as the integration of partners' information systems (Hsu *et al.,* 2008:279). Pooe, Mafini and Loury-Okoumba (2015:11) found that IS between organisations and their suppliers has the effect of improving the synergistic corporation, as well as shared trust, and these synergies, in turn, have the effect of improving the performance of these suppliers. Luo, Sha and Huang (2013:1945) are of the same view as they note that, the extent to which information is shared can create opportunities for firms to collaboratively work together and remove supply chain inefficiencies which hinder them to perform as expected. Thus, adequate sharing of critical information between business partners (customers and suppliers) has a significant direct impact on the relationship between buyers and

suppliers as well as their operational efficiency and success. As derived from the foregoing discussion, the study formulated the following hypothesis:

Ha3: There is a significant relationship between information sharing and supplier performance.

4.5.4 Information quality and supplier performance

Organisations that are engaged in collaborative supply chain activities and strategies require a significant level of quality information to be processed across each unit of activities (Chen, Yen, Rajkumar & Tomochko, 2011:262). Gorla, Somers and Wong (2010:207) define IQ as a concept that is related to the quality of information system outputs, which can be described in terms of outputs that are useful for business users' decision making, and easy and to understand, as well as outputs that meet users' information specifications. Other scholars such as Moberg, Cutler, Gross and Speh (2002:755); Feldmann and Muller (2003:63) and Vivek *et al*. (2011:186) posit that for supply chains to work effectively and efficiently there is a need to share adequate, accurate, timeless and credible information between supply chain partners.

The satisfactory flow of quality information in supply chains is of prime importance as it represents a crucial value in the effectiveness of the firms' operations (Mafini, Pooe & Loury-Okoumba, 2016:262). Scholars such as Wiengrten, Humphreys, Cao, Fynes and McKittrick (2010:462) posit that IQ is a major factor impacting on the overall performance of supply chains. Sharing of quality information influences the running of businesses and customer satisfaction (Gorla *et al.,* 2010:208; Gao, Zhang, Wang & Ba, 2012:772; Nicolaou, Ibrahim & Van Heck, 2013:986). Fawcett, Osterhaus, Magnan, Brau and McCarter (2007:358) are of the view that the ability of business partners to build and establish an acceptable degree of trust resides in their willingness to share critical, sensitive and crucial strategic information. Nicolaou *et al*. (2013: 986) are of the same view as they state that an increase in the quality of information exchange between organisations has a positive effect on enhancing the level of trust that business associates have with one another. Organisations need to view their information as a strategic asset and ensure that it flows with minimum delay and distortion.

In addition, Sahadev (2008:178), in his study, suggests that the sharing of quality information in supply chains may result in the establishment of trust and sound cooperation between each member of a supply chain network. Also, the continuous exchange of strategic decisions and key information may result in developing a certain level of trust which enables supplier partners to perform well (Zhou, Shou, Zhai, Li, Wood & Wou, 2014:624). This implies that effective exchange and transfer of up-to-date information in all sections of a firm's supply chain units may enable each link to better coordinate its strategic actions and respond to customers' final orders more effectively. Thus, supply chains owe their optimum functioning to the sharing of quality information. Based on the above-mentioned evidence, the following hypothesis was formulated:

Ha$_4$: There is a significant relationship between information quality and supplier performance.

4.5.5 Supply chain design and supplier performance

The last two decades have seen the emergence of and growth of the supply chain as a critical force in today's increasingly turbulent marketplace (Melnyk *et al*., 2009:4629). This volatile environment gave birth to the call for implementing SCM and its best practices as a way to survive and improve performance. One of the celebrated SCM practices is SCD which has been described as the ultimate core competence of an organisation by Wu, Melnyk and Flynn (2010:721). SCD has been defined by Fine (2000:2013) and Melnyk et al. (2014:1) as choosing what capabilities along the value chain to invest in and develop internally and which to allocate for development by suppliers.

The design of a supply chain incorporates a wide range of decisions which can be grouped into three categories, namely, traditional design, product, and process design decisions (Wu et al., 2014:1894). The traditional design decisions concern the facility characteristics of each supply chain node, the number, location and sizing of facilities, and interconnections between the supply chain nodes. Product design decisions concern the efforts to set strategic and tactical activities from generation to commercialisation, whereas process design decisions concern the effort to link market objectives with high supply chain performance. These decision categories allow supply chains to be responsive to uncertainty and variability concerning SCM flexibility, as well as

inventory control strategies. With SCD, firms can realise significant benefits in the form of reduced inventories, lower cost, enhanced responsiveness and improved strategic focus in terms of design, execution and capital investments (Melnyk, Narasimhan & DeCampos, 2014:1887).

SCDs help organisations to perform and survive by drawing on the capabilities offered by supply chain partners who are directly or indirectly involved with the firm and by developing and fostering appropriate ties with both customers and suppliers (Melnyk *et al.,* 2014:1887). Leukel and Ssugumaran (2013:288) concur with Mellnyk *et al.* (2014:1887), as they put forward that it is in SCD where decisions about the number of suppliers, proximity to a supplier, supplier selection and evaluation are made. As depicted from the preceding discussion, suppliers owe their success to how their supply chains are designed. Hence, this study formulated the following hypothesis:

Ha$_5$: There is a significant relationship between supply chain design and supplier performance.

4.5.6 Supply chain integration and supplier performance

Recent developments, such as subdued economic performance, increasing levels of cost, competition, and regulatory pressures, have contributed to making the current business environment increasingly complex and volatile (Stevens & Johnson, 2016:20). These developments have re-emphasised the imperative for firms to increase the synchronisation of supply chain activities and build close, cooperative relationships with supply chain partners through the process of SCI (Mostert *et al.,* 2017:1). Danese and Romano (2010:220) advocate that SCI is a decisive factor that should be investigated if organisations are to survive, grow and achieve a competitive advantage in an increasingly competitive environment. Organisations are entering a period in which independence of operations can no longer provide a competitive advantage, hence, for them to survive, they have to integrate with their supply chain partners.

SCI has been described as a compelling enabling factor that contributes to the effectiveness of managing a firm's supply chain (Huo, Zhao & Zhou, 2014:552). Integration pertains to concise, synergistic working alliances amongst business parties through mutual sharing of information and management of operational processes to offer the best value to their customers (Qi, Huo, Wang,

Yan & Yeung, 2017:164). Uwamahoro (2018:4) describes it as the extent to which all activities within an organisation and the activities of its suppliers, customers, and supply chain are integrated. Danase and Romao (2011:220) suggest that a well-integrated supply chain offers opportunities for improving the accuracy of demand information, increased inventory obsolescence and reduced planning time, allowing organisations to be more responsive to customer demands.

Furthermore, SCI has been known for its ability to reduce costs, increase flexibility and detect demand changes more quickly (Danese & Bortolotti, 2014:7062). Other most-cited benefits of SCI include improved financial performance, enhanced efficiency and competitiveness (Ralston, 2014:8; Cao *et al.,* 2015:24). Danese (2013:1029) opines that SCI leads to supplier development, sharing of data, supplier involvement, and inventory planning, which in turn leads to smoothing and optimisation of the procurement process. In light of the above discussion, SCI can be viewed as one of the critical practices in supply chains that can enhance the performance of supply chain actors.

In his study on SCI and supply chain performance, Katua (2014:20) acknowledges the impact of an integrative approach towards supply chain partners. The author further observes that SCI activities are necessary to improve information sharing, trust, and commitment across the supply chain partners and to help the partners to delegate decision making. Danese (2013:1030) is of the same view as she suggests that SCI facilitates the sharing of complementary resources and information within the supply chain network, as well as fundamentally tacit knowledge generated by collaborative relationships and joint improvements efforts. Also, Huang, Yen and Liu (2014:64) posit that a firm's effort to adequately integrate its supply chain activities has a massive impact on their SP. As such SCI can be heavily linked with SP. Weighing all the above information, this study provides the following hypothesis:

Ha$_6$: There is a significant relationship between supply chain integration and supplier performance.

4.5.7 Supplier performance and supply chain resilience

Basically, in business to achieve long term sustainable competitive advantage, organisations need to have a vibrant and well-performing supplier base. Suppliers play a strategic role in influencing the overall performance in supply-performance networks, especially in a competitive business environment (Ho, Feng, Lee & Yen, 2012:7102). SP has been described as a major predictor of reseller satisfaction. A supplier performing at an optimum level is crucial in enabling the buying firm to reach its performance outcomes in terms of serving its customers more efficiently (Mafini *et al*., 2016:3). SP has a significant impact on maintaining collaborative relationships and enhancing integration between supply chain partners (Huang *et al*., 2014:64). Well-performing suppliers also play critical roles in improving product quality and delivery performance (Yen, 2012:7102). Huang *et al*. (2014:64) suggest that organisations have to regularly evaluate their supplier's performance since their efforts to adequately integrate supply chain activities have a significant effect on their operations. Thus, SP plays a critical role in supply chains as they influence performance and sustainable competitive advantage.

Ha7: There is a significant relationship between supplier performance and supply chain resilience.

4.6 CHAPTER SUMMARY

This chapter provided a discussion on SP, which is the mediating variable and SCR, which is the outcome variable of the study. The study revealed that it is imperative to measure the performance of suppliers as it enables them to perform effectively and efficiently. The study also found that SCR is an crucial practice that is worthy not to be ignored by supply chains and organisations as it allows them to adapt and deal with disruptions that emanate from the environment. This chapter further provided a discussion of the main hypotheses, which form the empirical foundation of the present study. The study developed seven alternative hypotheses. The first six hypotheses pertain to the role and importance of the SCM practices under consideration in the study. From the study, it was established that the six constructs, namely, SCC, INV, IS, IQ, SCD and SCI influences SP, which in turn significantly impacts on SCR, which is the ability of an organisation to bounce back

to full-scale operation after a disruption. The next chapter focuses on the research methodology to be applied in the study.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 CHAPTER OVERVIEW

This chapter discusses in detail the research methodology introduced in Chapter One of the thesis. It describes the research approach that was followed and provides a comprehensive summary of research philosophies that form the foundation of the methodology. These philosophical foundations spell out the nature of the study, as well as how and why the data were collected. The initial sections of the chapter focus on research reasoning where the two forms of logic that exist in research, namely, deductive and inductive reasoning are discussed. Secondly, the study discussed the research paradigms that influenced the type and nature of the methodology used in the study. Three major paradigms that are normally followed by researchers, namely, positivism, pragmatism, and phenomenology were discussed. Also, the chapter discussed the research approach that was followed as well as the research strategy and design followed in the study. Elements of the sampling design, namely the population, the target population, sampling frame, and procedure are then discussed, followed by an outline of the research instrument and procedures for data collection. The chapter then discusses how the data were analysed before examining how reliability and validity were ascertained and which ethical considerations were followed.

5.2 RESEARCH REASONING

Good business research is based on sound reasoning. Babbie (2016:23) submits that there are two modes of inquiry or reasoning to social science research, namely, inductive and deductive reasoning. On the one hand, deductive reasoning is a form of argument that purports to be conclusive in nature (Cooper & Schindler, 2013:67). On the other hand, deductive reasoning is an approach to developing or confirming a theory that begins with abstract concepts and theoretical relationships and works toward more concrete empirical evidence (Neuman, 2014:69). Deductive reasoning moves from the general to the specific (Babbie, 2016:23). It starts with a hypothesis or

general rule that is then tested with data and only if found true leads to a specific conclusion (Dudovskiy, 2016:2; Mitchell, 2018:104). Hence, it is sometimes called a top-down approach.

In contrast, inductive reasoning is radically different in that a conclusion is drawn from facts and pieces of evidence (Cooper & Schindler, 2013:68). Neuman (2014:70) describes inductive reasoning as an approach to developing or confirming a theory that begins with concrete empirical evidence and works toward more abstract concepts and theoretical relationships. Inductive reasoning moves from the particular to the general, from a set of specific observations to the discovery of a pattern that represents some degree of order among all the given events (Babbie, 2016:23). Thus, in inductive research reasoning, general principles are developed from specific observations (Dudovskiy, 2016:2; Mitchell, 2018:104). It is also called the bottom-up approach. Figure 5.1 presents a summary of the two forms of reasoning.
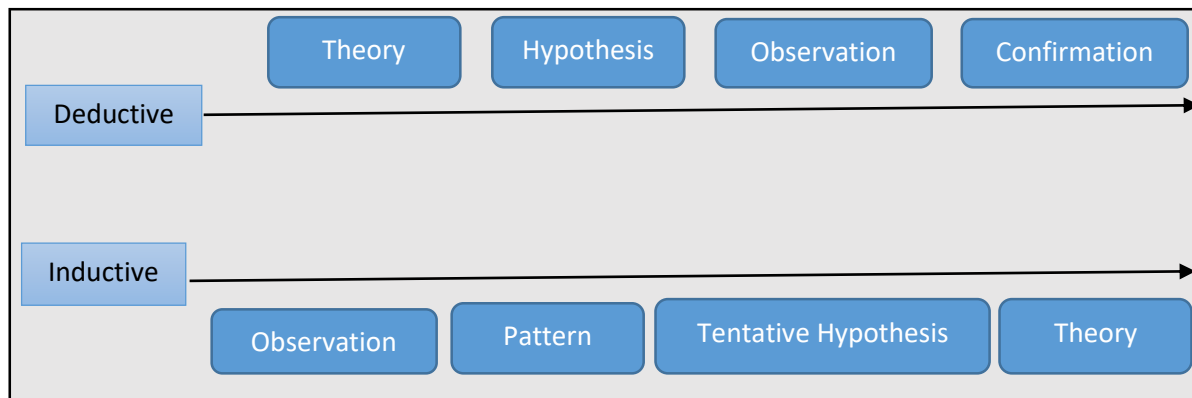
Figure 5.1: Deductive and inductive reasoning
Source: Dudovskiy (2016:2)

In this study, deductive reasoning is regarded as the more appropriate method because it provides support to and follows a quantitative research approach. This is owing to the fact that the study seeks to test causal direct and indirect relationships between different constructs. Moreover, the present study places attention on the accuracy and validity of a cognitive stance using statistical procedures to solve research problems (Heit & Rotello, 2010:805; Babbie, 2016:23). Hence, deductive reasoning was followed in this study.

5.3 RESEARCH PARADIGMS

The term paradigm originated from the Greek word "paradeigma", which denotes a pattern and it was first used in the research conducted by Kuhn in 1962 to describe a conceptual framework that is accepted by a community of researchers or scientists and that provides them with an in-depth guideline to conduct a research study (Antwi & Kasim, 2015:1). Other scholars impart that Kuhn (1977:22) in his seminal work, "The Structure of Scientific Revolution", defines a paradigm as an integrated cluster of substantive concepts, variables and problems attached with methodological approaches and tools (Shah & Al-Bargi, 2013:253; Brooke, 2013:430). Additionally, Hua (2016:1) defines a paradigm as the constructive framework and meta-thinking behind a piece of research. After analysing the above definitions, a paradigm may be thought of as a pattern or model of how something is structured and how it functions.

A research paradigm is an approach or a research model to conducting research that has been verified by the research community for a length of time and has been in practice for hundreds of years (Antwi & Kasim, 2015:218). Rahi (2017:1) describes a research paradigm as an essential collection of beliefs shared by the scientist, a set of agreements about how problems are to be understood, how we view the world and thus go about conducting research. They contain a basic set of beliefs or assumptions that guide the inquiries for particular research. Every research study uses research paradigms as a guideline for developing research methodology and to take on the research venture in a manner that is most valid and appropriate. Romm (2018:18) also notes that research paradigms serve as frameworks that guide researchers in the identification and clarification of their beliefs about ethics, reality, knowledge, and methodology of research. Thus, they form the niche through which research methodologies are developed.

There are many research paradigms such as the positivist, post-positivist, interpretivism, phenomenology and pragmatism, among others (Handerson, 2011:341; Hakansson, 2013:1; Easterby-Smith, Thorpe & Jackson, 2015:53; Romm, 2018:19). However, the most distinctive in business research include positivism, phenomenology, and pragmatism. The roots of the positivist paradigm can be traced back to the works of Auguste Comte who saw human beings as a phenomenon to be studied scientifically (Babbie, 2016:35). De Vos, Strydom, Schulze and Patel

(2011:5) opine that the positivist view assumes that human beings are seen objectively and as a result, the social scientist looks to different avenues to study human society. The positivist paradigm may be seen as an approach to social science research that seeks to apply the natural science model of research as a point of departure for investigating social phenomena and explanations of the social world (Denscombe, 2010:120). It entails a belief that valid knowledge can only be produced based on direct observation by the senses and that scientific knowledge is gained through the accumulation of verified facts (Ani, 2016:1). It also assumes that by using the results of scientific tests, one can understand how the world works. Hence, it is generally referred to as the scientific method.

Phenomenology is a paradigm that entails a proper understanding of life experience engagements (Oiler, 1986:92). The phenomenological paradigm can be traced back to early 20th-century philosophers such as Husserl, Sartre and Merleau-Ponty who studied individual's perceptions, feelings and lived experiences. Other scholars such as Smith, Flowers and Larkin (2009:15) and Guest, Namey and Mitchell (2016:10) conceptualised phenomenology as a philosophical approach to the study of experience that shares a particular interest in thinking about what the experience of being human is like, in all of its various aspects, but especially in terms of the things that matter to us, and which constitute our lived world. One of the applauded characteristics of this paradigm is to emphasise better comprehension of individuals' social life experiences (Hakansson, 2013:1). Moreover, Lien *et al*. (2014:191) highlight that the phenomenological research approach involves more reliability and validity of the entire process of evaluating how a human understands their life experiences. Gallagher (2012:7) adds that this philosophy is centred on observing individuals' perceptions of a specific matter and is mostly used in qualitative studies. Generally, phenomenology is allied to qualitative studies.

Apart from the phenomenology paradigm is the pragmatism approach. The pragmatism research paradigm recognises that there are different ways of interpreting the world and undertaking research, such that no single point of view can ever give the entire picture and that there may be multiple realities (Romm, 2018:20; Dudovskiy, 2016:3). Dudovskiy (2016:3) highlights that in the pragmatism paradigm both observable phenomena and subjective meanings can provide acceptable knowledge that is dependent upon the research question. Thus, it endows that to gain

knowledge one has to use both subjective and objective means. The pragmatic paradigm is therefore associated with mixed methods research.

Among the research paradigms above, the positivism approach was followed in this study. The paradigm was chosen based on its conformity with the nature of the study. It allows scales to be developed and measured from a positivist perspective. Additionally, the present study is quantitative in nature and used a highly structured data collection instrument which enables measurements to be conducted and measured from a positivist point of view as argued by Creswell (2009:8).

The next section discusses the research approach utilised in this study.

5.4 RESEARCH APPROACH

There are three broad methodologies in social science research, which have been consistently applied over the years (Cresswell, 2014:3). They include the qualitative, quantitative and mixed methods approaches. Qualitative research methodology denotes the subjective analysis and interpretation of wording and meaning over the quantification of objective analysis and data collection of social components (Zou, Sunindijo & Dainty, 2014:318; Babbie, 2016:48). Leedy and Ormrod (2015:269) present it as a multimethod research approach that entails studying a subject in a naturalistic and interpretive manner. The qualitative research approach is an effective method to represent respondents' real-time views and perceptions of a certain social fact (Neuman, 2014:128). It is most prominent in sociology, psychology, anthropology, engineering, nursing and cultural fields in which first respondents' views are required (Flick, 2014:14; Leedy & Ormrod, 2015:269). Qualitative research approaches make use of interpretive techniques such as grounded theory and content analysis to interpret qualitative data (McLeod, 2017:2).

The quantitative method, on the other hand, is an objective, statistical-based approach to research, which encompasses the adoption of deductive reasoning to ground the research with an appropriate theory (Punch, 2013:20). McLeod (2017:3) describes a quantitative research approach as an approach that primarily entails mathematically collecting data to insert the data into rank orders or

categories. This method is most appropriate when assessing the beliefs and attitudes of respondents towards particular research patterns or phenomena (Babbie, 2016:56). McLeod (2017:3) submits that the quantitative research approach uses methods such as experiments, questionnaires and controlled observations to acquire quantitative data. McLeod (2017:3) further states that in terms of data analysis, quantitative research makes use of descriptive statistics to convert data into essential information for decision making and it also entails the utilisation of inferential statistics to identify crucial differences between multiple variables.

A mixed methods protocol is more of an integrative approach, which combines both qualitative and quantitative methodologies (Zou *et al.,* 2014:320). The essence of this methodology hinges on the assumption that the combination is more of a complementary one, as the loopholes in both approaches are compensated for by the other's strong points (Neuman, 2014:25). The mixed methods approach, which draws upon the relative strengths of both qualitative and quantitative methods, is most suitable for nursing and health sciences due to the complexity and critical nature of the identified field (Creswell, 2014:54). Mixed methods are associated with the pragmatism paradigm which supports the use of and mix of different research methods as well as various modes of analysis combined with a continuous cycle of deductive reasoning (Feilzer, 2010:6; Mitchell, 2018:106).

As the current investigation is grounded on deductive reasoning and the positivism paradigm, a quantitative research approach was chosen. Also, the fact that the study seeks to examine direct and indirect relationships among research constructs provides the link with the quantitative approach. Moreover, the quantitative method is widely regarded as reliable and valid in that it allows for the unbiased interpretation of results through a concise analysis of the collected data (Zou *et al.,* 2014:319). It was also intended that the results of the study be generalised to other environments and contexts, hence the use of the quantitative research approach. Neuman (2014:24) affirms that quantitative research is suitable when numerical variances are tested, such as descriptive statistics and when an investigation intends to test hypotheses, as is the case in this study.

The next section discusses the time dimension of the study.

5.5 TIME HORIZON

Time is a critical dimension to every study. The research time dimension can be incorporated in two ways, namely, cross-sectional and longitudinal (Neuman, 2014:44). Cross-sectional research can be described as any research that examines information in many cases at one point (Neuman, 2014:44). Cross-sectional research can be exploratory, descriptive, correlational or explanatory in nature. This study utilised cross-sectional research since longitudinal research would be inappropriate because it denotes any research that examines information from many units or cases across more than one point in time.

Ex-post facto analysis is yet another dimension of research time, which has been increasingly used in several fields such as education, transport economics and criminality (Broughton, 2011:719; West & Lee, 2011:9; Jarde, Losilla & Vives, 2012:97; Tuckman & Harper, 2012:1). Simon and Goes (2013:1) define ex-post facto as an after-effect/fact research, subject to an analysis of the causal reasons for a problem once the problem/fact has occurred. These authors further stress that ex-post facto utilises secondary data and is regarded as a method of determining the cause of a specific problem. Therefore, the ex-post facto approach is suitable for any study that seeks to establish the underlying cause of a problem after its occurrence.

In the current study, cross-sectional research was selected because of its suitability. In cross-sectional research, data are collected from respondents once at a single point in time. This is the case in this study, where data were collected from respondents only once in a specific period of time which was during the months of March to September 2019.

The next section discusses the research design employed in this study.

5.6 RESEARCH DESIGN

A research design is defined as a detailed framework or plan that helps to guide the researcher through the research process (Babbie, 2016:87). Creswell (2014:15) defines research design as a plan of action for research that spans from the broad assumptions to detailed methods of data

collection and analysis. The research design clarifies the purpose of the study, outlines the type of data to be collected, describes the methods to be used to gather and analyse data, the extent to which they are manipulated and controlled by the researcher and also the justifications for using the data collection methods selected (Creswell, 2014:4). Malhotra (2010:4) postulates that there are various frameworks of research designs with each type of research design having a range of research methods that are commonly used to collect and analyse data. This study utilises a combination of a descriptive and correlational research design.

The descriptive research design involves the study of the descriptive characteristics of a study's population or phenomenon (Punch, 2013:15). Bist (2014:36) presents it as research that describes the state of affairs, as it exists at present. Sekeran and Bougie (2009:105) also specify that descriptive studies are conducted to assess and describe the characteristics of the variables of interest in a situation. They are more inclined to provide answers to questions about the "what" as opposed to the "when/how/and why" (De Vaus, 2013:22; Malhotra, 2010:4). Wilson (2010:104) suggests that descriptive research studies do not determine cause-effect relationships but provide accurate information and help form the basis of simple decision making by setting out to provide answers to what and who questions. Consistently, Bist (2014:36) submits that in descriptive research, the researcher only reports what has happened or what is happening, but he has no control over the variables. Descriptive research studies are quantitative in nature and they include surveys and fact-finding inquiries (Krosnick *et al.,* 2014:406). The descriptive research design was selected because of its high degree of representativeness and the ease in which the researcher could obtain the participant's opinion (Pilot & Beck, 2004:50; Pickard, 2013:112). In the present study, a descriptive method was used to determine the nature and attributes of a demographic composition as well as the perceptions of respondents towards the research constructs.

Correlational research is a method that analyses the variances between the characteristics of two separate groups (Leedy & Ormrod, 2001:3). The main purpose of a correlational study is to determine relationships between variables, and if relationships exist, to determine a regression equation that could make predictions to a population (Simon & Goes, 2011:1). A correlation study describes the degree to which two or more quantitative variables are related and it does so using a specific relationship coefficient. Correlation research is sometimes referred to as a form of

descriptive research because it describes an existing relationship between variables (Samya, 2018:332). However, the two designs are differentiated in the way they describe the relationships. This design was chosen based on its ability to explain certain behaviours and its ability to predict the likely outcome. The correlational design in this study was used to test the relationship between SCM practices, namely, SCC, INV, IS, IQ, SCD, SCI and SP, which is the mediating variable and SCR which is the outcome variable.

5.7. RESEARCH STRATEGY

Research strategy is defined as an overall plan for conducting a research study (Johannesson & Perjons, 2014:39). Examples of research strategies include cases studies, observations, experiments and surveys. The present study utilised a survey research strategy to gather data. Pickard (2013:111) describes survey research as a research strategy that is used to gather and analyse information by administering a questionnaire to individuals who are representatives of the selected research population. Pickard (2013:111) highlights that in the survey research method, questions are asked to respondents by utilising a standardised questioning procedure that is equal and consistent across the identified and selected respondents. This is the case in this study, where a standardised questionnaire (Appendix 1) was used as the instrument for data collection. Ponto (2015:168) emphasises that it is vital to highlight the difference between a survey and a questionnaire as they are often used interchangeably. A survey is a method whereas a questionnaire is a data collection tool that may be incorporated within various research methods (Check & Schutt, 2012:160; Ponto, 2015:168).

The next section provides an overview of how secondary data were collected.

5.8 COLLECTION OF SECONDARY DATA

In the present study, secondary data were collected through a review of previous literature. A literature review refers to an appraisal of information obtained in the previous writings associated with a chosen study area (Zikmund, Babin, Carr & Griffin, 2013:23). The review summarises, evaluates and clarifies these past writings, provides a theoretical underpinning for the research,

and assists in determining the direction of the study as well as providing a solid background to support the investigation (Rowe, 2014:241). The literature review also facilitates the overall comprehension which provides sense to the data interpretation, inferences, and what will be recommended in the study (Zikmund *et al.,* 2013:34). It is moreover considered central to conduct a literature study because it limits the drawbacks of research methods and restricts the collection of data to what is actually substantially worthwhile for the current study (Neuman, 2014:67). This has the effect of linking the current research to prior efforts and extends it to build on improved understanding.

In light of the above insights, a review of literature was conducted with the aim of understanding various aspects of the study. Chapter One focused on the introduction of the study. It discussed the background of the study, the problem statement and highlighted the objectives, research questions as well as the conceptual framework of the study. Chapter Two focused on SCM in South Africa. It analysed the frameworks that underpin supply chains and what public SCM seeks to achieve. The chapter also discussed the challenges facing public SCM in South Africa. Chapter Three was devoted to the review of literature related to the constructs under consideration in this study. The chapter reviewed literature on SCC, INV, IS, IQ and SCD as well as SCI. Chapter Three also analysed the antecedents that drive each of the constructs and the possible outcomes that public sector organisations might benefit from if they employ these SCM practices. The chapter also reviewed the research theory that was employed in this present study.

Chapter Four reviewed literature on SP and SCR. The chapter discussed how the two practices are conceptualised, the benefits of evaluating SP and benefits of a resilient organisation as well as the antecedents that drive them. Chapter Four also focused on the formulation of hypotheses to be tested in this study. The data used in the literature review were derived from internet sources, textbooks and journal articles available in databases such as Emerald, Researchgate, Sabinet, Francis and Taylor as well as Science Direct, among others.

The next chapter discusses the collection of primary data.

5.9 EMPIRICAL PORTION OF THE STUDY

The empirical research portion of the study pertains to the actual collection of primary research data. It encompasses the sampling design, the formulation of the measurement items in the form of structured research questionnaires, and the data collection and analysis procedures. The next subsections discuss these respective topics.

5.9.1 Sampling design

Sampling design is the researcher's provisional plan for a quantitative description of trends, attitudes or opinions of a population by studying a sample of that population (Creswell, 2013:235; Mackey & Gass, 2015:11). It encompasses the target population, sampling frame, sampling size and sampling method (Feildmann, 2014:1). Figure 5.2 provides a depiction of the sampling design framework used in this study.
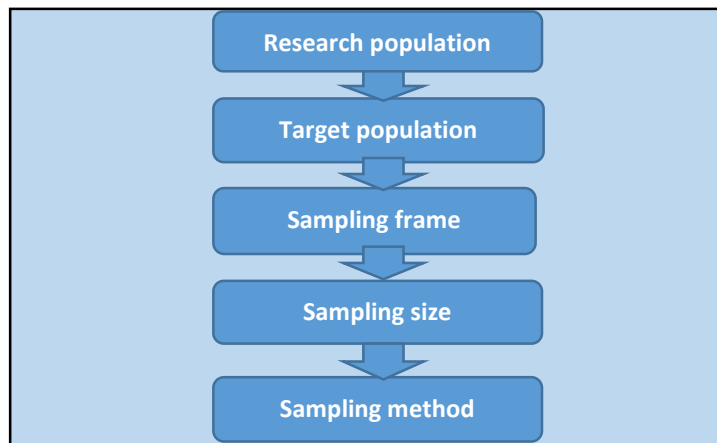
Figure 5.2: Sampling design framework
Source: Author's own compilation

5.9.2 Population

A population pertains to the abstract idea of a large group of many cases from which a researcher draws a sample and to which results from a sample are generalised (Neuman, 2014:247). Babbie (2012:197) conceptualises it as the aggregation of elements from which a sample is selected. In

this study, the population was SCM professionals in South African public sector organisations. This study focused on SCM professionals based in the Gauteng Province, which is the economic hub of South Africa and most government departments are located there.

5.9.2.1 Target population

A target population refers to all the members who meet the particular criterion specified for a research investigation (Alvi, 2016:10). Ott and Rongnecker (2015:26) describe it as the complete collection of objects whose description is the major goal of the study. Neil (2015:3) put it as the entire group or set of individuals from which research data is collected. In this study, the target population comprised SCM professionals such as demand planners, purchasing and procurement managers and officers as well as logistical personnel employed in public sector departments in the Gauteng Province. These professionals qualify as the target population because of their experience, association and in-depth knowledge in relation to SCM issues under investigation in this study. However, the exact number of SCM professionals employed in public sector organisations in Gauteng was not available since no single list containing the names and statistics of such professionals was accessible to the researcher.

5.9.3 Sampling frame

A sampling frame is a list of cases in a population, or the best approximation of them (Neuman, 2014:252). Babbie (2016:201) defines a sampling frame as the list or quasi list of units composing a population from which a sample is selected. If the sample is to be representative of the population, it is essential that the sampling frame includes all (or nearly all) members of the target population (ibid). Sirakaya-Tuck, Uysal, Hummitt and Vaske (2015:7) define a sampling frame as a list or frame that identifies every member (element) of the population under consideration in a study. Sampling frames can be the list of names of addresses or households in the city or telephone numbers (Ott & Rongnecker, 2015:25). The sampling frame of this study consists of SCM professionals in the public sector in the Gauteng Province. However, the sampling frame for this study was not available since a list of such professionals was unobtainable for use in this study.

Hence, only SCM professionals in public sector organisations (departments) in the Gauteng province that were willing to participate in the study were included.

5.9.4 Sample size

A sample size may be perceived as the determination by the researcher of the number of respondents that can be feasibly included in a statistical sample (Singh & Masuku, 2014:6). Kumar (2014:45) presents it as the number of respondents from which information is obtained. As such, the sample size can be viewed as being the number of respondents to be included in the study. It is imperative to determine the right and appropriate sample for any study as it limits the influence of outliers and is also critical for economic and ethical reasons. Kumar (2014:46) is of the view that it is essential to determine the most appropriate sample size because if the number of respondents is too large it is tantamount to unnecessary wastage of resources, while a sample that is too small may affect adversely the accuracy of sample estimates and in turn the very utility of the sampling plan. The sample size for this study was determined using the historical sample size approach, which determined sample size by benchmarking with previous studies related to this one. Table 5.1 presents the historical evidence of estimated sample sizes derived from previous studies in SCM.

Table 5.1: Historical sample size from previous studies

CONSTRUCT	Previous study	Country/region	Sample Size used
Supply chain collaboration	Salam (2017:305)	Thailand	181
	Liao, Hu & Ding (2017:147)	Taiwan	465
	Ralston (2014:47)	USA	432
	Kumar (2017:49)	India	812
	Ramanathan (2014:210)	India	150
Supply chain innovation	Kim & Chai (2017:48)	South Korea	272
	Lee, Lee & Schniederjans (2011:1202)	South Korea	700
	Strorer *et al*. (2014:498)	Australia	412

	Yoon, Lee & Schniederjans (2016:416)	Korea	600
	Lii & Kuo (2016:146)	Taiwan	480
Information sharing	Riley *et al.* (2016:961)	USA	231
	Song *et al.* (2016:746)	China	208
Information quality	Zhou *et al.* (2014:627)	China	125
	Marinagi, Trivellas & Reklitis (2014:476)	Greece	200
	Turson *et al.* (2016:748)	China	208
	Ding *et al.* (2014:96)	Australia	162
Supply chain design	Kumar (2016:11)	India	220
	Sezen (2008:235)	Turkey	125
Supply chain integration	Beheshti (2014:25)	Sweden	271
	Sandram *et al.* (2016:1453)	Malaysia	156
	Huo (2012:601)	China	671
Supplier performance	Hwang and Min (2013:1032)	USA	120
	Ashenbaum & Maltz (2017:380)	USA	364
	Stouthuysen *et al.* (2012:427)	Belgium	252
	Yang & Zhang (2017:119)	China	256
	Lee (2015:42)	South Korea	207
Supply chain resilience	Park, Min & Min (2016:125)	Korea	174
	Cheng and Lu (2017:12)	Taiwan	297
	Golgeci & Ponomarov (2013:608)	US	114
	Pournader *et al.* (2016:597)	Iran	150

Source: Author's own compilation

As indicated in Table 5.1, the lowest sample size used is 144 and the highest size is 850. Based on this guideline and the need to have equal representation of all disciplines within the public sector the sample size was initially set at n=500 respondents. Thompson (2004:160) provides that the sample size has an impact on the precision of all statistical estimates. Hair, Michael and Brunsveld (2019:210) are of the view that in determining the sample size no rule of thumb applies as there are several factors to be considered. However, Dolnicar, Grun and Leich (2016:1003) opine that a

sample of 500 respondents prevents limiting the statistical significance of the results as would be the case if a small sample size is used. Consistently, Wang, Noe and Wang (2015:1003) suggest that having a large sample size in quantitative studies prevents limiting the statistical significance of the results as would be the case if a small sample is used. Hair, Celsi, Money, Samouel and Micheal (2015:185) add that it is acknowledged generally that large sample sizes result in accurate and credible statistical findings. Therefore, a sample size of n=500 respondents was set initially for this study.

In addition, since the data collected were analysed using SEM, there was a need to motivate the use of a sample size of 500 respondents as the standard. Generally, there is no consensus in the literature regarding the minimum number of respondents in quantitative research where SEM is used. Kline (2016:3) alludes to the premise that SEM is used where large samples are drawn. Some scholars (Anderson & Gerbing, 1984:155; Jackson, 2001:205), in their simulation studies suggest a minimum sample size of N= 100. However, scholars such as Hoe (2008:76) and Sigh, Junnarkar and Kaur (2016:60) dispute the sample of 100 as they suggest that minimum sample sizes of 100 are poor. They alternatively suggest that at least 200 respondents offer adequate power for data analysis. Besides, Nevitt and Hancock (2001:353) recommend a sample of 200-1000 when the model is complex whereas Bandalos (2014:102) highlights that a sample of 200-500 is needed for sufficient power to reject models. Consistently several scholars (Comrey & Lee, 1992:15; Tabachnick & Fidell, 2013; DeVelli, 2017:260; Kyriazos, 2018:2216) present sample sizes of 50 as very poor, 100 as poor, 200 as fair, 300 as good and 1000 as excellent. Additionally, Shumacker and Lomax (2016:240) highlight that in SEM, sample sizes can be 100-500 or more subjects per study. Hence, the sample size used in this study is justifiable as it was pegged at n=500 initially.

5.9.5 Sampling approach

Sampling refers to the process of obtaining samples to estimate characteristics of the whole population (Berndt & Petzer, 2013:349; Grami, 2019:242). Other scholars (Baran & Jones, 2016:108; Digout, Senechal & Salloum, 2019:262) view sampling as the act, process or technique of selecting a suitable sample or a representative part of a population for determining parameters or characteristics of the whole purpose. Generally, there are two main types of sampling

approaches used in research, namely, non-probability and probability sampling (Zikmund *et al.,* 2013:392). To Babbie (2016:195), non-probability sampling, includes any technique in which samples are selected in some way not suggested by probability theory. Various scholars (Gravetter & Forzano, 2012:125; Shorten & Moorley, 2014:1; Alvi, 2016:13; Elfil & Negida, 2017:1) also suggest that non-probability sampling methods are approaches where the sample population is selected in a non-systematic process that does not guarantee an equal chance for each subject of the target population. Thus, in non-probability sampling, randomisation is not important in selecting a sample from the population of interest, rather subjective methods are used. Non-probability sampling includes techniques such as convenience, judgemental, snowballing and quota sampling.

In contrast, the probability sampling approach is one in which every item in the population has an equal and known chance of being selected and included in the sample (Elfil & Negida, 2017:1). Consistently, Ary *et al.* (2018:172) state that probability sampling employs random selection, which implies that every element in the population has a non-zero chance of being selected. In probability sampling, the inclusion of each population element takes place by chance and is attained through random selection. Ary *et al.* (2018:172) further highlight that the main characteristic of probability sampling is that every element or unit of the population has a known probability of being chosen in the sample. Examples of probability sampling include simple random, systematic, stratified, cluster and multistage sampling techniques (ibid).

Despite the nature of this study, non-probability sampling techniques, namely, convenience sampling and judgemental sampling were used. Convenience sampling has been defined by Neuman (2014:248) as a non-random sample in which the researcher selects anyone he or she happens to come across. It can also be termed accidental, availability or haphazard sampling (Alvi, 2016:29; Etikan, Musa & Alkassim, 2017:1). The ideal criteria of convenience sampling are for selecting cases that are easy to reach, convenient or readily available. Convenience sampling was used to select public sector organisations from which sampling elements were drawn. It was utilised because of its usefulness in situations where the population is broad. Also, since the sample frame (list) of all public sector organisations in the Gauteng Province was not available, the

convenience sampling technique was used to select departments/entities from which samples were drawn.

Judgemental sampling refers to a type of sampling in which the units to be observed are selected based on the most useful or representative (Babbie, 2012:191). It can also be described as purposive, selective or subjective sampling and is a non-random technique that is not based on underlying theories or a set number of respondents (Cresswell & Plano Clark, 2011:144). The researcher decides what needs to be known and sets out to find people who can and are willing to provide information by virtue of their knowledge and experience. The judgemental sampling technique was used to select respondents from the selected public sector organisations. The technique was applied in selecting SCM professionals because of their experience and professional knowledge. It was also used to select respondents since there is no single list of all SCM professionals working in the public sector in the Gauteng province. However, to be included in the study, respondents were expected to have at least two years of experience in public SCM.

The next section discusses procedures for data collection.

5.10 PROCEDURES FOR DATA COLLECTION

Data collection is a research process that informs how relevant information to address the research problem will be gathered (Sani, 2013:40). Others refer to it as the process of gathering information on the variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes (Bacardit, Widera, Lazzarini & Krasnogor, 2014:2; Rosalina & Jayanto, 2018:42). The sole purpose of collecting data is to capture quality evidence that translates to rich data analysis and allows the building of a convincing and credible answer to questions that have been posted (Rosalina & Jayanto, 2018:42). This section focuses on the primary methods that were used by the researcher to collect data.

Quantitative data or numerical evidence are often collected through self-reported questionnaires and surveys (Allen, 2017:336). However, these data can also be from structured interviews, observations, tests, and inventories. In the present study, primary data were collected using a

survey questionnaire. A questionnaire is a list of mimeographed or printed questions that are completed by or for a respondent to give his opinion (Roopa & Rani, 2012:273). The use of the questionnaire instrument was influenced by its ability to enable quantitative data to be collected in a standardised approach which makes them internally consistent and coherent for analysis. The method also ensures the protection of the privacy of the respondents as they will respond honestly only if their identity is hidden and confidential (Roopa & Rani 2012:273). The questionnaire method was further chosen because it eliminates bias, is less expensive, and satisfies the sample size requirements for quantitative research, which was pegged at n=500.

A survey questionnaire can be either be structured or unstructured (Maruyama & Ryan, 2014:176) Structured questionnaires can be described as those questions in which there are definite, concrete and predetermined questions where the questions are presented with the same wordings and in the same order to all respondents (Roopa & Rani, 2012:274). In contrast, in the unstructured questionnaire, the interviewer is provided with a general guide on the type of information to be obtained, but the exact question formulation is largely his/her responsibility and the responses are to be recorded in the respondent's own words (Ponto, 2015:170). This study utilised the structured questionnaire technique to collect data that satisfies the sample size of the study.

Questions in a survey questionnaire can either be open-ended or closed-ended in nature (Sreejesh, Mohapatra & Anusree, 2014:148). Maruyama and Ryan (2014:176) went further, explaining that open-ended questions allow respondents to answer in a relatively unconstrained way, either by writing or typing a response or telling it to the interviewer who is instructed to record the response verbatim. This view is supported further by Sreejesh *et al*. (2014:148), who mention that in open-ended questions, respondents reply in their own words without being constrained by a fixed set of possible responses. In contrast, closed-ended questions are those that provide two or more response alternatives and respondents are instructed to select the choice closest to their position (Maruyama & Ryan, 2014:176). Roopa and Rani (2012:274) denote that responses to closed-ended questions are measured using the Likert scale and the semantic differential scale.

In addition, to open-ended and closed-ended questions, two additional types of questions, namely, contingency or cascade format questions and matrix questions have been identified. Some scholars

(Vijay & Arvind, 2010:70; Hulley, Cummings, Browner, Grady & Newman, 2015:18) advise that contingency questions (cascade format) include questions that are answered only if the respondent gives a particular response to a previous question. They help in avoiding asking questions to people that do not apply to them. On the other hand, matrix questions include providing identical response categories that are assigned to multiple questions. The questions are placed one under the other, forming a matrix with response categories along the top and a list of questions down the side (Rubin & Babbie, 2010:175). In this study, questionnaire items were closed-ended, which denotes that respondents were restricted to indicating their answers to the structured questions provided. Closed-ended questions were chosen on the basis that they are easily scored to produce meaningful results for analysis and the provision of response categories helps to clarify the intent of the question (Vijay & Arvind, 2010:70).

Data from survey questionnaires can be collected through a myriad of ways such as emails, postal, telephone, drop and collect, group-administered and online questionnaires (Mathers, Fox & Hunn, 2009:8). In this present study, data were collected using a combination of e-mails and self-administered, through the drop and collect method, which allows the researcher to distribute and allocate questionnaires to respondents and collect them once completed. The researcher physically distributed questionnaires to SCM professionals who are employed in the public sector in the Gauteng province. This method is appropriate because it increases the overall response rate (Maruyama & Ryan, 2014:397).

The distribution and collection of questionnaires was conducted from March to September 2019. Respondents were given three weeks to complete the questionnaires. Resources used in the preparation, distribution, and collection of questionnaires were provided by the Higher Degrees Research Department at the Vaal University of Technology. In line with the predetermined sample size, a total of 500 questionnaires were prepared and distributed to respondents. Out of these distributed, 402 were returned, and 334 were used in the final data analysis (refer to Chapter 6.2).

5.10.1 Questionnaire design

A questionnaire is a research instrument consisting of a series of questions and other prompts to gather information from respondents (Kabir, 2015:208). Questionnaires serve four functions, namely, enabling data collection from respondents, lending structure to interviews, providing a standard means for writing down answers, and helping in processing data (Sreejesh, Sanjay & Anusree, 2014:143). The effectiveness of the questionnaire lies in its design. Bryman and Bell (2014:278) stress the importance of questionnaire design as they propose that to gather useful and relevant information, careful consideration must be given to the design of the questionnaire. Sreejesh *et al*. (2014:143) are of the same view, as they stress that a questionnaire will be ineffective if it is not designed in a manner easily understood by both the interviewer and the interviewee. Rossi, Wright and Anderson (2013:205) mention that question sequence, question formulation and general form of questions are the three most critical aspects of a questionnaire as they reduce the chances of being misunderstood and giving a biased picture of the true state of affairs. The first few questions are particularly essential because they are likely to influence the attitude of respondents towards participating, hence they should not be confusing, time-consuming or threatening (Rossi *et al*., 2013:219). Given these suggestions, the questionnaire used in this study was designed systematically to make it simple, clear and to ensure that the questions were arranged in a logical sequence. The next section discusses the structure of the questionnaire used in this study.

5.10.2 Questionnaire cover letter

Generally, questionnaires are accompanied by a cover letter, which serves to introduce the researcher and alert the respondent about the questionnaire as well as providing details of requested actions on the part of the respondent. Moreover, cover letters play a crucial role in survey questionnaires as they shed light on the significance of the study, the importance of the respondent's assistance and seeking informed consent from the respondents. The cover letter also highlights that participation is voluntary and assures respondents of important ethical issues such as the maintenance of honesty, anonymity and confidentiality, and that participation in the study is voluntary without coercion.

The questionnaire for this study is divided into three parts, namely, A, B and C. Part A of the questionnaire contains Section A and B, which contains nine questions eliciting the demographic information of the respondents and that of their organisations in general. The questions elicit information on gender, age group, race, highest educational qualification, employment period in the organisation, the position occupied, number of years of experience in SCM, type of employment as well as the department where the respondent is based.

Part B of the questionnaire contains Sections B through G and is composed of the questions about the constructs under consideration in this study, namely, SCC, INV, IS, IQ, SCD, and SCI. Part C contains Sections H and I, and elicits information on SP and SC. Response options in all sections are presented and measured using a seven-point Likert-type scale ranging from 1=strongly disagree to 7=strongly agree. The Likert scale has been defined by Zikmund *et al*. (2014:318) as a measure of attitudes designed to allow respondents to rate how strongly they agree or disagree with carefully constructed statements, ranging from very positive to very negative attitudes towards some object. The rationale for using a Likert scale in this study lies in its ability to measure variables easily. It also enables the researcher to measure the direction and intensity of the responses from respondents, in addition to facilitating the use of different statistical tools for the purpose of data analysis and testing (Pangrika, 2016:60).

The questionnaire for this study was developed using instruments (questions) adapted from other previous studies. However, not all the questions were adopted and used in their original format but were adjusted to fit the context of this study without changing their value and meaning. A questionnaire that contains 63 questions was designed in which nine of the questions elicited demographic information of the respondents and their organisations. The other 54 questions were adapted from various previous works. The questionnaire contains eight constructs, namely, SCC (seven measurements items), INV (seven measurement items), IS (seven measurement items), IQ (seven measurement items), SCD (five measurement items), SCI (seven measurement items), SP (seven measurement items), and SCR (seven measurement items). The construct items, their sources, and reliability are presented by Tables 5.2 to 5.9. Measurement scale items are presented in a questionnaire in Appendix A.

5.10.2.1 Measurement items in Section C

This section elicited information on SCC using seven questions adapted from previous studies. These questions were adapted from validated scales used in previous studies by Fawcett, Wallin, Allred, Fawcett and Magnan (2011:38). This study used the same scale used by Fawcett *et al*. (2011:38). Further details regarding this scale are provided in Table 5.2.

Table 5.2: Scale development and reliability for supply chain collaboration

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
SCC1	Our organisation shares resources to help suppliers improve capabilities, e.g. innovation.	Fawcett, Wallin, Allred, Fawcett, & Magnan (2011:38)	Various industries in the USA	0.76
SCC2	Strategic objectives are jointly developed by supply chain partners.			
SCC3	Supplier performance is monitored and is the basis for future business.			
SCC4	The principle of shared rewards and risks governs supply chain relationships.			
SCC5	Value-added resources are shared among supply chain members.			
SCC6	Our organisation has joint decision-making activities with its supply chain partners.			
SCC7	Our organisation shares cross-functional processes with its supply chain partners to make improvements.			

Source: Author's own compilation

As shown in Table 5.2, the scale used in this study attained a Cronbach alpha value of 0.76 in the study from which it was adapted. This confirms that the scale was reliable for the use in the present study.

5.10.2.2 Measurement items in Section D

Section D sought responses regarding INV using seven measurement items. These items were adapted from different studies conducted by various scholars (Jambulingam, Kathuria & Doucette, 2005:23; Scot & Bruce, 1994:58; Lee, Lee & Sciederjans, 2011:1204; Golgeci & Ponomarov, 2013:616). The scale is presented in Table 5.3.

Table 5.3: Scale development and reliability for supply chain innovation

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
INV1	Our organisation's management actively seeks innovative technologies, processes, techniques, and/or product ideas.	Golgeci & Ponomarov (2013:616)	Manufacturing industry in USA and Europe	0.76
INV2	Our organisation is known as an innovator among others in the public sector.			
INV3	Our organisation investigates and secures funds needed to implement new ideas.			
INV4	Our organisation constantly experiments with new ideas.			
INV5	Our organisation pursues continuous innovation in core processes.	Lee, Lee & Sciederjans (2011:1204)	Healthcare industry in South Korea	0.811
INV6	Our organisation focuses on process innovations.			
INV7	Our organisation pursues new technological innovations.			

Source: Author's own compilation

As shown in Table 5.3, the innovation scale attained Cronbach alphas of 0.76 and 0.811 in previous studies conducted by Golgeci and Ponomarov (2013:616) and Lee *et al.* (2011:1204). This confirms its suitability for the present study.

5.10.2.3 Measurement items in Section E

Section E elicited information on Information sharing (IS) using questions adapted from several studies (Frohlich & Westbrook, 2001:185; Li *et al.,* 2006:107; Sheu *et al.,* 2006:24; Cao & Zhang,

2011:177; Prajogo & Olhager, 2012:514; Riley *et al.,* 2016:962). Further details regarding this scale are presented in Table 5.4.

Table 5.4: Scale development and reliability for information sharing

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
IS1	Most people within my organisation believe that sharing information is important.	Riley *et al.* (2016:962)	Health sector in United States of America	0.793
IS2	Managers from departments across the organisation are expected to share information with others.			
IS3	Our organisation shares the knowledge of core business with its supply chain partners.	Frohlich & Westbrook (2001:185)	Manufacturing industry in United Kingdom	0.7
IS4	Our organisation shares proprietary information with its supply chain partners.	Sheu *et al.* (2006:24); Projogo & Olhager (2012)	Retail industry in Taiwan	0.89
IS5	Our organisation and supply chain partners exchange confidential information.	Cao & Zhang (2011:177)	Manufacturing industry in the United States of America	0.7
IS6	Our organisation and its supply chain partners keep each other informed about events or changes that may affect them.			
IS7	Our organisation informs its supply chain partners in advance of its changing needs.	Li *et al.* (2006:107)	Various industries in China	0.83

Source: Author's own compilation

As highlighted in Table 5.4, the scale has attained Cronbach alpha values of more than 0.7 in the indicated previous studies. This confirms its suitability for use in the present study.

5.10.2.4 Measurement items in Section F

Section F used questions adapted from several previous studies (Monczka *et al.,* 1998:5553; Moberg *et al.,* 2002:775; Wiengarten *et al.,* 2010:473; Sundram *et al.,* 2016:1469) to elicit responses on IQ. Table 5.5 presents the information on these questions in detail.

Table 5.5: Scale development and reliability for information quality

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
IQ1	Information exchange between our organisation and its supply chain partners is reliable.	Monczka *et al*. 1998:5553); Moberg *et al*. (2002:775)	Manufacturing industry in Asian countries	0.82
IQ2	Information exchange between our organisation and its supply chain partners is adequate.	Sundram *et al*. (2016:1469)	Electronics industry in Malaysia	0.89
IQ3	Information exchange between our organisation and its supply chain partners is up-to-date and timely.	Wiengarten *et al*. (2010:473)	Automotive industry in Germany	0.899
IQ4	Information exchange between our organisation and its supply chain partners is accurate.	Sundram *et al*. (2016:1469)	Electronics industry in Malaysia	0.89
IQ5	Information exchange between our organisation and its supply chain partners is complete.	Wiengarten *et al*. (2010:473)	Automotive industry in Germany	0.899
IQ6	Our organisation and its supply chain partners exchange relevant information.			
IQ7	The quality of the exchanged information with our key suppliers adds value for our organisational requirements.			

Source: Author's own compilation

As presented in Table 5.5, the IQ scale attained different but acceptable Cronbach alpha coefficients between 0.7 and 0.9, which indicates that the scale is reliable. This confirms its suitability for use in the present study.

5.10.2.5 Measurement items in Section G

Section G contains five questions designed to measure SCD. These items used were adapted from a previous study by Sezen (2008:236). Table 5.6 presents further details about the items used in this scale.

Table 5.6: Scale development and reliability for supply chain design

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
SCD1	Proximity to suppliers is an important consideration for our organisation.	Sezen (2008:236)	Manufacturing industry in Turkey	0.83
SCD2	Our organisation's supplier selection criteria are well defined.			
SCD3	The number of suppliers and their capacities are sufficient to handle any possible needs of our clients.			
SCD4	Distribution channels in our supply chain can sufficiently serve the current and potential service delivery areas.			
SCD5	Logistical activities in our supply chain are coordinated to minimise problems in service delivery.			

Source: Author's own compilation

As presented in Table 5.6, the SCD scale achieved an acceptable Cronbach alpha score of 0.8 in the study by Sezen (2008:236). This attests that the scale used is reliable and confirms its suitability for use in this present study.

5.10.2.6 Measurement items in Section H

Section H contained seven questions adopted from Sezen (2008:236) and Lui *et al*. (2018:214). The questions sought to elicit information on SCI. The information on the items is presented in Table 5.7.

Table 5.7: Scale development and reliability for supply chain integration

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
SCI1	Organisations in our supply chain establish more frequent contact with each other.	Sezen (2008:236)	Manufacturing industry in Turkey	0.73

SCI2	Organisations in our supply chain create a compatible communication and information system.			
SCI3	Our organisation extends its supply chain beyond its suppliers and clients.			
SCI4	Our organisation participates in the sourcing decisions of its suppliers.			
SCI5	Our organisation's compensation and motivation mechanisms consist of factors that promote integration.	Liu *et al.* (2018:214)	Liner shipping industry in BRICS countries	0.9
SCI6	Our organisation's integration with the upstream and downstream supply chain members has increased the flexibility of its operations.			
SCI7	Our organisation has made supply chain agreements with some suppliers and clients to share risks together.			

Source: Author's own compilation

As presented in Table 5.7, the SCI scale attained acceptable Cronbach alpha values of 0.83 and 0.9 in studies by Sezen (2008:236) and Lui *et al.* (2018:214), respectively. This reveals that the scales used are valid and reliable. Attaining such Cronbach alpha values also confirms the suitability of the questions for use in this present study.

5.10.2.7 Measurement items in Section I

Section I elicited information on SP using seven items adapted from studies by Ashenbaum and Maltz (2017:336) and Millington *et al.* (2006:193). Information on these seven items is shown in Table 5.8.

Table 5.8: Scale development and reliability for supplier performance

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
SP1	Our suppliers provide us with the best prices given the desired quality of the items/services purchased.	Ashenbaum & Maltz (2017:336)	Various industries in United State of America	0.70
SP2	Our suppliers attempt to reduce the time between order receipt and			

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
	delivery to as close to zero as possible.			
SP3	Our suppliers have the ability to meet quoted or anticipated delivery dates and quantities on a consistent basis.			
SP4	Our suppliers have the ability to provide the ordered quantities on a consistent basis.			
SP5	Our suppliers have the ability to provide high-quality products/services.			
SP6	Our suppliers adhere to specifications relative to industry norms.	Millington *et al*. (2006:193)	Manufacturing industry in China	0.83
SP7	Our suppliers adhere to specifications relative to our requirements.			

Source: Author's own compilation

As shown in Table 5.8, acceptable Cronbach alpha values of 0.7 and 0.83 were attained by the SP scale in previous studies by Ashenbaum and Maltz (2017:336) and Millington *et al*. (2006:193). This confirms the suitability of the scales used for this study.

5.10.2.8 Measurement items in Section J

Section J used seven items adapted from Golgeci and Ponomarov (2013:616) and Sundram (2016:1469) to elicit information on SCR. Table 5.9 shows this information in detail.

Table 5.9: Scale development and reliability for supply chain resilience

Item code	Code description	Author(s) and year	Industry and region where scale was applied	Reliability (Cronbach's alpha)
SCR1	Our supply chain can quickly return to its original state after being disrupted.	Golgeci & Ponomarov (2013:616)	Manufacturing industry in USA and Europe	0.89
SCR2	Our supply chain can move to a new, more desirable state after being disrupted.			
SCR3	Our supply chain is well prepared to deal with financial outcomes of supply chain disruptions.			
SCR4	Our supply chain has the ability to maintain a desired level of control over			

	structure and function at the time of disruption.			
SCR5	Our supply chain has the ability to extract meaning and useful knowledge from disruptions and unexpected events.			
SCR6	Our organisation is fairly sensitive to the opportunities and threats in the business environment.	Sundram (2016:1469)	Electronics industry in Malaysia	0.77
SCR7	One of the organisation's important criteria for finding collaborative partners is their agility and ability to react.			

Source: Author's own compilation

As shown in Table 5.9, in both studies by Golgeci and Ponomarov (2013:616) and Sundram (2016:1469), the SCR scale attained Cronbach alpha values of 0.89 and 0.77. This confirms the suitability of the items for use in this present study.

The next section discusses data analysis and statistical approaches applied in this study.

5.11 DATA ANALYSIS AND STATISTICAL APPROACHES

Data analysis is a process of inspecting, cleansing, transforming, and modelling data to highlight useful information, suggesting conclusions and supporting decision-making (Bihani & Patil, 2014:95). Others describe it as the process of bringing order, structure, and meaning to the mass of collected data (Achari, 2014:180). It is a process that leads to putting the collected data into shape and suggesting how it might be analysed and interpreted. Thus, the process takes into consideration many approaches and techniques. In the present study, data analysis composed of several actions such as data preparation, data editing, data coding, data cleansing. The process also included subjecting the coded data processing through software such as Analysis of Moment Structures (AMOS Version 25.0) and Statistical Packages for the Social Sciences (SPSS Version 25.0). Other activities included testing for normality of data, descriptive statistics, and inferential statistics.

5.11.1 Data preparation

The data preparation stage takes place after data are collected and before data analysis (Anguinis, Hill & Bailey, 2019:3). It involves converting survey data collected into a format that can be accurately analysed (Kochanski, 2010:25; Hair, 2015:294). The purpose of data preparation is to check and remove outliers from the data before they are analysed and its importance is making sure that only accurate data are entered into the analysis system. This stage also involves the correction of all anomalies in the data before they are analysed. Data preparation involves several processes such as data editing, data coding and data cleansing.

5.11.2 Data editing

Data editing refers to the process through which the data are reviewed to check for consistency, adequacy, to detect errors and outliers and the correction of errors within data to maximise their usefulness for the purpose for which they were collected (Naeem, 2019:1). The purpose and objectives of data editing are to improve the quality, accuracy, and adequacy of the collected data. Naeem (2019:1) highlights that the primary data collected through various means are raw and there are likely chances of errors and inconsistencies in them, hence the need for researchers to edit them to reduce the anomalies. It involves changing the values of data shown to be incorrect. Typical errors in data include omissions, inconsistences as well as incompleteness. In this study, each questionnaire will be evaluated to ensure that it is it has been filled in correctly and where an error is detected, corrective action will be taken by making suitable adjustments where necessary.

5.11.3 Data coding

Data coding in research is a preliminary step to analysing data, which includes assigning numeric codes to responses of a questionnaire (Elliot, 2018:2851). In this study, data coding included the numbering of collected questionnaires and entering the data into an Excel spreadsheet document. In the process, all the questionnaires were numbered using a unique number and all responses were allocated a specific number. For instance, the two responses on gender, namely, male and female were allocated specific numbers, 1 for males, and 2 for the female gender. After the allocation of numeric values (codes), only the codes were entered on the Excel spreadsheet to facilitate data

analysis. The functional process of allocating data codes was applied to all questionnaires collected.

5.11.4 Data cleansing

After data have been captured and entered into an Excel spreadsheet document, they need to be checked for errors that may have occurred during the capturing process. Kochanski (2010:27) defines data cleansing as a stage that involves a one-time correction of the data residing in the elimination of all kinds of errors resulting from human negligence in the process of data capturing. It includes the replacement of missing and empty values, accuracy improvement and inconsistency removal. Common examples of irregularities and errors in entering data in the Excel spreadsheet document include missing entries, entering the numeric value twice and entering of wrong digits, for instance, entering a '5' instead of a '4' in the spreadsheet. In the case that an error occurred and was identified, corrections were made by referring to the numbered questionnaire and then re-entering the missing or wrong data. This process was repeated until no missing and wrong entries were found.

After the data were cleaned they were loaded and analysed using two statistical software packages, namely, SPSS 25.0 and the Analysis of Moment Structures (AMOS 25.0). In analysing data, various statistical techniques such as frequency distribution, measures of central tendency and dispersion, reliability analysis and factor analysis were conducted using SPSS 25.0. The structural equation modeling and path analysis were conducted using AMOS 25.0.

5.11.5 Test for normality of data

An assessment of the normality of data is a prerequisite for many statistical tests because normal data is an underlying assumption in parametric testing (Mishra, *et al.,* 2019:67). The test for normality of data refers to a process that determines if a set of data is well modelled by a normal distribution (Ghasemi & Zahediasl, 2012:487). Ghasemi and Zahediasl (2012:487) went further, posing that there are numerous ways to test if the data set is normal and these include the Kolmogorov-Smirnov (K-S) test, Lilliefors corrected K-S test, Shapiro-Wilk test, Anderson-

Darling test, Cramer-von Mises test, D'Agostino k-squared test, Anscomber-Glynn kurtosis test, D'Agostino-Pearson omnibus test, and the Jarque-Bera test.

In the present study, normality of data was tested using the D'Agostino k-squared test, which involves computing the skewness and kurtosis. Skewness is a measure of the asymmetry of the distribution of a variable (Kim, 2013:52). Cisar (2010:95) and Jain (2018:4) describe skewness as a measure that characterises the degree of asymmetry of a given distribution around its mean. It is an asymmetric representation of the mean of data distribution. Skewed data distribution can either be positive or negative. A positive skew shows that the extreme data results are large, thus bringing the mean average up (Lien & Wang, 2015:13). Positive skewness indicates a distribution with an asymmetric tail extending towards more positive values (Cisar, 2010:95). In contrast, a negative skewness indicates a distribution with an asymmetric tail extending towards more negative values (Cisar, 2010:95). Consistently, Gonzalez (2019:1) submits that in a negative skewed distribution, the extreme results are smaller than the median, thereby bringing the mean down. On the other hand, kurtosis is a measure of the peakedness or flatness of a distribution (Kim, 2013:53). Kurtosis can be defined as a measure of the combined weight of the tails relative to the rest of the distribution (Cisar, 2010:96).

There is no consensus regarding the acceptable range value for skewness. According to Kim (2013:52), the skew value of a normal distribution close to 0 and the value of kurtosis close to 3 is favourable and recommended. However, other scholars (Trochim & Donnelly, 2006:92; George & Mallery, 2010:22) state that for asymmetry to be considered acceptable (normally distributed) skewness should be between -2 and +2. Regarding the accepted range of kurtosis, some scholars (Brown, 1997:22; Kim, 2013:52; Kaller, 2018:162) provide a range of -3 and +3. The results of the D'Agostino k-squared test are reported on in Chapter Six (refer to Section 6.5).

5.11.6 Descriptive statistics

Descriptive statistics refer to a general type of simple statistics used by researchers to describe basic patterns in the data (Neuman, 2014:396). Zikmund, Babin, Carr and Griffin (2010:486) describe it as the basic transformation of raw data to represent characteristics such as central

tendency, distribution, and variability. They describe the distributions or patterns shown by the data. Generally, there are three major types of descriptive statistics, namely, measures of frequency, measures of central tendency (mean, median and mode) and measures of dispersion that include variance, standard deviation, standard error, quartile, interquartile range, percentile range and coefficient of variation (Mashra *et al.,* 2019:67). Measures of frequency are usually used to measure categorical facts whereas measures of central tendency and dispersions are used to measure quantitative (numeric) data. In this study, descriptive statistics were used to analyse data from Section A of the questionnaire which elicited information on the demographics of the respondents and their organisations. The present study used descriptive statistics such as frequency distribution tables, mean scores, and standard deviations. The results are reported on in Chapter Six (refer to Section 6.3 & 6.6).

5.11.6.1 Frequencies

Frequency statistics simply count the number of times that each variable occurs (Mashra *et al.,* 2019:68). In this study, statistical frequencies were utilised in analysing the demographic information of the population sample. For instance, the number of males and females within the sample (population). Moreover, the frequencies were used in determining the perceptions of respondents towards each construct of the study, for example, the number of respondents who agreed or disagreed with each item of the construct. The frequencies are presented in frequency tables that show the variables, their categories, the score occurrences/the actual number and the percentage (%) of the score against the total number of samples. Also, some of the frequencies are presented using graphs such as the histogram and charts such as bar and pie charts.

5.11.6.2 Mean scores

The mean score can be described as a measure of central tendency for one variable that indicates the arithmetic average, which is the sum of all scores divided by the total number of them (Neuman, 2014:399). Others consider it as the mathematical average value of a set of data (Sundaram, Dwivedi & Sreenivas, 2014:26; Mashra *et al.,* 2019:68). It is calculated using the summation of all the observations divided by the number of observations. In this study, the mean

was used to establish the most critical set of items in a specific construct and this was done by identifying the construct with the highest mean. Thus, the construct with the highest mean was considered to be the most significant construct.

5.11.6.3 Standard deviation

Standard deviation (SD) can be referred to as a measure of dispersion for one variable that indicates an average distance between the scores and the mean (Neuman, 2014:401). Sundaram *et al*. (2014:27) describe it as a measure of how spread out values are from the mean. Riggo (2015:47) and Romanowski (2017:139) are of the view that a low standard deviation indicates that the data points tend to be very close to the mean, whereas a high standard deviation indicates that the data is spread out over a wider range of values. The standard deviation was used in this study to determine if the data were normally distributed.

5.11.7 Inferential statistics

Research does not provide conclusive results based on descriptive statistics only (Andele, 2014:1). Descriptive statistics only help to describe the properties of a specific sample under study. Hence, to obtain conclusive results, hypotheses formulated in the study need to be tested. These statistics are tested statistically using inferential techniques (Ali & Bhaskar, 2016:622). Upton and Cook (2014:2) define statistical inference as the process of using data analysis to deduce the properties of an underlying probability distribution. Baddie and Halley (1995:47) and Kolawole (2001:15) submit that inferential statistics involve the use of techniques in the testing of hypotheses and drawing inferences from the findings of a study. These statistical techniques consist of two major types, namely nonparametric and parametric tests (Adeyemi, 2009:47). To test the hypotheses, the study utilised inferential statistics. Inferential statistics were analysed using structural equation modelling (SEM), which uses SPSS 25.0 and AMOS 25.0 software packages. Thus, data from Section B through I, which sought to test the hypotheses, were analysed using inferential statistics.

5.11.7.1 Exploratory factor analysis

Exploratory factor analysis (EFA) is a statistical technique that is used to reduce data to a smaller set of summary variables and to explore the underlying theoretical structure of the phenomena (Yong & Pearce, 2013:79). It is a multivariate statistical technique to model the covariance structure of the observed variables by three sets of parameters, namely, factor loading associated with latent variables called factors, residual variances called unique variances and factor correlations (Salkind, 2010:1). EFA is used to try to uncover complex patterns by exploring the dataset and testing predictions (Child, 2006:6). Moreover, EFA is used to identify the structure of the relationships between the measured variables (Singh, Gupta, Tyagi, Flusser & Oren, 2018:465). It is also used to discover the number of factors influencing variables and to analyse which variables go together (Yong & Pearce, 2013:80). It is commonly used by researchers when developing a scale and it serves to identify a set of latent constructs underlying a battery of measured variables (Myers, 2019:45). In this study, the latent variables include SCC, INV, IS, IQ, SCI, and SCD. The proposed structure of these variables is presented through the items under each section in the questionnaire. In this study, it is paramount to employ the EFA to test the data as the items in the questionnaire were borrowed and adapted from various previous studies. The results on the EFA are reported on in Chapter Six (refer to Section 6.4).

5.11.7.2 Structural equation modelling

The term structural equation modeling (SEM) does not designate a single statistical technique but instead refers to a family of related procedures. It is a statistical methodology that takes a confirmatory approach to the analysis of a structural theory bearing on some phenomena (Byme, 2016:1). Scholars such as Stein, Morris and Nock (2012:495), and Kim, Lee, Cho and Kim (2019:4) suggest structural equation modeling (SEM) is a statistical multivariate method that involves the estimation of parameters for a system of simultaneous equations. SEM is useful when measuring causal relationships between variables (Sturgis, 2016:1). Fan, Chen, Shirkey, John, Wu, Park and Shao (2016:1) are also of the same view as they state that SEM as an approach seeks to test the direct and indirect effects of pre-assumed causal relationships. Kim *et al*. (2019:4) point out that SEM as a statistical technique enables the setting up of the initial model reflecting the

hypotheses of the research, and encompasses various tests such as regression analysis, correlation analysis, and factor analysis to confirm the causal relationships between variables. Kim *et al*. (2019:4) further highlight that the factor analysis application can be divided into two strati, namely, exploratory factor analysis and confirmatory factor analysis.

SEM is presented as a combination of two statistical methods, namely, confirmatory factor analysis and path analysis (Fan *et al.,* 2016:1). Confirmatory factor analysis originated in psychometrics and has an objective of estimating latent psychometric traits (Spearman, 1904:201). On the other hand, path analysis has its beginning in biometrics and is aimed at finding the causal relationship among variables by creating a path diagram (Wright, 1921:557). Scholars such as Belkiri and Narany (2015:2073), and Hatami (2018:138) suggest that various indices can be used in testing whether the collected data support the conceptualised model. In this study, indices such as the Goodness-of-Fit Index (GFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Normed Fit Index (NFI) were used to check that the collected data support the conceptualised model. Both the confirmatory factor analysis and path analysis were conducted using AMOS 25.0.

5.11.7.3 Confirmatory factor analysis

Confirmatory factor analysis (CFA) refers to a statistical technique used to verify the factor structure of a set of observed variables (Suhr, 2018:1). Lam and Maguire (2012:4) describe it as a process of specifying the number and types of observed variables associated with one or more hypothetical constructs and analysing how well the observed variables measure the constructs. Byrne (2013) states it as the method for measuring latent variables as it extracts the latent construct from other variables and shares the most variance with related variables. It allows researchers to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. In this study, CFA was implemented to assess the psychometric properties of measurement scales. The results (refer to Section 6.7) showed satisfactory validity and reliability, thereby confirming the suitability of the measurement scales for use in this study.

5.11.7.4 Path analysis

Path analysis quantifies specific cause-and-effect relationships between observed variables (Fan *et al.,* 2016:2). Kim *et al*. (2019:3) stress that the path analysis is the basis for constructing the basic structure of the SEM. Various scholars conceptualise it as an extension of multiple regression statistical analysis with a path model that depicts the direct and indirect effects of independent variables on one or more independent variables based on a hypothesis to be verified (Moreira, Cabral, Oliveira & Silva, 2009:791; Kim *et al.,* 2019:3). Crossman (2017:2) and Fan *et al.* (2016:2) argue that, for the path analysis to be considered for use, all causal relationships between variables must go in one direction only as one cannot have a pair of variables that have a causal effect on each other. Through path analysis, the causal relationship can be represented in more detail by confirming the inherent causal effects as the direct, indirect and total effect. In this study, the path analysis was conducted after the CFA and it was performed using the AMOS (Version 25.0) software. Verification of the path model was performed by assigning data to the model and determining fitness (refer to Section 6.7).

The next section discusses the methods of establishing the reliability and validity in this study.

5.12 RELIABILITY AND VALIDITY

The use of reliability and validity in social science research is common (Golafshani, 2003:597). Reliability and validity concepts are relevant to this study as they are rooted in a positivist perspective and they are associated with quantitative research. Mohajan (2017:1) submits that they are the most crucial and fundamental features in the evaluation of any measurement instrument for valuable research. Thus, they are used to measure whether the research being carried out, studies what it is meant to study, and whether the measures used are consistent (Heale & Twycross, 2015:66). Reliability and validity are useful in this study as they were used to ascertain and assess the fitness of the research instruments used in this study. Also, they increase transparency and decrease opportunities to insert the researcher's bias thereby increasing readers' confidence. The results on reliability and validity are delineated in Chapter Six (refer to Section 6.7).

5.12.1 Reliability

Reliability relates to the consistency of a measure (Heale & Twycross, 2015:66). Other scholars conceptualise it as the extent to which results are consistent over time (Joppe, 2000:1; Golafshani, 2003:598; Singh, 2014:77). Various scholars (Drost, 2011; Campos, da Silva Oliveira, Feitoza & Cattuzo, 2017:21; Johnson, Kording, Hargrove & Sensinger, 2017:3) submit that there are various methods of ensuring the reliability of a study, namely, the Test and Retest, Alternative-Form method, Split-Halves method, Internal Consistency method, and Correction for Attenuation. Heale and Twycross (2015:2) suggest that the reliability of a study can be established through three means, namely, homogeneity, stability and equivalence. Heale and Twycross (2015:2) further explain that homogeneity or internal consistency signifies the extent to which all the items of a scale measure one construct. Homogeneity is assessed using item-to-total correlation, split-half reliability, the Kuder-Richardson coefficient and Cronbach's alpha (Lobiondo-Wood & Haber, 2013:16). On the other hand, stability is the consistency of results using an instrument with repeated testing. It is tested using test-retest and parallel or alternate-form reliability testing whereas equivalence (signifying consistency among responses of multiple users of an instrument) is assessed through inter-rater reliability. In this study, reliability was assessed through the use of the internal consistency method, which is ascertained through measures such as Cronbach's alpha, composite reliability, and item-total correlations.

5.12.1.1 Cronbach alpha

The Cronbach alpha coefficient is the most commonly used test to determine the internal consistency of an instrument (Andrew, Peedersen & McEvoy, 2015:202). It measures how well a set of variables or items measures a single, unidimensional latent construct (Andrew, Peedersen & McEvoy, 2015:202). It is essentially a correlation between the item responses in a questionnaire assuming the statistic is directed towards a group of items intended to measure the same construct (Andrew, Peedersen & McEvoy, 2011:202). The Cronbach alpha was coined and developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale. In this research study, the use of the Cronbach alpha as a psychometric test for reliability was deemed fit

because of its objectivity especially in providing statistical references that are subjected to very few questions (Yang & Green, 2011:377). In applying the Cronbach alpha coefficient, the present study utilised the rules of thumb coined by Cronbach (1951) as presented in Table 5.10.

Table 5.10: Rules of thumb for the Cronbach alpha

Cronbach alpha value	Internal consistency
0.9	Excellent
0.8-0.9	Good
0.7-0.8	Acceptable
0.6-0.7	Questionable
0.5-0.6	Poor
0.5	Unacceptable

Source: George and Mallery (2003:89-90)

The Cronbach's alpha coefficient result is a number between 0 and 1 (Tavakol & Dennick, 2011:53; Namdeo & Rout, 2016:1371). As revealed in Table 5.10, an accepted Cronbach alpha coefficient reliability of 0.7 and higher is regarded to be reliable, desirable and acceptable (Shuttleworth, 2015:1). Therefore, the alpha values for all measurement scales used in this study were above 0.7. Also, values well above 0.9 were deemed not desirable as they reveal that the scale used was likely to be too narrow in focus.

5.12.1.2 Item-total correlations

Item-total correlations refer to a psychometric measure used to judge the reliability and consistency of a measurement scale (Churchill, 1979:64; Morgado *et al*., 2017:2). The measures are performed to check if any item in the set of tests is inconsistent with the averaged behaviour of the other items on the same scale, and thus can be discarded (MaCrae, Kurtz & Terracciano, 2011:29). The item-total correlation is performed to purify the measure by eliminating garbage items before determining the factors that represent the construct (Churchill, 1979:64). Scholars such as Nunnally,(1978:1), and Hair, Black, Babin and Anderson (2010:86) submit that in testing the item-total correlations, scores should be equal to or greater than a threshold value of 0.5 for a construct

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to be regarded as reliable and it uses measures such as the Kuder-Richardson Formula 20 (K-R-20). The outcomes of all reliability computations for this present study are detailed and discussed in the next chapter.

5.12.2 Validity

Validity is defined as the extent to which a concept is accurately measured (Heale & Twycross, 2015:66). Ghauri and Gronhaug (2005:113) present it as a concept that explains how well the collected data cover the actual area of investigation. The validity of research can be ascertained through testing research instruments for criterion validity, face validity, content validity and construct validity (Mohajan, 2017:2; Taherdoost, 2016:29). Figure 5.3 presents the various sub-types of validity tests.
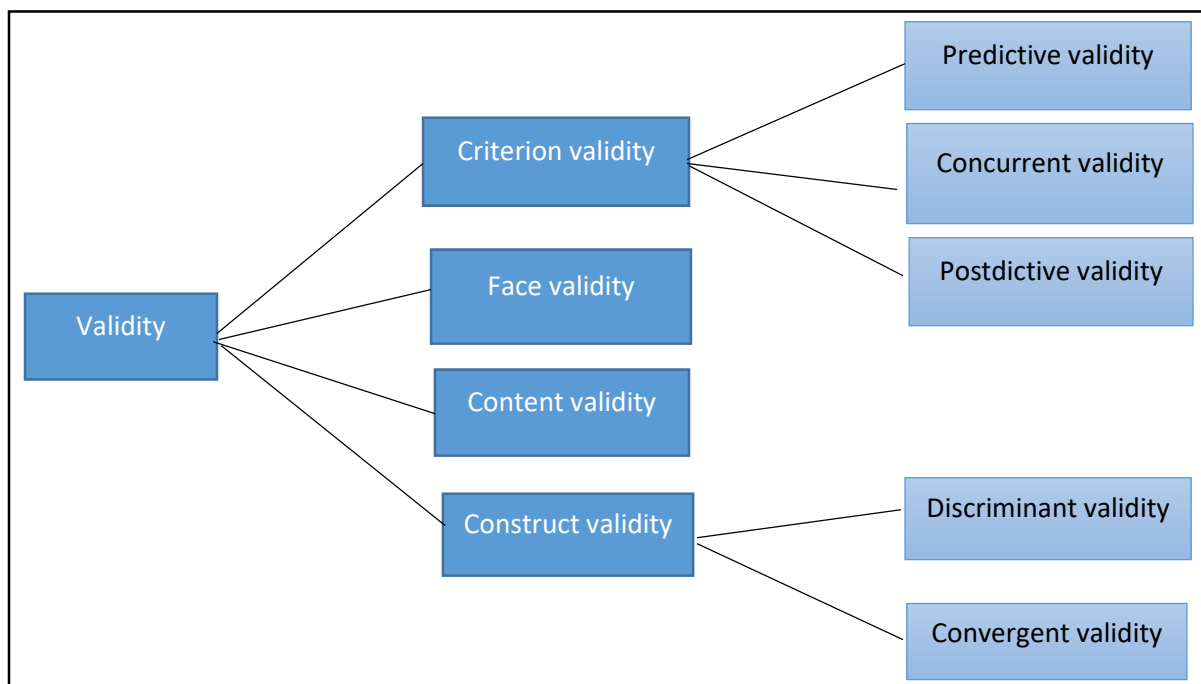
Figure 5.3: Typologies of validity
Source: **Taherdoost (2016:30)**

5.11.2.1 Face validity

Face validity can be defined as the degree to which a test appears to measure what it claims to measure (Leedy & Ormrod, 2013:27). Face validity tends to measure three things: does the measurement appear to intuitively measure the construct, are there any obvious errors in the measurement and would the question be better posed with less face validity, for instance to avoid interviewer bias or social desirability (Ruel, Wagner III & Gillespie, 2015:94). Hence some scholars refer to it as a subjective judgment on the operationalisation of a construct. In this study, face validity was established through a review of literature after which experts in the field were consulted. After a literature review and expert consultation, the questionnaire was further reviewed by a panel of academics from the Vaal University of Technology who are experts in the SCM field. Their feedback was used to improve the questionnaire through suitable modification to the wording, structure, and length of the questions.

5.12.2.1 Content validity

Content validity refers to the comprehensiveness, relevance, and representativeness of the measurement (Ruel *et al.,* 2015:90). Heale and Twycross (2015:66) view it as the extent to which a research instrument accurately measures all aspects of a construct. In other words, convergent validity analyses whether the instrument adequately covers all the content that it should concerning the variable. Content validity seeks to answer questions such as: are all components of the construct being measured, is each component necessary, relevant and representative of the concept, do the components together compose the comprehensive range for the concept and have experts agreed that this is an adequate and precise measurement (Ruel *et al.,* 2015:93). In this study, a pilot study was conducted to ascertain the content validity of the study.

5.12.2.2 Construct validity

Construct validity refers to the extent to which a research instrument measures the intended construct (Heale & Twycross, 2015:66). Brown (2000:9) conceptualises it as the experimental demonstration that a test is measuring the construct it claims to be measuring. Construct validity

is tested using two components, namely, convergent and discriminant validity (Taherdoost, 2016:30). Convergent and discriminant validity seeks to establish that the measures fit the appropriate and expected patterns of relationships with other constructs (Ruel *et al.,* 2015:94).

5.12.2.3 Convergent validity

Convergent validity refers to the degree to which two measures of constructs that theoretically should be related are related (Taherdoost, 2016:30; Grobler & Joubert, 2018:5). Hair (2011) defines it as the degree to which items converge or share a high proportion of variance in common. Convergent validity of a factor is reached if all standardised loadings of items are significant and higher than 0.5 or 0.7 and variance extracted (AVE) has a factor of 0.5 (Hair, 2011; Marnburg & Luo, 2014:39). In this study, convergent validity was tested by checking whether factor loadings were above 0.5 as suggested by Hair (2011) and Marnburg and Luo (2014:39). All items with loadings of less than 0.5 were discarded from the scale as they were a threat to convergent validity (refer to Section 6.6). In addition, the Average Variance Extracted (AVE) was also used to test convergent validity. However, despite the suggestion by Hair *et al*. (2011) of a minimum cut-off value, this study used the minimum cut-off value of 0.4 as suggested by Hair *et al.* (2010:87).

5.12.2.4 Discriminant validity

Discriminant validity denotes the degree to which two conceptually similar concepts are distinct (Hair *et al.,* 2011). This concurs with the explanation given by Ruel *et al*. (2015:94) who point out that discriminant validity is established when a measurement is not correlated with constructs to which it is assumed to be dissimilar - also known as divergent validity. The above explanations imply that each item scale must result in various loadings of different constructs (Malhotra, 1996:10). Various scholars (Anderson & Gerbing, 1988:411; Segars, 1997:107; Zait & Bertea, 2011:217) argue that discriminant validity is tested through various methods such as the correlation matrix, O-sorting, Chi-square difference test and Average variance extracted analysis (AVE). In the present study, discriminant validity was tested using the analysis of inter-factor correlations computed in the CFA (refer to Section 6.6). Discriminant validity requires correlations between items to be below 0.7 so that they can measure different issues (Anderson & Gerbing, 1988:411).

5.12.3 Research model fit analysis

Apart from testing the reliability and validity of a study, there is also the need to test the model fit. Lui, Lee and Jordan (2016:276) denote that the model fit analysis is defined as a statistical model that describes how well a set of observations fit a theoretical observation. Fit indices are important indicators of model performance. Schreiber, Stage, King, Nora and Barlow (2006:330) describe the model fit as the determination of the interaction that exists between latent constructs of a research model and the analysis of the relevant hypothesised relationship, and covariance with the identified latent constructs. It summarises the discrepancy between the observed values and the values expected under the statistical model. Models, due to their different properties are sensitive to many factors such as data distribution, missing data, model size and sample size (Hu & Bentler, 1999:815; Barret, 2007:821; Fan *et al.,* 2016:9). Hence, how they are assessed is dependent on several indices.

In this present study, to establish whether the collected data link with the conceptualised model, several model fit indices were used. These indices include the Chi-square test $\chi 2$, Goodness of Fit Index (GFI), Comparative Fit Index, (CFI), Incremental Fit Index (IFI), Normed Fit Index (NFI), Adjusted Goodness of Fit Index (AGFI), Random Measure of Standard Error Approximation (RMSEA) and Tucker-Lewis Index (TIL) (Adeyemi, 2009:49; Fan *et al.,* 2016:4). Each model fit indice has an acceptable threshold as indicated in Table 5.11.

Table 5.11: Model fit indices and their thresholds

Model fit indicator	Accepted threshold
Chi-square	≤3
Goodness of Fit Index	>0.9
Comparative Fit Index	>0.9
Incremental Fit Index	>0.9
Normed Fit Index	>0.9
Adjusted Goodness of Fit Index	>0.9
RMSEA	<0.08
Tucker-Lewis Index	>0.9

Source: Bagozzi and Yi (2012:28); Fan *et al*. (2016:6)

The results of the model fit analysis are reported on in Chapter Six (refer to Section 6.6). The next section discusses the ethical considerations followed in this study.

5.13 ETHICAL CONSIDERATIONS

Ethics refers to what is viewed as morally good in society (Babbie, 2016:61). Neuman (2014:145) stresses that ethical issues in research refer to concerns, dilemmas, and conflicts that arise over the proper way to conduct research. They define what is or is not legitimate to do or moral research procedures. This concurs with the definition of ethics coined by Creswell (2013:92), which views research ethics as reasonable approaches adopted by researchers before collecting data, during data collection and reporting of research findings to avoid violating the rights of respondents. Babbie (2016:62) highlights that anyone involved in social science research needs to be aware of the general agreement shared by researchers about what is proper and improper in the conduct of scientific agony for the subject. Thus, they stress the need for the importance of ethical considerations in research to avoid running the risk of injuring research respondents. In this study, research ethics were observed in all the processes from the coining of the research topic, literature review, data collection, and final research document. The university librarian checked if there had been a previous similar study. In the literature review, efforts were made to acknowledge and reference all sources cited in the study to avoid plagiarism. In the data collection process, ethical considerations such as informed consent, privacy, confidentiality, the anonymity of respondents, and voluntary participation among others were observed. Finally, the final research was put through a plagiarism test using the Turn-it-in software package, which produced accepted margins as per the university standards of the ethics committee. In terms of data collection, the following ethics were followed.

5.13.1 Informed consent

Informed consent refers to a norm in which subjects base their voluntary participation in research projects on a full understanding of the possible risks involved (Babbie, 2016:65). Neuman

(2014:151) defines it as a fundamental ethical principle that usually comes in the form of a statement that explains aspects of a study to respondents and asks for their voluntary agreement to participate before the study begins. In this study, informed consent was achieved by seeking permission to research the public sector (refer to the letter in Appendix B). Also, formal consent was sought from respondents before they responded to questions. Respondents were asked to sign on the questionnaire cover letter to acknowledge that they understood the research and agreed to participate (refer to the questionnaire cover letter in Appendix A).

5.13.2 Confidentiality and anonymity

Confidentiality refers to the ethical protection for those who are studied by holding research data in confidence or keeping them secret from the public, not releasing information in a way that permits linking specific individuals to specific responses; researchers do this by presenting data only in an aggregate form (Neuman, 2014:156). Also, Babbie (2016:67) submits that a research project guarantees confidentiality when the researcher can identify a given person's responses but promises not to do so publicly. On the other hand, anonymity refers to the ethical protection that respondents remain nameless (Neuman, 2014:155). Babbie (2016:67) submits that in anonymity the identity is protected from disclosure and remains unknown, guaranteed in a research project when neither the researchers nor the readers of the findings can identify a given response with a given respondent (Babbie, 2016:67). In this study, research respondents and their organisations' identities were not required in the questionnaire to ensure they are protected and anonymous. If some identities were mistakenly revealed their identities were not included in research findings and they were kept confidential. This was done to protect respondents from being victimised or prevent any harm that may result from participating in the study. Private information on individuals, such as email addresses of the respondents, was kept secure.

5.13.3 Voluntary participation

Voluntary participation refers to the human research subject's exercise of free will in deciding whether to participate in research activity (Lavrakas, 2008:1). In this study, all respondents were provided with full details of the research and were informed that their participation was voluntary

and not based on coercion. Respondents were also informed that they are free to withdraw from participating in the study.

5.14 CHAPTER SUMMARY

This chapter discussed and described the methodology that was utilised to gather and analyse data for this present study. It discussed issues to do with research reasoning where it emerged that there are two types of reasoning, namely, deductive and inductive. Amongst the two, it was established that deductive reasoning was the one that applied to this study due to its compatibility and association with the quantitative research approach. The study also discussed the paradigms that are associated with social science research and the positivist paradigm route was followed due to its compatibility and acquaintance with quantitative research. Amongst the research approaches, the quantitative approach was identified as the most appropriate for this study as it is grounded in deductive reasoning and the positivism paradigm school of thought. The study also made use of descriptive, correlational and survey research design. More importantly, the study utilised non-probability sampling techniques, namely, judgemental and convenience sampling were used to select organisations and respondents for the study. These sampling techniques were used because a list of all SCM professionals employed in the public sector was unavailable. Moreover, the chapter discussed issues that involve determining the sampling frame, sample size, research population, and target population. The study also deliberated on data collection procedures where it outlined the development of the data collection instrument used. Furthermore, the study highlighted data analysis techniques where it was revealed that descriptive and inferential statistics were used and how they were applied. The chapter further deliberated on the research ethics that were followed in the process of data collection. The next chapter discusses the results of the research.

CHAPTER 6

DATA ANALYSIS AND INTERPRETATION OF RESULTS

6.1 CHAPTER OVERVIEW

The previous chapter provided a detailed overview of the methods and techniques that have been utilised to collect the research data. It was highlighted that this study made use of a structured questionnaire to gather primary data concerning the study from targeted public sector organisations. The previous chapter further discussed the statistical techniques applied to analyse the data collected using the research instrument.

The aim of the current chapter is to present the final results from the collected data as well as to provide the analyses and interpretations of the research results. All data were analysed using a combination of the SPSS (Version 25.0) and AMOS (Version 25.0) statistical packages. The analysis of the data was divided into two phases, namely, descriptive statistics and inferential statistics. Descriptive statistics were applied first to analyse the data provided in Section A of the questionnaire that sought to establish the demographic patterns of the respondents and the profile of their organisations. This was followed by the descriptive analysis of the results where the mean scores and the standard deviations in each measurement item/scale were established to determine the perceptions of the respondents towards each construct. This chapter also presents an analysis of the psychometric properties of measurement scales utilised in the study, using the CFA procedure. These include computations of various matrices that indicate the validity, reliability and model fit results. The chapter further presents the results of the path and regression analyses performed to check the hypotheses of the study. Finally, the link between the results and the research theory is discussed.

The chapter begins with a determination of the response rate of the survey, which will then be followed by the descriptive statistical analyses.

6.2. RESPONSE RATE

Response rate pertains to the number of people participating in a survey divided by the number of people who were requested to respond, expressed as a percentage (Rubin & Babbie, 2009:117). The American Association for Public Opinion Research (AAPOR) (2001:44) defines the response rate as the number of completed interviews or distributed questionnaires divided by the total number of respondents with whom contact was made. Mitchell (1989:5) presents it as the total number of returned questionnaires divided by the total sample who were sent and completed the survey initially. This study utilised the definition given by Rubin and Babbie (2009:117) and the AAPOR (2001:44) to calculate the response rate of this study. The response rate for this study is presented in Table 6.1.

Table 6.1: Response rate

Description	Frequency
Total number of questionnaires distributed	500
Total number of questionnaires returned	402
Total number of questionnaires not returned	50
Usable responses discarded	68
Valid questionnaires retained	333
Response rate percentage	66.8

Source: Author's own compilation

Table 6.1 highlights the total number of questionnaires distributed, returned, discarded and retained during the survey and data capturing process. A total of 500 questionnaires were distributed to public sector organisations in the Gauteng Province. From the questionnaires distributed, 402 were returned, depicting a response rate of 66.8 percent. From the returned total, 68 questionnaires were discarded because they were unusable as several items had ambiguous responses (for example double-ticking) and some sections were unmarked. A total of 333 questionnaires were retained after establishing that they were valid to be used in the study. Therefore, the usable total number of responses available for analysis is 333 questionnaires.

There is no consensus regarding the minimum response rate as various scholars suggest different values. A quick review of survey literature reveals a lack of consistency and benchmark set in literature regarding the minimum and highest response rates. Some scholars (Carley-Baxter, Hill, Roe, Twiddy, Baxter & Ruppenkamp, 2009:1; Krosnik, Presser, Fealing & Ruggles, 2012:6) mention that there is no absolute threshold for a minimum response rate for sampling elements as no rate is indicative of greater or lesser accuracy utility. Dillman (2000:22) and Babbie (2009:118) suggest that a response rate of at least 50 percent is usually considered adequate for analysis and reporting. Some scholars (Babbie, 2007:22; Fincham, 2008:43) suggest that a minimum response rate of 60 percent is both desirable and acceptable, while Dong (2012:150) suggests a response rate of 70 percent. However, the proposed thresholds for response rates may be taken to be rough guides that have no statistical basis such that a demonstrated lack of response bias is far more important than a high response rate (Rubin & Babbie, 2009:388). As such the 66.8 percent response rate achieved in the present study satisfies the different recommendations cited above.

6.3 DESCRIPTIVE ANALYSIS

This section presents the results drawn from the descriptive statistics of the first part of the analysis. The discussion revolves around the data received in Section A of the questionnaire, which seeks to establish the demographic details of respondents. The descriptive analysis is premised on determining the gender, age, race, highest qualification, number of years employed, type of contract, occupational area and position.

6.3.1 Demographic profile of respondents

The data about the demographic profiles of respondents were analysed using descriptive statistics, which focused on categories such as gender, age, race, highest qualification, employment period, type of contract, occupational area and occupational position of the respondents. The statistical information in Section A of the questionnaire was divided into two categories. The first categories sought information on the respondents' gender, age, highest qualification, and race, which are presented in Table 6.2. The second category sought information about the employment status of the respondents, which was established through questions on employment period, type of contract

and type of organisation. Tables 6.2 and 6.3 are followed up with graphical representations and explanations describing the statistics depicted in them.

Table 6.2: Descriptive statistics results

Variable	Category	Frequency (n)	Percentage (%)
(A1) Gender	Male Female	166 167	49.8 50.2
Total		n= 333	100
(A2) Age	25 years and below 26-33 years 34-41 years 42-49 years 50 years and above	27 81 149 61 15	8.1 24.3 44.7 18.3 4.5
Total		n= 333	100
(A3) Race	Black White Indian Mixed Race Other	244 67 9 13 0	73.3 20.1 2.7 3.9 0
Total		n= 333	100
(A4) Highest qualification	Matric Certificate Diploma Degree Postgraduate Other	20 38 118 117 40 0	6.0 11.4 35.4 35.1 12.0 0
Total		n=333	100

Source: Author's own compilation

The discussions of each specific category are provided in Section 6.3.1.

6.3.1.1 Gender distribution of respondents

The gender distribution of respondents is presented in Figure 6.1.
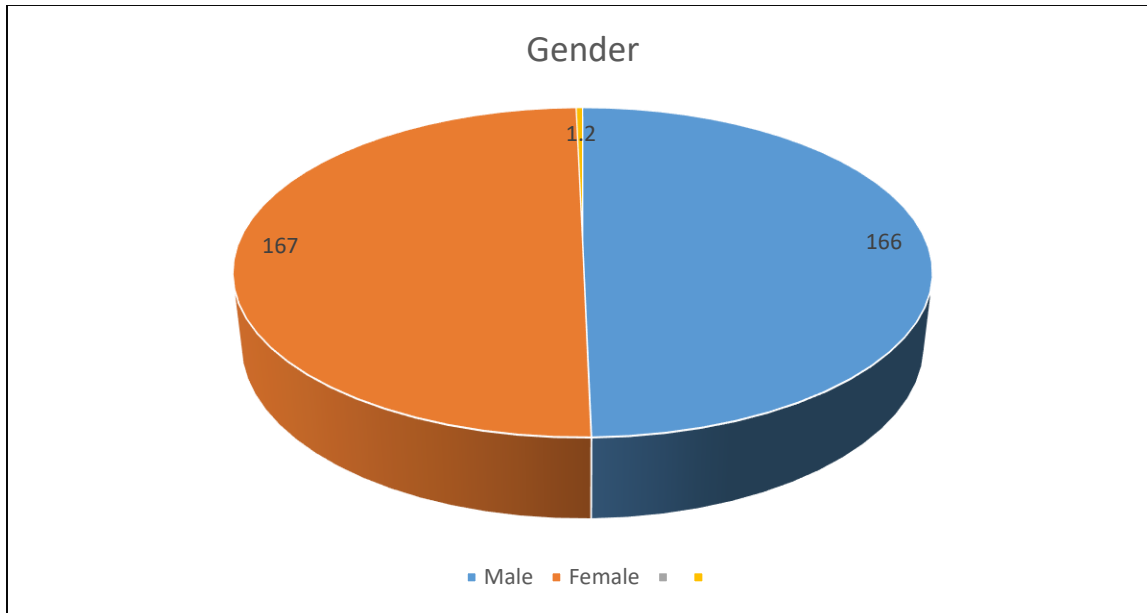
Figure 6.1: Gender distribution of respondents
Source: Author's own compilation

Figure 6.1 provides a graphical illustration of the gender structure of the surveyed respondents. It shows that there is no principal number or any gender dominance as the number of male respondents is almost equivalent to the number of the female gender. The male population registered a total of 166 (49.8%) respondents, whereas the female gender registered a total of 167 (50.2%). The percentages of both genders show an equal representation of male and female SCM professionals in the study.

6.3.1.2 Age distribution of the respondents

The age distribution of respondents is presented in Figure 6.2.
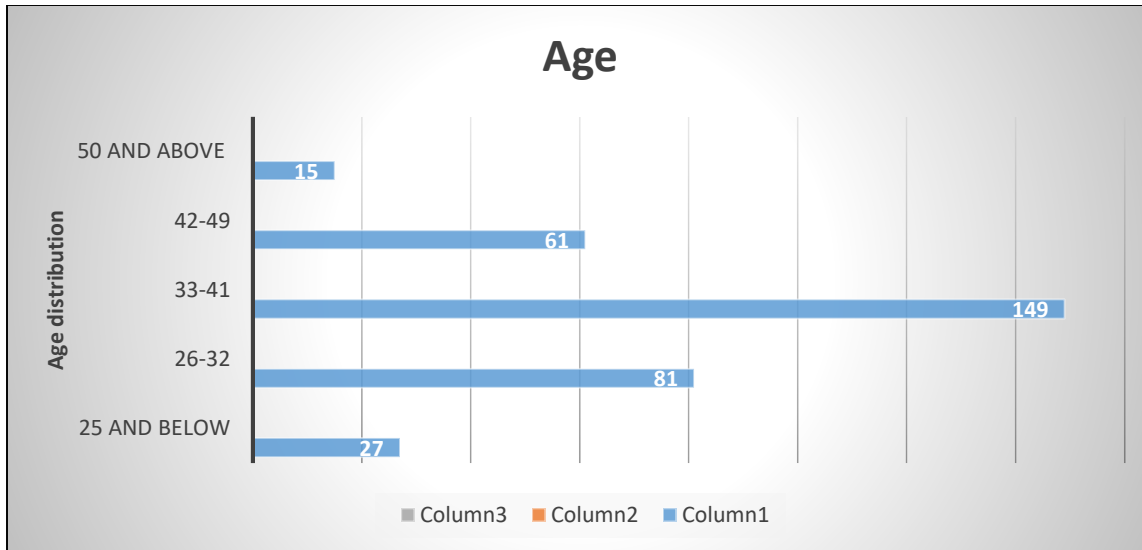
Figure 6.2: Age distribution of respondents

Source: Author's own compilation

In terms of the age distribution, the results show that a large portion of the respondents were aged between 34-41 years (44.7%; n=149). This is followed by those aged between 26-33 (24.3%; n=81). A total of 61 respondents (18.3%) of the total sample were aged between 42-49 years. The study also revealed that a total of 27 respondents (8.1%) of the sample were aged 25 years and below, while 15 respondents (4.5%) were aged 50 years and above.

6.3.1.3 Race distribution

The discussed results regarding the racial distribution among respondents are reported in Figure 6.3.
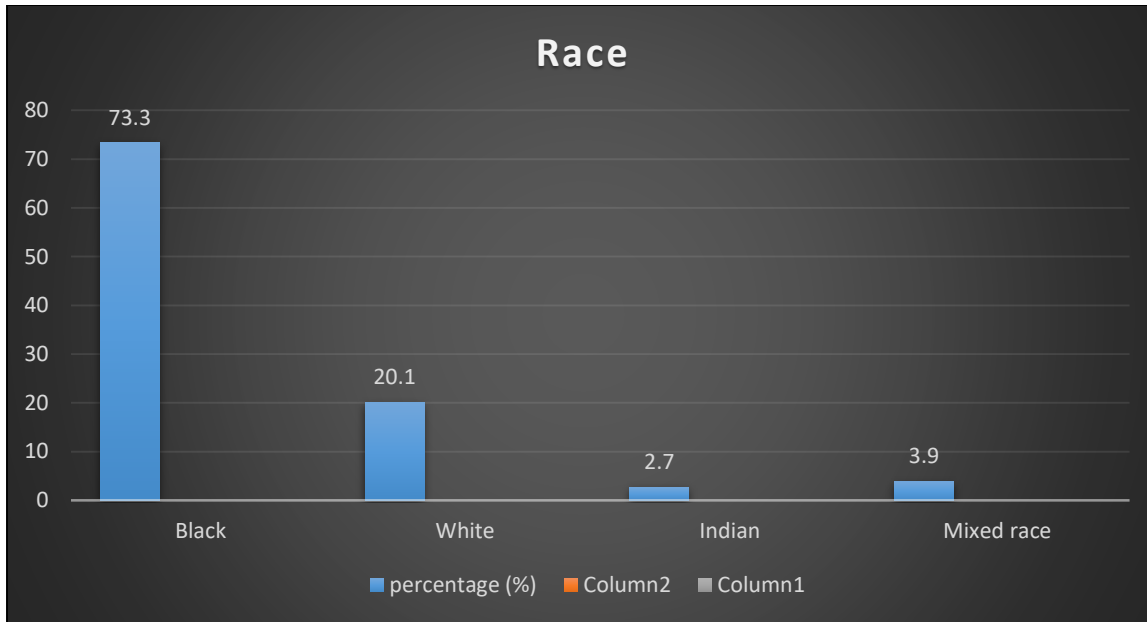
Figure 6.3: Racial distribution of the respondents
Source: Author's own compilation

Regarding the race distribution of the respondents, interesting results were shown. The highest percentage of SCM professionals in the study belonged to the black race which constituted 73.3 percent (n=244) of the total sample. The black race is followed by the white race which accounts for 20.1 percent (n=67) of the 333 surveyed respondents. The mixed-race (coloured) comes third in terms of dominance with 3.9 percent (n=13) and the Indian race constitutes 2.7 percent (n=9) of the respondents. There were no other races that were identified in the study other than the ones identified above.

6.3.1.4 Highest qualification distribution of respondents

Information regarding the highest qualification distribution is presented in Figure 6.4.
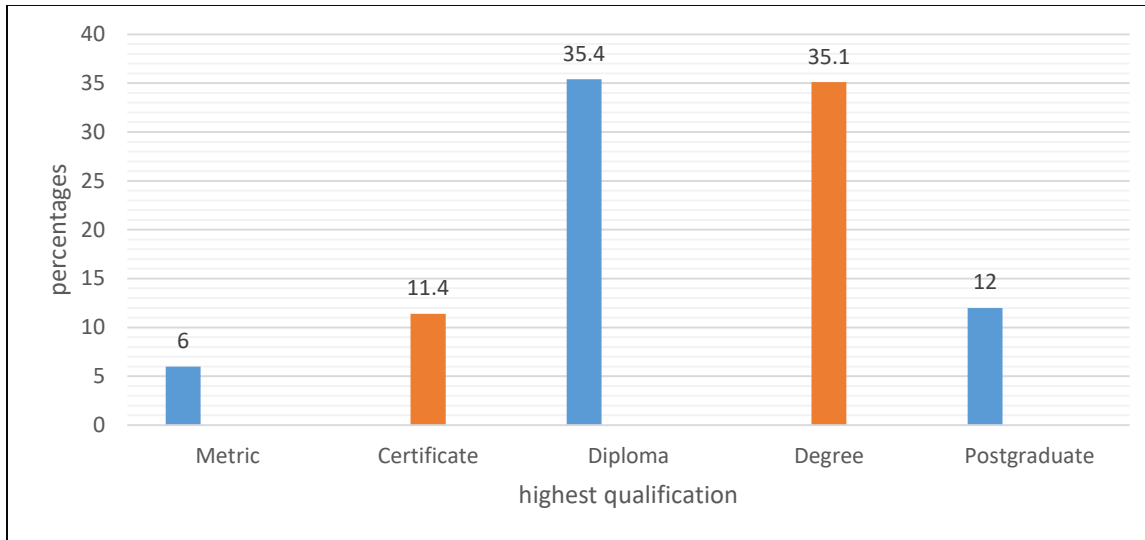
Figure 6.4:   Highest qualification distribution
Source: Author's own compilation

Regarding the qualifications of the respondents, the results show that out of n=333 respondents, 6 percent n=20) were matriculants whilst 11.4 percent (n=38) were certificate holders. The results also revealed that most of the respondents were diploma holders as they constituted 35.4 percent (n=118) of the surveyed population. Close to diploma holders are respondents who have degrees as their highest qualifications as they constituted 35.1 percent (n=117) of the total sample. Only 12 percent (n=40) of the total sample were holders of postgraduate qualifications. Thus, most of the respondents in this study are diploma holders followed by degreed ones and respondents with postgraduate qualifications are third. Respondents with certificates are fourth and respondents with a matric certificate are the least in terms of representation.

6.3.2 Demographic analysis of results on employee status

The second part of the analysis was about the status of employment of the respondent, which was established through categories such as employment period in the organisation, experience as an SCM professional, type of employment and department-based as presented in Table 6.3 and Figure 6.5.

Table 6.3: Descriptive statistics of results on employment status

Variable	Category	Frequency (n)	Percentage (%)
(A5) Employment period in organization	Less than 1 year 1-2 years 3-5 years 6-9 years 10 years and above	15 56 141 84 37	4.5 16.8 42.3 25.2 11.1
Total		333	100
(A6) Experience as a supply chain management professional	Less than 1 year 1-2 years 3-5 years 6-9 years 10 years and above	59 113 111 34 16	17.7 33.9 33.3 10.2 4.8
Total		333	100
(A7) Type of contract	Permanent Contract Internship	274 43 16	82.3 12.9 4.8
Total		333	100

Source: Author's own compilation

6.3.2.1 The employment period of respondents

From the results presented in Table 6.3, 4.5 percent (n=15) of the surveyed respondents were employed in their organisations for less than one year. It is shown that 16.8 percent (n=56) of the surveyed individuals were also employed in their organisations for a period of 1-2 years. The results further show that the largest number of sampled individuals of 42.3 percent (n=141) were employed in the organisation for a period of between 3-5 years, whereas a total of 25.2 percent (n=84) were employed for a period of between 6-9 years. Only 11.1 percent per cent (n=37) were employed for a period of 10 years and above in their organisations. The results regarding employment period is shown in Figure 6.5.
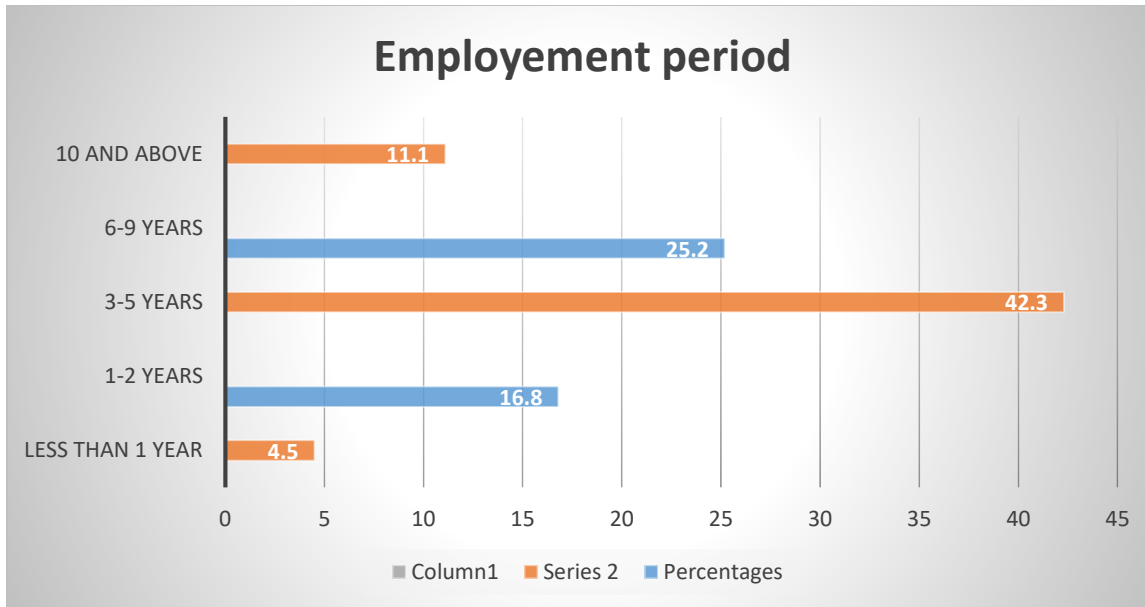
Figure 6.5: Employment period in the organisation

Source: Author's own compilation

From the statistical results in Table 6.3, it was established that the majority of the respondents were employed in their respective organisations for a period of less than 10 years. Information regarding employment period is presented in Figure 6.5.

6.3.2.1 Experience as a supply chain management professional

Pertaining to the experience of surveyed respondents, the results revealed that 17.7 percent (n=59) were employed in their positions as SCM professionals for a period of less than one year. From the results, it was also established that the majority of SCM professionals in the sample possessed 1-2 years of experience and they constituted 33.9 percent (n=113) of the respondents. Close to that is also SCM professionals who possessed 3-5 years of experience as they accounted for 33.3 percent (n=111). Only 10.2 percent of the surveyed population had experience of 6-9 years (n=34) and only 4.8 percent of the professionals had experience of more than 10 years. This information is further presented in Figure 6.6.
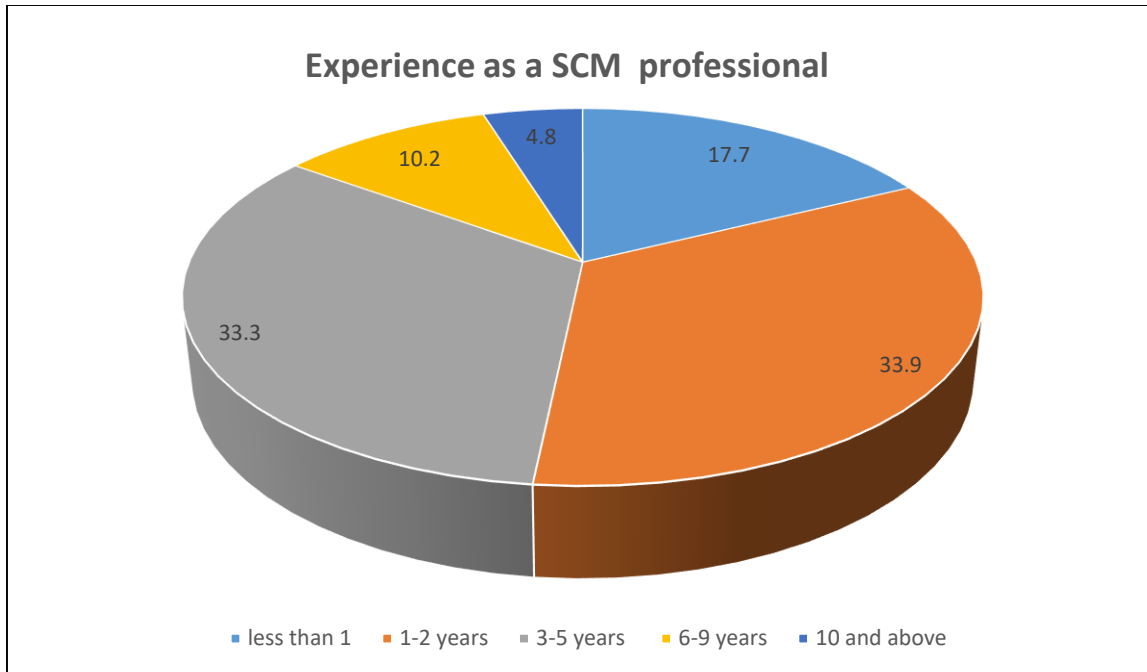
Figure 6.6: Experience as an SCM professional

Source: Author's own compilation

6.3.2.3 Type of employment

The results regarding the type of employment are shown in Figure 6.7.
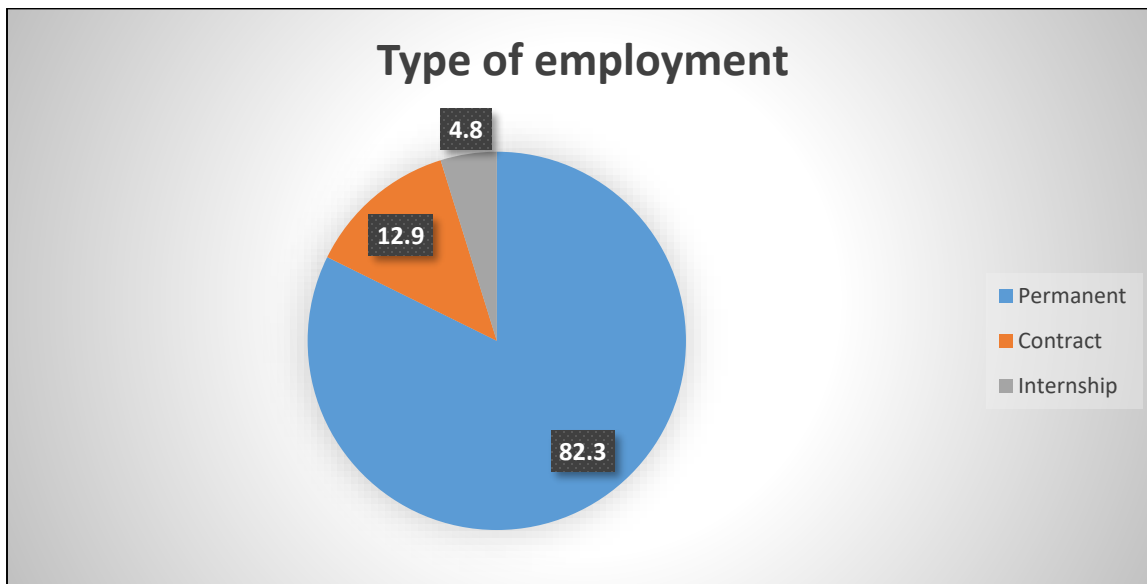
Figure 6.7: Type of employment

Source: Author's own compilation

The results presented in Figure 6.7 show that out of 333 surveyed respondents, 82.3 percent (n=274) were employed in their respective organisations on a permanent basis. The results also reveal that 12.9 percent (n=43) were employed on a contract and only 4.8 percent (n=16) were employed on internships.

6.3.2.4 Respondents' departments

The information regarding the departments where respondents were sampled from is presented in Table 6.4.

Table 6.4: Descriptive statistics of results on department based

Variable	Category	Frequency (n)	Percentage (%)
(A8) Department based	SA Police Service	49	14.7
	Defence	49	14.7
	Correctional services	23	6.9
	Agriculture, Land Reform & Rural Development	31	9.3
	Sports, Arts & Culture	31	9.3
	Mineral resources & Energy	33	9.9
	Environmental, Forest & Fisheries	35	10.5
	Woman, Youth & Persons with Disabilities	22	6.6
	Justice & Constitutional Development	5	1.5
	Basic Education	4	1.2
	Higher Education & Training	5	1.5
	Home Affairs	3	0.9
	Human Settlement	5	1.5
	Public Works & Infrastructure	8	2.4
	Science & Technology	3	0.9
	SARS	10	3.0
	Statistics SA	2	0.6
	Tourism	7	2.1
	Trade & Industry	4	1.2
	Public Enterprises	4	1.2
Total		**333**	**100**

Source: Author's own compilation

As presented in Table 6.4, data were collected in 21 government departments based in the Gauteng Province in South Africa. Interestingly the South African Police Services and the Defence departments had 14.7 percent (n=49) of the respondents each. These departments were followed by the Environment, Forest and Fisheries department (10.5%; n=35). The Mineral Resources and Energy registered a total of 33 respondents which amounts to 9.9 percent. The Agriculture, Land Reform and Rural Development (n=31) and the Sports, Arts and Culture (n=31) had a combined percentage of 18.6. Other departments were also sampled as follows: Correctional Services (n=23; 6.9%); Women, Youth and Persons with Disabilities (n=22; 6.6%); South Africa Revenue Services (n=10; 3%); Public works and Infrastructure (n=8; 2.4%) and Tourism (n=7; 2.1%). In addition, the Justice and Constitutional Development, Higher Education and Training, and the Human Settlement departments recorded a total of 1.5 percent (n=5) each. Similarly, the Trade and Industry, Public Enterprises and Basic Education departments had 1.2 percent (n=4) respondents each. The Home Affairs Department (n=3: 0.9%), Science and Technology department (n=3; 0.9%) and Statistics South Africa (n=2: 0.6%) had the least number of respondents.

The next section discusses the results of the EFA.

6.4 EXPLORATORY FACTOR ANALYSIS

An EFA was performed to check the factor structure of the collected data. The EFA procedure is a data-driven exploratory method for determining the number of common factors underlying a response set as well as the relationship between individual items and those common factors (Kline, 2011:5; Chumney, 2012:5). Salkind (2010:1) defines it as a multivariate statistical technique to model the covariance structure of the observed variables by three sets of parameters, namely, the factor loadings associated with latent variables, residual variances called unique variances, and factor correlations. Additionally, Young and Pearce (2013:79) describe EFA as a statistical method used to reduce data into smaller sets of summary variables and to explore the underlying theoretical structure of phenomena. Implied in the mentioned definitions is that EFA is a method used to

discover the number of factors influencing variables in a collected data set and to analyse which observed variables relate commonly to specific latent variables.

Commonly, EFA is aimed at determining the number of dimensions underlying a response set, the subjective meaning of each dimension, how items relate to the dimensions and how the dimensions relate to each other (Chumney, 2012:6). In addition, several scholars (Williams, Ondman & Brown, 2010:2; Young & Pearce, 2013:79; Osborne, 2014:1) submit that EFA aims at achieving several objectives such as evaluating the construct and content validity of the instruments used, reducing the number of variables into smaller sets, examining the pairwise relationships between variables, identifying unidimensional and multidimensional factors in variables, and proving or disproving proposed theories. In this study, EFA was applied to assess the factor structure of the captured data. This implies that EFA was used to test if the data loaded as arranged in the constructs proposed initially in this study.

In performing the EFA procedure, three criteria were applied. The first criterion was to use the factor loadings. Factor loadings pertain to coefficients found in either a factor pattern matrix or a factor matrix (Sakind, 2010:1). The minimum cut-off value for any factor loadings to be accepted in the study is 0.5 (Arifin & Yusoff, 2016:4; Maskey, Fei & Nguyen, 2018:91). The second consideration applied in the study is the eigenvalue criterion. An eigenvalue has been defined as the total amount of variance that can be explained by a given principal component (Pituch & Stevens, 2015:349). The Institute for Digital Research and Education (2019:1) highlights that eigenvalues also represent the sum of the squared component loadings across all items for each component, which represents the amount of variance in each item that can be explained by the principal component. As recommended by Guttman (1954:149), only those factors with eigenvalues greater than 1 should be considered in the study. The third criterion used is the scree plot formula. A scree plot refers to a line plot of eigenvalues of factors or principal components in an analysis used to determine the number of factors to retain in exploratory factor analysis (EFA) or principal components to keep in a principal component analysis (PCA) (Lewith, Jonas & Walach, 2010:354). In the study, the scree plot was used to provide a pictorial view of the factors that loaded with eigenvalues greater than 1.

Before performing the EFA procedure, it was deemed necessary to check whether the captured data were factorable, as prescribed by several scholars (Yong & Pearce, 2013:80; Hauben, Hung & Hsieh, 2017:2). Two tests, namely, the Kaiser Meyer Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were used to check the factorability of the captured data. The KMO is a test used to measure the sampling adequacy for each variable in the model (Kaiser, 1974: 31; Shree, Pugazhenthi & Chandrasekraran, 2017:229). The acceptable minimum threshold for the KMO is 0.5 (Kaiser, 1974:31). The Bartlett's test of Sphericity is a test used to test the hypothesis that the correlation matrix is an identity of the matrix (Chan & Idris, 2017:403). In order for data to be considered factorable, Bartlett's test must be significant at 0.000.

The results for the KMO and Bartlett's test for all constructs considered in the study are presented in Table 6.5.

Table 6.5: The KMO measure and the Bartlett's test results

CONSTRUCTS	KMO MEASURE	BARTLETT'S TEST		
		Approximate Chi-Square	Degrees of freedom	Significance level
SCC	0.823	959.054	15	0.000
INV	0.826	822.741	21	0.000
IS	0.845	975.821	21	0.000
IQ	0.812	448.079	15	0.000
SCD	0.817	533.266	10	0.000
SC1	0.792	571.199	15	0.000
SP	0.763	503.345	6	0.000
SCR	0.720	374.361	10	0.000
SCC= supply chain collaboration; INV= supply chain innovation; IS= information sharing; IQ= information quality; SCD= supply chain design; SCI= supply chain integration; SP= supplier performance; SCR= supply chain resilience.				

Source: Author's own compilation

As indicated in Table 6.5, the KMO values for all scales used in the study were above 0.5, as they ranged from 0.720 to 0.845. Similarly, the Bartlett's test for all scales yielded significant levels of 0.000. These results confirm that the data captured in this study were suitable for the EFA procedure. The next sections show the results of the EFA performance on SCC, INV, IS, IQ, SCD, SCI, SP and SCR.

6.4.1 FACTOR ANALYSIS FOR THE SUPPLY CHAIN COLLABORATION SCALE

In subjecting the SCC data to the EFA procedure, two factors were extracted. One item (SCC1) was discarded from the scale due to cross-loadings. The resultant factor structure is presented in Table 6.6.

Table 6.6: Two-factor rotated structure for the SCC scale

ITEM CODE	Description	Factor	
		1	2
SCC2	Strategic objectives are jointly developed by supply chain partners.	**.876**	.189
SCC 3	Supplier performance is monitored and is the basis for future business.	**.873**	.189
SCC 4	The principle of shared rewards and risks governs supply chain relationships.	**.788**	.349
SCC5	Value-added resources are shared among supply chain members.	.476	**.672**
SCC6	Our organisation has joint decision-making activities with its supply chain partners.	.257	**.854**
SCC7	Our organisation shares cross-functional processes with its supply chain partners to make improvements.	.123	**.854**
Eigenvalue		3.543	1.018
Total variance explained		59.051	16.961
Cumulative variance explained		59.051	76.011

Source: Author's own compilation

As indicated in Table 6.6, the two factors extracted in the EFA procedure explain 76 percent of the variance in SCC. The remaining 24 percent is explained by other extraneous factors that were

not considered in the current study. The loadings for both factors were acceptable and ranged from 0.672 to 0.876, which is greater than the minimum cut-off value of 0.5. The scree plot further supporting that only two factors were extracted since they had eigenvalues greater than 1 is presented through Figure 6.8.
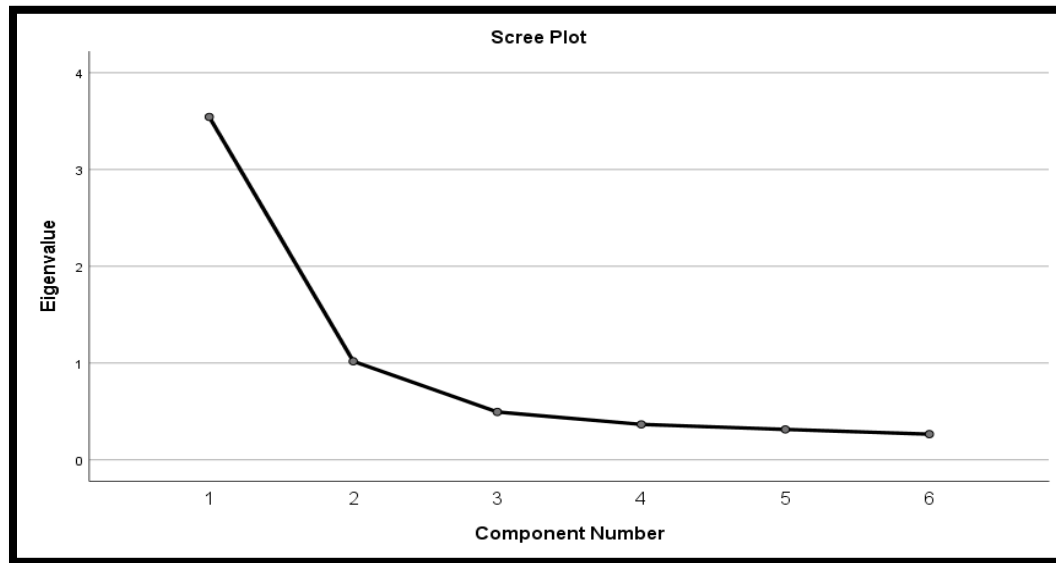
Figure 6.8: Scree plot for SCC
Source: Exported from SPSS (Version 25.0)

The first of the two extracted factors retained the label SCC and accounted for 59 percent of the variance. Factor 2 was labelled as Supply Chain Synergies (SCS) and accounted for 17 percent of the variance in SCC. Both factors were retained for use in further data analyses in the present study. Supply chain synergies (SCS) refer to the interaction or cooperation of two or more organisations in their operations to produce a combined effect greater than the sum of their separate effect (Mesaric, Segetlija & Dujak, 2015:114). Manikas and Jaswal (2015:120) suggest that supply synergies can also be called mergers where organisations partner and integrate certain activities to increase competitive advantage. Herd, Sksena and Steger (2015:1) state that the ultimate goal of SCSs is to improve shareholder value and achieve integration objectives without jeopardising supply or order fulfillment continuity. Nahass, Giguere and Verma (2016:2) add that SCSs revolve around direct and indirect procurement leverage, supply base consolidation, manufacturing and distribution footprint realisation, duplication function consolidation, product and service offerings rationalisation supply chain strategy alignment, and investment prioritisation.

Synergies can take different forms such as cost synergies, revenue synergies, market power synergies, financial synergies and intangible synergies (Hindi & Lienzen, 2018:10-11). Cost synergies denote the process of reducing the cost to increase cash flows whereas revenue synergies are connected to creating value through cross-selling products or services by complementary distribution and sales channels (Schweiger & Very, 2003:5). Sevenius (2003:22) describes market power synergies as a process of eliminating competition by acquiring the competitor. This type of synergy is commonly used in a mature market where overcapacity is present and prices are pushed down by fierce competition (Hindi & Lienzen, 2018:11). Financial synergies, on the other hand, refer to the organisation's partners in lowering the cost of capital to lower financial risks to create value (Sevenius, 2003:22). Intangible synergies denote a process where supply chain partners collaborate to create and extend their brand name and knowledge sharing to possibly increase product value (Schweiger & Very, 2003:6; Hindi & Lienzen, 2018:11).

6.4.2 FACTOR ANALYSIS FOR THE INNOVATION SCALE

In subjecting the INV data to the EFA procedure, two factors were extracted. The resultant factor structure is presented in Table 6.7.

Table 6.7: Two-factor rotated structure for the INV scale

ITEM CODE	Description	Factor	
		1	2
INV1	Management in our organisation actively seeks innovative technologies, processes, techniques, and/or product ideas.	-.042	**.839**
INV2	Our organisation is known as an innovator among others in the public sector.	.356	**.735**
INV3	Our organisation investigates and secures funds needed to implement new ideas.	.417	**.576**
INV4	Our organisation constantly experiments with new ideas.	**.755**	.195
INV5	Our organisation pursues continuous innovation in core processes.	**.839**	.179
INV6	Our organisation focuses on process innovations.	**.792**	.174
INV7	Our organisation pursues new technological innovations.	**.821**	.137
Eigenvalue		3.460	1.113

Total variance explained	49.434	15.895
Cumulative variance explained	49.434	65.329

Source: Author's own compilation

As revealed in Table 6.7, two factors were extracted in the EFA procedure in the INV scale. The two factors explained 65 percent of the variance in innovation. Factor 1 accounted for 49 percent of the variance in innovation while Factor 2 accounted for 16 percent. The loadings for both factors were acceptable and ranged from 0.576 to 0.839, which is greater than the minimum cut-off value of 0.5. The scree plot further supporting that only two factors were extracted since they had eigenvalues greater than 1 is presented through Figure 6.9.
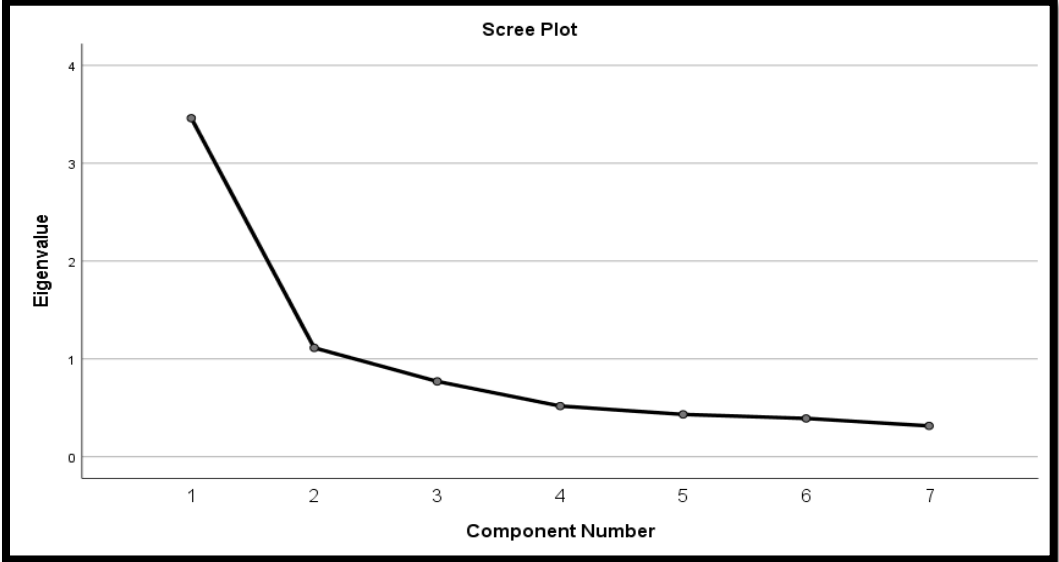
Figure 6.9: Scree plot for INV values
Source: Exported from SPSS (Version 25.0)

Although two factors were extracted from the INV scale, the second (composed of INV 1, 2 & 3) was discarded because it had unacceptable reliability as indicated by a low Cronbach alpha value of 0.635. This suggests that the factor was internally inconsistent, hence its exclusion. Therefore, the INV scale used in further analyses of data was composed of four items (INV 4, 5, 6 & 7), which in total explained 49 percent of the variance and had an eigenvalue of 3.460.

6.4.3 FACTOR ANALYSIS FOR THE INFORMATION SHARING SCALE

The EFA was conducted for the IS scale. Only one factor was extracted, as shown in Table 6.8.

Table 6.8: Uni-dimensional factor structure for the IS scale

ITEM CODE	Description	Factor 1
IS1	Most people in my organisation believe that sharing information is important.	.745
IS2	Managers from departments across the organisation are expected to share information with others.	.761
IS3	Our organisation shares the knowledge of core business with its supply chain partners.	.781
IS4	Our organisation shares proprietary information with its supply chain partners.	.763
IS5	Our organisation and supply chain partners exchange confidential information.	.787
IS6	Our organisation and its supply chain partners keep each other informed about events or changes that may affect them.	.704
IS7	Our organisation informs its supply chain partners in advance of its changing needs.	.633
Eigenvalue		3.841
Total variance explained		54.876
Cumulative variance explained		54.876

Source: Author's own compilation

As shown in Table 6.8, only one factor was extracted on the IS scale. The factor was composed of seven items which contributed 55 percent of the variance in IS. Factor loadings were acceptable and ranged from 0.633 to 0.787, which is greater than the minimum cut-off value of 0.5. The scree plot further supporting that only one factor was extracted and had an eigenvalue greater than 1 is presented in Figure 6.10.
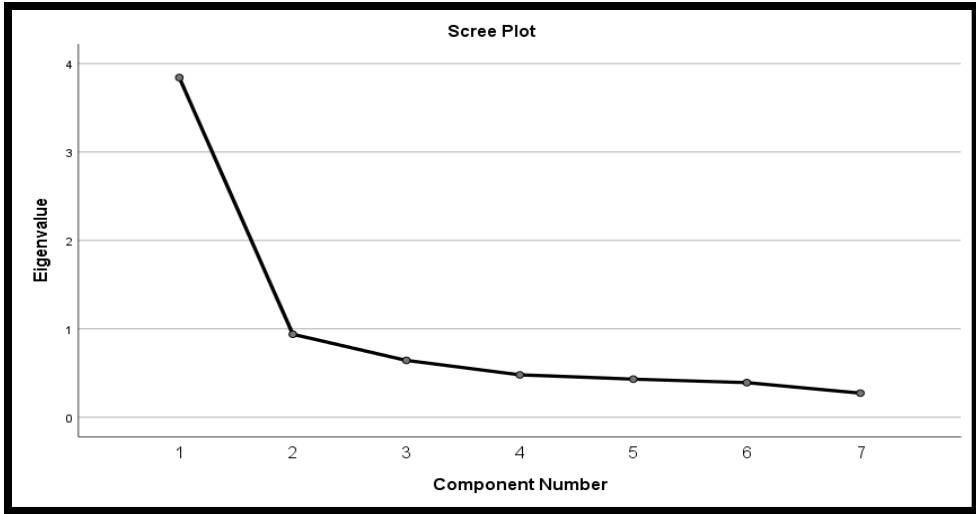
Figure 6.10: Scree plot for IS values
Source: Exported from SPSS (Version 25.0)

Figure 6.10 represents the scree plot for the IS scale. It shows that the scale for IS has a unidimensional factor structure as it extracted only one factor with an eigenvalue of greater than 1. This indicates that the IS items measured what they intended to measure. The IS scale had an eigenvalue of 3.841.

6.4.4 FACTOR ANALYSIS FOR THE INFORMATION QUALITY SCALE

In subjecting IQ data to the EFA procedure, only one factor was extracted. One item (IQ6) was removed and discarded from the scale due to cross-loadings. The result of the factor structure is presented in Table 6.9.

Table 6.9: Uni-dimensional factor structure for the IQ scale

ITEM CODE	Description	Factor 1
IQ1	Information exchange between our organisation and its supply chain partners is reliable.	**.720**
IQ2	Information exchange between our organisation and its supply chain partners is adequate.	**.700**
IQ3	Information exchange between our organisation and its supply chain partners is up-to-date and timely.	**.751**

IQ4	Information exchange between our organisation and its supply chain partners is accurate.	.634
IQ5	Information exchange between our organisation and its supply chain partners is complete.	.621
IQ7	The quality of the exchanged information with our key suppliers adds value for our organisational requirements.	.680
Eigenvalue		**2.823**
Total variance explained		**47.046**
Cumulative variance explained		**47.046**

Source: Author's own compilation

As indicated in Table 6.9, only one factor extracted from the EFA procedure explained 47 percent of the variance in the IQ scale. The remaining 53 percent is explained by other extraneous factors that were not considered in this current study. Factor loadings were acceptable and ranged from 0.621 to 0.751, which is greater than the minimum cut-off value of 0.5. The scree plot further supports that only one factor was extracted since there is only one eigenvalue which is greater than 1, as presented in Figure 6.11.
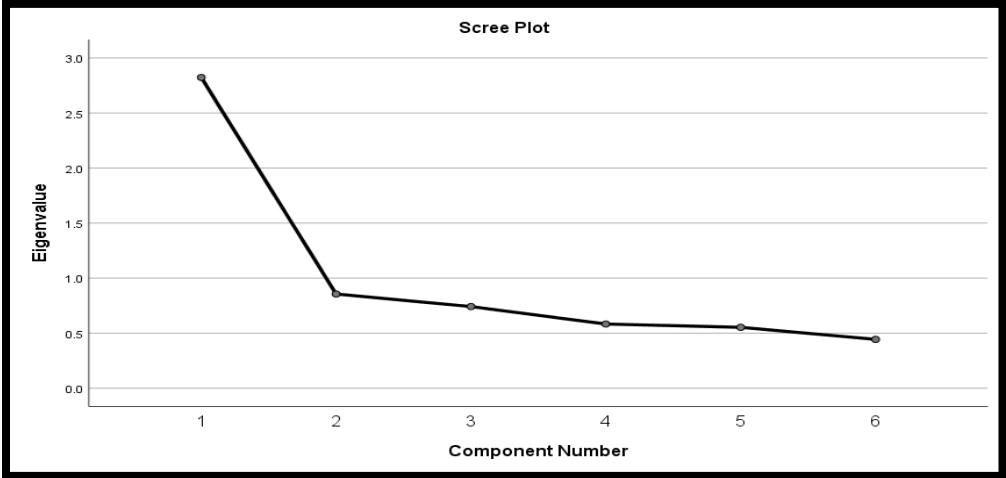
Figure 6.11: Scree plot for IQ values
Source: Exported from SPSS (Version 25.0)

As indicated in Figure 6.11, the scree plot represents the IS scale. It demonstrates that the scale for IQ has a unidimensional factor structure as it extracted only one factor with an eigenvalue of

greater than 1. This shows that the IQ items measured what they intended to measure. The IQ factor structure had an eigenvalue of 2.906.

6.4.5 FACTOR ANALYSIS FOR THE SUPPLY CHAIN DESIGN SCALE

In subjecting SCD data to the EFA procedure, one factor was extracted. The result of the factor structure is presented in Table 6.10.

Table 6.10: Uni-dimensional factor structure for the SCD scale

ITEM CODE	Description	Factor 1
SCD1	Proximity to suppliers is an important consideration for our organisation.	.726
SCD2	Our organisation's supplier selection criteria are well defined.	.795
SCD3	The number of suppliers and their capacities are sufficient to handle any possible needs of our clients.	.772
SCD4	Distribution channels in our supply chain can sufficiently serve the current and potential service delivery areas.	.768
SCD5	Logistical activities in our supply chain are coordinated to minimise problems in service delivery.	.749
Eigenvalue		**2.906**
Total variance explained		**58.119**
Cumulative variance explained		**58.119**

Source: Author's own compilation

As revealed in Table 6.10, the one factor that was extracted from the EFA procedure explained 58 percent of the variance in SCD. The remaining 42 percent is explained by other factors that were not considered in the current study. Factor loadings were acceptable and ranged from 0.726 to 0.795, which is greater than the minimum cut-off value of 0.5. The scree plot further supports that only one factor was extracted since there is only one factor that had an eigenvalue which is greater than 1.
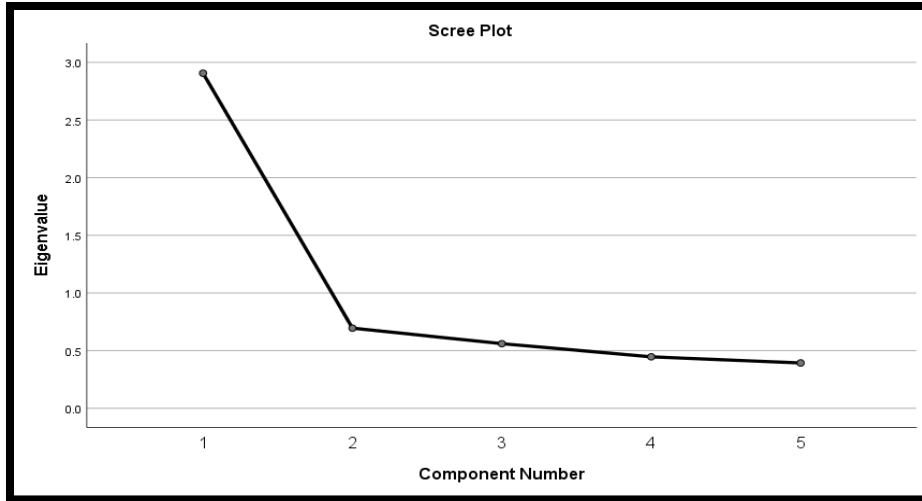
Figure 6.12: Scree plot for SCD values
Source: Exported from SPSS (Version 25.0)

Figure 6.12 depicts the total eigenvalue for the SCD scale. It shows the uni-dimensionality of the SCD scale as only one factor was extracted in the EFA procedure. The unidimensional factor structure for SCD attained an eigenvalue of 2.906. The attainment of a unidimensional factor structure shows that the SCD items used in this study measured what they intended to measure.

6.4.6 FACTOR ANALYSIS FOR THE SUPPLY CHAIN INTEGRATION SCALE

In subjecting SCI data to the EFA procedure, only one factor was extracted from the data set. However, one item (SCI 1) was discarded from the scale due to cross-loadings. Table 6.11 presents the results of the factor structure for SCI.

Table 6.11: Uni-dimensional factor structure for the SCI scale

ITEM CODE	Description	Factor 1
SCI2	Organisations in our supply chain create a compatible communication and information system.	.713
SCI3	Our organisation extends its supply chain beyond its suppliers and clients.	.785
SCI4	Our organisation participates in the sourcing decisions of its suppliers.	.800

185

SCI5	Our organisation's compensation and motivation mechanisms consist of factors that promote integration.	.747
SCI6	Our organisation's integration with the upstream and downstream supply chain members has increased the flexibility of its operations.	.631
SCI7	Our organisation has made supply chain agreements with some suppliers and clients to share risks together.	.516
Eigenvalue		**2.988**
Total variance explained		**49.808**
Cumulative variance explained		**49.808**

Source: Author's own compilation

As presented in Table 6.11, the single factor extracted explains 50 percent of the variance in SCI. The other 50 percent is explained by other factors that were not considered in the current study. Factor loadings were acceptable and ranged from 0.516 to 0.800, which is greater than the minimum cut-off value of 0.5. The scree plot further supports that only one factor was extracted as there is only one eigenvalue which is greater than 1.
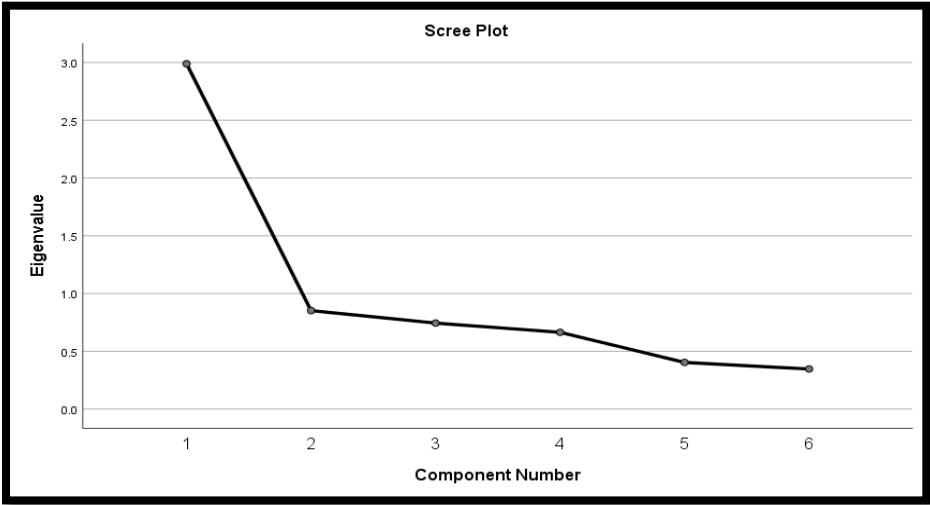
Figure 6.13: Scree plot for SCI values
Source: Exported from SPSS (Version 25.0)

Figure 6.13 represents the scree plot for SCI, further supporting the eigenvalues shown in Table 6.11. The point of the curve represents the threshold chosen for retention and it indicates that one

factor was extracted, and it had an eigenvalue of 2.988. Thus, the SCI factor structure is unidimensional as shown in Figure 6.13 as there is only one eigenvalue which is greater than 1.

6.4.7 FACTOR ANALYSIS FOR THE SUPPLIER PERFORMANCE SCALE

In subjecting the SP data to the EFA procedure, a unidimensional factor structure was realised after three items (SP4, 6 & 7) were discarded for cross loadings. Table 6.12 presents the results of the factor structure for SP.

Table 6.12: Uni-dimensional factor structure for the SP scale

ITEM CODE	Description	Factor 1
SP1	Our suppliers provide us with the best prices given the desired quality of the items/services purchased.	.834
SP2	Our suppliers attempt to reduce the time between order receipt and delivery to as close to zero as possible.	.865
SP3	Our suppliers have the ability to meet quoted or anticipated delivery dates and quantities on a consistent basis.	.771
SP5	Our suppliers have the ability to provide high-quality products/services.	.768
Eigenvalue		2.629
Total variance explained		65.728
Cumulative variance explained		65.728

Source: Author's own compilation

As indicated in Table 6.12, only one factor was extracted in the EFA procedure and it explains 66 percent of the variance in SP data. The other 34 percent is explained by a combination of both the discarded items and other extraneous factors that were not considered in the current study. Factor loadings were acceptable and ranged from 0.768 to 0.865, which is greater than the minimum cut-off value of 0.5. The scree plot further supports that one factor was extracted, which had an eigenvalue greater than 1 as the other factor was discarded and removed from the scale.
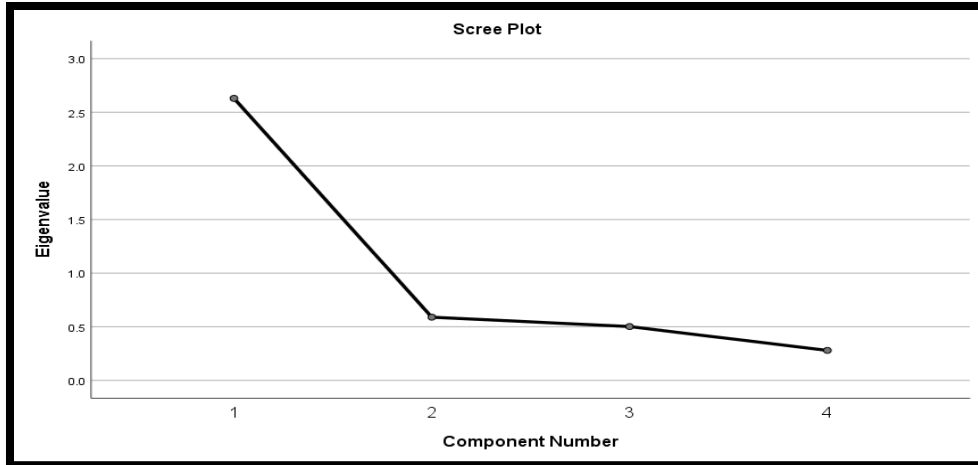
Figure 6.14: Scree plot for SP values
Source: Exported from SPSS (Version 25.0)

Figure 6.14 represents the scree plot for SP, further supporting the eigenvalues shown in Table 6.12. The scree plot curve indicates that one factor was extracted, and it had an eigenvalue of 2.629. Hence, the SCI factor structure is unidimensional as shown in Figure 6.14, as there is only one eigenvalue which is above 1.

6.4.8 FACTOR ANALYSIS FOR THE SUPPLY CHAIN RESILIENCE SCALE

In subjecting SCR data to the EFA procedure two factors were extracted. Two items (SCR 4 & 5) were removed and discarded from the scale because of cross-loadings. The resultant factor structure is presented in Table 6.13.

Table 6.13: Two factor structure for the SCR scale

ITEM CODE	Description	Factor	
		1	2
SCR1	Our supply chain can quickly return to its original state after being disrupted.	**.769**	.222
SCR2	Our supply chain can move to a new, more desirable state after being disrupted.	**.830**	.138
SCR3	Our supply chain is well prepared to deal with financial outcomes of supply chain disruptions.	**.781**	.122
SCR6	Our organisation is fairly sensitive to the opportunities and threats in the business environment.	.175	**.847**

SCR7	One of the organisation's important criteria for finding collaborative partners is their agility and ability to react.	.162	**.859**
Eigenvalue		**2.441**	**1.045**
Total variance explained		**48.810**	**20.905**
Cumulative variance explained		**48.810**	**69.715**

Source: Author's own compilation

As depicted in Table 6.13, two factors that were extracted in the EFA procedure explain 70 percent of the variance. The remaining 30 percent is explained by other items that were either discarded (SCR 4 & 5) or not considered in the current study. Factor loadings were acceptable and ranged from 0.769 to 0.859, which is greater than the minimum cut-off value of 0.5. The scree plot further supports that only two factors were extracted since they had eigenvalues greater than 1, as presented in Figure 6.15.
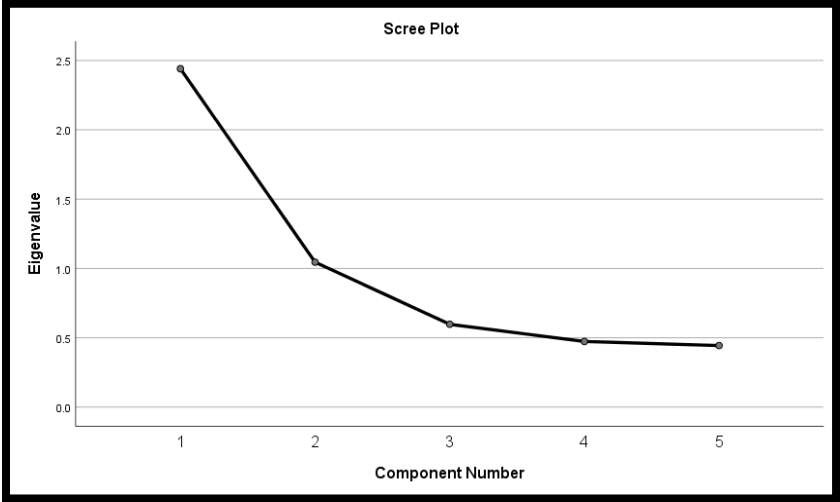
**Figure 6.15: Scree plot for SCR values**
Source: Exported from SPSS (Version 25.0)

As indicated in Figure 6.15, two factors were extracted in the EFA procedure for SCR. However, the second factor was discarded since it was composed of two items only (SCR6 & 7) and for attaining a poor reliability value shown by a Cronbach alpha value of 0.679. As recommended by Osborne and Costello (2009:3) and Matsunaga (2010:97), latent variables should have at least

three items, for a factor with fewer than three items is generally considered weak and unstable. This suggests that the second factor extracted in the EFA was internally inconsistent and unsuitable for use in further analyses of data. Therefore, the SCR scale used in further analysis of data was composed of items (SCR 1, 2 & 3) which in total explained 49 percent of the variance and had an eigenvalue of 2.441.

The next section discusses the revised conceptual model developed based on the EFA results.

6.5 REVISED CONCEPTUAL MODEL DEVELOPED BASED ON EXPLORATORY FACTOR ANALYSIS

A conceptual model was developed based on the data structure generated in the EFA. The EFA identified two factors linked to the SCC constructs (refer to Section 6.4). The two factors were given different labels. The first factor (Item SCC2, SCC3, SCC4) retained the name label SCC while the second factor was labelled as supply chain synergies (SCS) (Items SCC5, SCC6, SCC7). Subsequently, a new (revised) conceptual model specifying the new relationships and proposed hypotheses (inclusive of SCS) was developed. This model is presented in Figure 6.16.
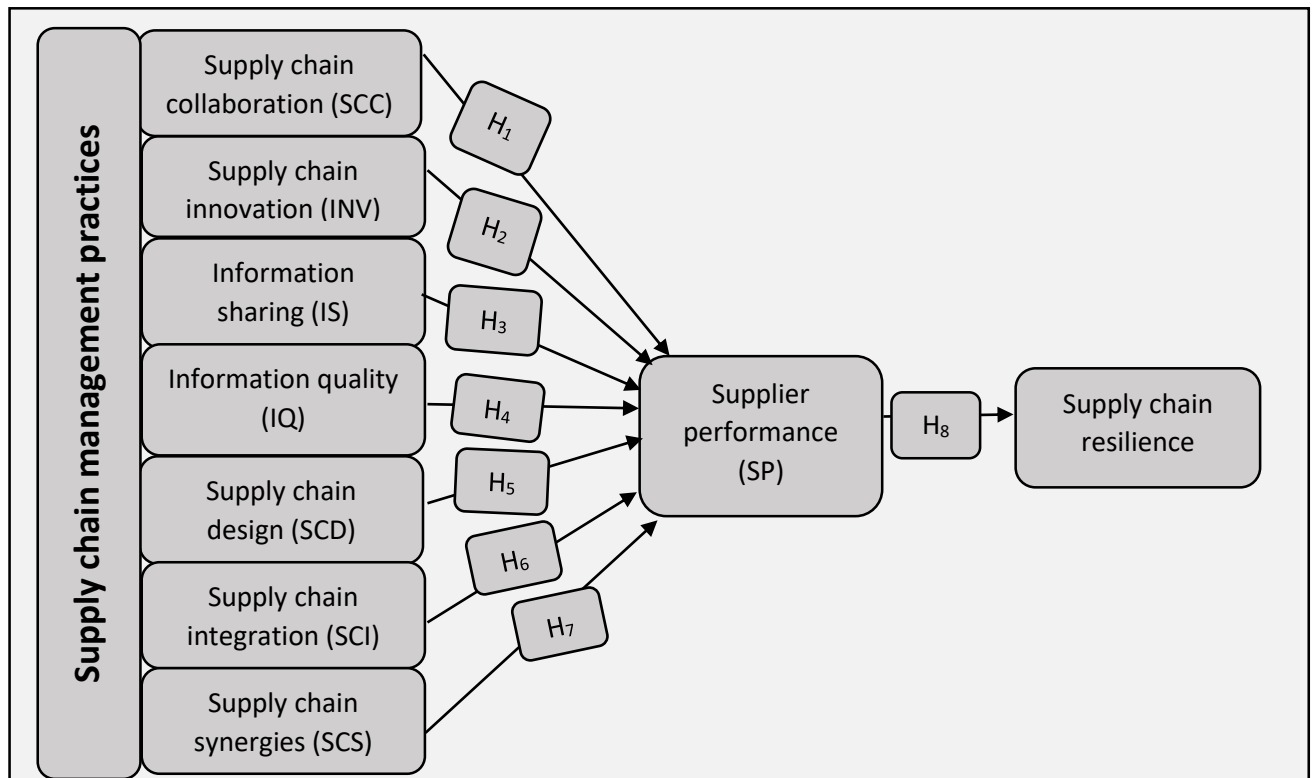
Figure 6.16: Revised conceptual model for SCM practices, supplier performance and supply chain resilience in the South African public sector
Source: Compiled by author

As shown in the revised conceptual model, a new hypothesis (H_7) has been formulated, which links SCS and SP. The conceptual model indicated in Figure 6.16, illustrates the new relationship structure that was followed and examined henceforth in the present study. The eight revised hypotheses of the study read as follows:

H_1: Supply chain collaboration (SCC) exerts a significant positive influence on supplier performance (SP) in the South African public sector

H_2: Supply chain innovation (INV) exerts a significant positive influence on supplier performance (SP) in the South African public sector.

H_3: Information sharing (IS) exerts a significant positive influence on supplier performance (SP) in the South African public sector.

H_4: Information quality (IQ) exerts a significant positive influence on supplier performance (SP) in the South African public sector.

H_5: Supply chain design (SCD) exerts a significant positive influence on supplier performance (SP) in the South African public sector.

H_6: Supply chain integration (SCI) exerts a significant positive influence on supplier performance (SP) in the South African public sector.

H_7: Supply chain synergies (SCS) exert a significant positive influence on supplier performance (SP) in the South African public sector.

H_8: Supplier performance (SP) exerts a significant positive influence on supply chain resilience (SCR) in the South African public sector.

The next section discusses the results of the analysis of descriptive statistics for the research constructs.

6.6 DESCRIPTIVE STATISTICS FOR THE RESEARCH CONSTRUCTS

This section is intended to address the first three empirical objectives of the study which are to:

1. Establish the levels of implementation of SCM practices in the public sector
2. To determine the levels of SP in the public sector
3. To determine the extent of the resilience of the public sector supply chain

Descriptive statistics were applied in addressing the empirical objectives above. Specifically, the descriptive statistics used included minimum and maximum values, mean scores and standard deviations. Also reported in this section is the application of the tests for normality of data using Argostino's K-squared test, which considers skewness and kurtosis. The results of the descriptive statistical analysis for each construct extracted in the EFA are thus presented in this section.

Minimum and maximum values represent the degree of either disagreement or agreement with the questionnaire items as provided on the Likert scale. The standard deviation was used to determine how dispersed the data values were from the mean value, as recommended by Barde and Barde (2012:113). Skewness and kurtosis were utilised to establish the normality of data distribution. This study applied the range of -2 to +2 as recommended by Trochim and Donnelly (2006:92) and George and Mallery (2010:22) to test for skewness. The range of -3 to +3, as recommended by Brown (1997:22) was applied to test for kurtosis.

It was the intent of the study to further analyse the captured data through SEM which is a multivariate statistical analysis technique that is used to analyse relationships between measured variables and latent constructs (de Carvalho & Chima, 2014:6; Hussain, Fangwei, Siddiqi, Ali & Shabbir, 2018:4). However, there is no harmony concerning the question on the necessity of normally distributed data when applying SEM in research. On the one hand, Byrne (2010:8) submits that normality is an issue because it is one of the basic assumptions required to perform SEM analysis. On the other hand, several scholars (Bentler & Chou, 1987:78; Barnes, Cote, Cudeck & Malthouse, 2001:255; Precher & Hayes, 2004:323) suggest that is not necessary for

data to be normally distributed when applying SEM. This view is also supported by some scholars (for example Rhemtulla, Brosseau-Liard & Savelei, 2012:354; Li, 2016:936) who suggest that survey data in the Likert-type scale format does not require normality tests for it to be applied in SEM. Therefore, in this study, it is not a requirement for data to be normally distributed for it to be tested using SEM. However, Argostino's K-squared test was still applied to provide an indication of the distribution of data in the study as this would assist later should any data analysis problems arise.

6.6.1 Descriptive statistics for supply chain collaboration

The descriptive statistics for SCC are presented in Table 6.14.

Table 6.14: Descriptive statistics for supply chain collaboration

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
SCC2	Strategic objectives are jointly developed by supply chain partners.	1	7	**5.25**	1.076	-0.554	0.203
SCC3	Supplier performance is monitored and is the basis for future business.	1	7	**5.20**	1.194	-0.672	-0.200
SCC4	The principle of shared rewards and risks governs supply chain relationships.	2	7	**5.25**	1.155	-0.363	-0.380
Overall scale				**5.23**	1.142	-0.539	-0.261
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, 7=Strongly agree							

Source: Author's compilation

The three measurement items in Table 6.14 tested the respondents' perceptions towards SCC in the South African public sector. Item SCC2 scored a mean of ($\bar{x}$=5.25: SD ±1.076). This result demonstrates that strategic objectives are jointly developed by supply chain partners. Regarding

item SCC3, a mean score of ($\bar{x}$=5.20; SD ± 1.194) was calculated, which suggests that the public sector has been able to monitor the performance of its suppliers and uses this as the basis for future business. Regarding item SCC4, it appears that the principle of shared rewards and risks is what governs relationships between public sector organisations, and their supply chain partners. This was indicated by a mean score of ($\bar{x}$=5.25: SD ± 1.155).

An analysis of the results in Table 6.14 reveal a mean score of ($\bar{x}$=5.23: SD ± 1.142), which demonstrates an inclination towards the 'somewhat agree' position on the Likert-scale. This result implies that SCM professionals in the public sector perceive that there is satisfactory SCC between the public sector and its supply chain partners. These results are consistent with a study conducted by Heller (2013:107), which found satisfactory levels of SCC in the municipalities in the state of Arizona in the USA. This enabled that sector to streamline its relationships with suppliers for improved service delivery in that country. Another study by Okuduba (2016:1) observed positive levels of collaboration in Kenyan public entities and found that factors such as technology, information sharing, and regulations are the most significant factors for SCC in these entities. The study further revealed that public entities should ensure that there is adequate technological infrastructure, high levels of IS and progressive regulations as well as nurtured partnerships, creativity, awareness, performance and contracting to improve SCC. Additionally, Soita (2015:1) found that there is a collaboration between government ministries and its various stakeholders in the supply chain in Kenya. The study also established that factors such as legal framework, quality of personnel, compliance with SCM policies, information technology, and stakeholder involvement affects SCC in the Kenyan government ministries.

Another study by Meehan, Ludbrook and Mason (2016:1) in the public authorities in the emergency services sector in the United Kingdom revealed that collaboration in procurement activities in the public sector is imperative to deliver value for money and meet service delivery needs and demand of citizens. Mobu (2018:1) found some positive levels of collaboration in state-owned enterprises in South Africa. However, the study revealed that corruption and lack of accountability were the primary factors hindering effective and efficient collaborative initiatives in the South African state-owned enterprises. Therefore, the satisfactory level of SCC in the South African public sector can be considered to be primary in aiding public institutions to manage and

overcome their challenges and succeed in delivering services. Also, public sector organisations in South Africa can succeed in delivering their services successfully, given that both inputs and feedback from external stakeholders are essential in developing and implementing effective strategies.

An analysis of the measures of the normality of data indicates a skewness range of -0.363 to -0.672 and a kurtosis range of -0.360 to 0.203. These values fall within the recommended cut-off values of -2 to +2 for skewness and -3 to +3 for kurtosis, signifying a distribution close to normality.

6.6.2 Descriptive statistics for supply chain synergies

The descriptive statistics for SCS are presented in Table 6.15. The construct SCS is a new variable that was extracted in the EFA. A brief theory about this construct is provided in Section 6.4.1.

Table 6.15: Descriptive statistics for supply chain synergies

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
SCS5	Value-added resources are shared among supply chain members.	2	7	**5.35**	1.053	-0.367	-0.525
SCS6	Our organisation has joint decision-making activities with its supply chain partners.	2	7	**5.44**	1.119	-0.448	-0.208
SCS7	Our organisation shares cross-functional processes with its supply chain partners to make improvements.	1	7	**5.38**	1.141	-0.609	0.492
Overall scale				**5.39**	1.104	-0.475	0.408
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, 7=Strongly agree							

Source: Author's compilation

Table 6.15 represents the descriptive statistics for supply chain synergies (SCS). The SCS construct was measured using three items as indicated in Table 6.15. Item SCS1 scored a mean score of ($\bar{x}$=5.35: SD$\pm$1.053), which depicts that value-added resources are shared between public sector organisations and their supply chain members. Regarding item SCS2, a mean score of ($\bar{x}$=5.44: SD$\pm$1.119) was calculated, which suggests that public sector organisations have joint decision-making activities with their supply chain partners. Concerning item SCS3, a mean score of ($\bar{x}$ =5.38: SD$\pm$1.141) was computed, which shows that public organisations share cross-functional processes with their supply chain partners to improve their business operations.

The overall mean score for the SCS scale was ($\bar{x}$=5.39; SD$\pm$1.104). This mean score value suggests an inclination towards the "somewhat agree" position on the Likert scale. This result implies that there is an acceptable SCS between the public sector and its supply chain partners. These results are in line with the conclusion of a study by Oteba, Wagner, Seru, Embrey and Trap (2018:11), which found synergistic activities in the Ugandan pharmaceutical sector between the Ministry of Health of Uganda and its supply partners. The study established that through synergistic activities, the sector has managed to build a solid foundation on which to base continued holistic pharmaceutical and health system development. Bent (2014:3) establishes the need for SCS in municipalities as he highlights that the Hessequa Municipality in South Africa needs to eradicate its silo approach to doing business and partner with other agents within the supply chain to improve service delivery. Regarding joint decision making, Apopa (2018:1) concludes that synergistic activities enhance SCM in Kenyan government ministries and they enhance performance through sharing of information, joint decision making, and inter-organisational relationships. A study by Mathu (2019:23) concludes that synergistic activities in government projects have improved public sector service delivery by South African governmental institutions. Given these results, the South African public sector may be commended for its ability to develop and maintain synergistic relationships with its supply chain partners as this leads to improved efficiency and effectiveness in service delivery.

An analysis of the measures of normality of data showed that an average of -0.475 was recorded on the level of skewness and an average of 0.408 was recorded towards the kurtosis. The results indicate a skewness range of -0.367 to -0.609 and a kurtosis range of -0.525 to 0.492. These values

fall within the recommended cut-off values of -2 to +2 for skewness and -3 to +3 for kurtosis, thereby signifying that distribution was close to normality.

6.6.3 Descriptive statistics for supply chain innovation

The descriptive statistics for INV are presented in Table 6.16.

Table 6.16: Descriptive statistics for supply chain innovation

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
INV4	Our organisation constantly experiments with new ideas.	1	7	**5.20**	1.235	-0.713	0.803
INV5	Our organisation pursues continuous innovation in core processes.	1	7	**5.34**	1.113	-0.773	0.915
INV6	Our organisation focuses on process innovations.	1	7	5.25	1.165	-0.508	0.177
INV7	Our organisation pursues new technological innovations.	1	7	5.33	1.143	-0.783	1.042
Overall scale				5.28	1.164	-0.926	0.735
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, 7=Strongly agree							

Source: Author's compilation

As indicated in Table 6.16, four items measured the perception of respondents on INV in the South African public sector. Item INV4 scored a mean score of ($\bar{x}$=5.20: SD$\pm$1.235). This result demonstrates that public sector organisations are constantly experimenting with new ideas. Regarding item INV5, a mean score of ($\bar{x}$=5.34: SD$\pm$1.113) was calculated, indicating that public sector organisations are pursuing continuous innovation in core processes. In item INV6, a mean score of ($\bar{x}$=5.25: SD$\pm$1.165) was recorded, indicating public entities have been able to focus on process innovations. The responses to item INV7 ($\bar{x}$=5.33: SD1.143) show that public sector organisations are pursuing new technological innovations, based on the mean score.

The overall mean score for INV was ($\bar{x}$=5.28: SD$\pm$1.164), which illustrates an inclination towards the 'somewhat agree' position on the Likert scale. This result implies that there is a decent level of innovation in the South African public sector. Similar to the present study, Mulweye and Paul (2018:206) established that the adoption of innovation factors such as e-procurement and information and technology innovations have a positive effect on supply chain performance in the Ministry of Lands Kisumu in Kenya. Also, Mwangi (2016:1) established that there is a strong relationship between information and communication technological innovation adoption and supply chain performance in the nine parastatals that operate in the Kenyan energy sector. Heller (2013:1) found meaningful levels of innovation in municipal organisations in the state of Arizona in the USA. Funda (2019:21) concluded that innovations in the supply chain have aided in reducing the cost of operations and streamlined the University of Zambia's Purchasing System. As such, the public sector in South Africa may realise similar paybacks from its innovative capabilities.

Additionally, an analysis of the measures of normality of data indicate a skewness range of -0.508 to -0.783 and a kurtosis range of 0.177 to 1.042. these values fall within the recommended cut-off values of -2 to +2 for skewness and -3 to +3 for kurtosis signifying a distribution close to normality.

6.6.4 Descriptive statistics for information sharing

The descriptive statistics for IS are presented in Table 6.17.

Table 6.17: Descriptive statistics for information sharing

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
IS1	Most people in my organisation believe that sharing information is important.	1	7	5.30	1.072	-0.851	1.360
IS2	Managers from departments across the organisation are expected to share information with others.	1	7	**5.29**	1.132	-0.748	0.750

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
IS3	Our organisation shares the knowledge of core business with its supply chain partners.	1	7	5.44	1.256	-1.023	1.176
IS4	Our organisation shares proprietary information with its supply chain partners.	3	7	**5.93**	0.945	-0.802	0.284
IS5	Our organisation and supply chain partners exchange confidential information.	1	7	5.63	1.169	-0.921	0.992
IS6	Our organisation and its supply chain partners keep each other informed about events or changes that may affect them.	2	7	5.38	1.085	-0.547	0.187
IS7	Our organisation informs its supply chain partners in advance of its changing needs.	1	7	5.43	1.080	-0.585	0.279
Overall scale				5.49	1.106	-0.782	0.718
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, 7=Strongly agree							

Source: Author's compilation

Table 6.17 represents the descriptive statistical results of IS in the public sector. In item IS1, a mean score of ($\bar{x}$=5.30: SD$\pm$1.072) was realised. This result demonstrates that public sector organisations believe that sharing information is important. Item IS2 scored a mean score of ($\bar{x}$=5.29: SD$\pm$1.132), which shows that managers from departments across public sector organisations are expected to share information with others. Regarding item IS3, a mean score of ($\bar{x}$=5.44: SD$\pm$1.25) was calculated, implying that public organisations have been able to share the knowledge of core business with their supply chain partners.

In item IS4, a mean score value of ($\bar{x}$=5.93: SD$\pm$0.945) was recorded, demonstrating that public sector organisations have been able to share proprietary information with their supply chain partners. Item IS5 scored a mean of ($\bar{x}$=5.63: SD$\pm$1.169), showing that an acceptable exchange of confidential information between public sector organisations and their supply chain partners exists.

Concerning item IS6, a mean score of ($\bar{x}$=5.38: SD$\pm$1.085) was calculated, signifying that public sector organisations and their supply chain partners tend to keep each other informed about events or changes that may affect them. Also, in item IS7, a mean score of ($\bar{x}$=5.43: SD$\pm$1.080) was recorded, showing that public sector organisations can inform their supply chain partners in advance of their changing needs.

Moreover, an analysis of the overall mean score of ($\bar{x}$=5.49: SD$\pm$1.106) for the IS scale shows a leaning towards the 'somewhat agree' position on the Likert scale. This result suggests that a meaningful level of IS exists between the public sector and its supply chain partners. These results are in sync with a study conducted by Sandhu, Kishore-Jain and Ahmad (2011:206), which found satisfactory levels of IS in the Malaysian Public Works Department (MPWD) and Implementation Coordination Unit (ICU). The study revealed that respondents have positive views towards the importance of information sharing, although there is a feeling that the relevant policy has not been communicated to them and there is no certainty that IS strategies exist in their departments. Another study by Yang and Wu (2014:21) found that in Taiwanese government department agencies, there is a regular exchange of critical information with supply chain partners. The study observed that four factors, namely, technological, organisational, legislation and policy, and environmental significantly influence IS in government agencies.

Additionally, John, Saviour and Essien (2019:657) conclude that the sharing of information is vital for achieving supply chain efficiency in the Nigerian public health system. Locally, Dikotla (2019:1) observes that there is insufficient information technology infrastructure to support IS and there is no reward system to encourage employees to engage in IS in the municipalities in the Limpopo province in South Africa. Ncoyini and Cilliers (2016:64) established that there are several problems associated with IS within South African local government entities. Since IS between the South African public sector and its suppliers is reasonable, it stands that public sector institutions can succeed in meeting their mandate and improve their levels of service delivery.

Furthermore, an analysis of the measures of normality of data indicates a skewness range of -0.547 to -1.023 and a kurtosis range of 0.187 to 1.360. These values fall within the recommended

threshold values of -2 to +2 range for skewness and -3 to +3 range for kurtosis signifying a distribution close to normality.

6.6.5 Descriptive statistics for information quality

The descriptive statistics for IQ are presented in Table 6.18.

Table 6.18: Descriptive statistics for information quality

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
IQ1	Information exchange between our organisation and its supply chain partners is reliable.	1	7	**5.24**	1.047	-0.629	1.236
IQ2	Information exchange between our organisation and its supply chain partners is adequate.	1	7	5.31	1.189	-1.121	2.041
IQ3	Information exchange between our organisation and its supply chain partners is up-to-date and timely.	1	7	5.26	1.138	-0.908	1.233
IQ4	Information exchange between our organisation and its supply chain partners is accurate.	1	7	5.28	1.174	-0.597	0.519
IQ5	Information exchange between our organisation and its supply chain partners is complete.	1	7	5.25	1.152	-0.327	0.046
IQ7	The quality of the exchanged information with our key suppliers adds value to our organisational requirements.	1	7	**5.36**	1.106	-0.729	0.529
Overall scale				5.28:	1.134	-0.719	0.934
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, 7=Strongly agree							

Source: Author's compilation

The six measurement items in Table 6.18 tested the perception of IQ in the South African public sector. Item IQ1 scored a mean of ($\bar{x}$=5.24: SD$\pm$1.047), implying that information exchange

between public sector organisations and their supply chain partners is somewhat reliable. Regarding item IQ2 a mean score of ($\bar{x}$=5.31: SD$\pm$1.189) was attained, providing a hint that information exchange between public sector organisations and their supply chain partners is adequate. In item IQ3 a mean score of ($\bar{x}$=5.26: SD$\pm$1.138) was achieved, depicting that information exchange between public sector organisations and their supply chain partners is up-to-date and timely.

In item IQ4, a mean score of ($\bar{x}$=5.28: SD$\pm$1.174) was realised, suggesting that information exchange between public sector organisations and their supply chain partners is accurate. Regarding item IQ5, a mean score of ($\bar{x}$= 5.25: SD$\pm$1.152) was calculated, which means that information exchange between the organisations and their supply chain partners is somewhat complete. Additionally, item IQ7 scored a mean of ($\bar{x}$=5.36: SD$\pm$1.106), which indicates that the quality of the exchanged information with key suppliers adds value to the requirements of public sector organisations.

An overall mean score of ($\bar{x}$=5.28: SD$\pm$1.134) was computed for the IQ scale, thereby indicating a closeness to the 'somewhat agree' position on the Likert scale. This result implies that there is a satisfactory IQ exchange between public sector organisations, and their supply chain partners. These results are parallel to a study conducted by Hsiao and Lin (2016:2), which revealed that the exchange of quality information is a priority in Taiwanese government departments. John, Saviour and Essien (2019:657) in their study found that the exchange of accurate and timely inventory and demand data along the supply chain network is capable of enhancing efficient supply operations in public hospitals in Nigeria. Azemi, Zaidi and Hussin (2017:429) established that the availability of quality information has become essential for decision-making in Malaysian government departments. The Global Justice Information Sharing Initiative (2019:1) concluded that reasonable sharing of timely, up-to-date and accurate information in the Department of Justice in the USA is the cornerstone of sound agency decision making and inspires trust in the justice system and in the law enforcement entities that use information. In South Africa, a study by Chawuke (2018:114) reveals that there is limited sharing of quality information in the Department of Public Service and Administration in South Africa. The study recommends that with the dissemination of quality information, the organisation can meet its mandated objectives. As such, the public sector in South

Africa may realise similar benefits with the sharing of quality information with its supply chain partners.

Moreover, an analysis of the measures of the normality of the data indicates a skewness range of -0.327 to -1.121 and a kurtosis range of 0.046 to 2.041. These values fall within the recommended cut-off values of -2 to +2 for skewness and -3 to +3 for kurtosis signifying a distribution close to normality.

6.6.6 Descriptive statistics for supply chain design

The descriptive statistics for SCD are presented in Table 6.19.

Table 6.19: Descriptive statistics for supply chain design

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
SCD1	Proximity to suppliers is an important consideration for our organisation.	1	7	**5.50**	1.118	-0.739	0.911
SCD2	Our organisation's supplier selection criteria are well defined.	1	7	5.38	1.175	-0.865	0.919
SCD3	The number of suppliers and their capacities is sufficient to handle any possible needs of our clients.	1	7	**5.29**	1.159	-0.708	0.613
SCD4	Distribution channels in our supply chain can sufficiently serve the current and potential service delivery areas.	1	7	5.41	1.107	-0.754	0.663
SCD5	Logistical activities in our supply chain are coordinated to minimise problems in service delivery.	1	7	5.41	1.095	-0.774	0.901
Overall scale				5.40	1.131	-0.768	0.801
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree,6=Agree,7=Strongly agree							

Source: Author's compilation

Table 6.19 provides details of the descriptive statistics regarding the five items measuring the perceptions of SCM professionals towards SCD in the South African public sector. Item SCD1 recorded a mean score of ($\bar{x}$=5.50: SD±1.118), a result demonstrating that the proximity to suppliers is an important consideration for public sector organisations. Regarding item SCD2, a mean score of ($\bar{x}$=5.38: SD±1.175) was recorded, indicating that supplier selection criteria are well defined in public sector organisations. Also, concerning item SCD3, a mean score value of ($\bar{x}$=5.29: SD±1.159) was calculated, depicting that the number of suppliers and their capacities is sufficient to handle any possible needs of the clients to public sector organisations. In item SCD4, a mean score of ($\bar{x}$=5.41: SD±1.107) was scored, which shows that distribution channels in the public supply chain can sufficiently serve the current and potential service delivery areas. Concerning item SCD5, a mean of ($\bar{x}$=5.41: SCD±1.095) was recorded, which implies that logistical activities in the public supply chain are coordinated to minimise problems in service delivery.

An overall mean score of ($\bar{x}$=5.40: SD±1.131) was computed for the SCD scale, which is close to the 'somewhat agree' point on the Likert scale. This result implies that the public supply chain in South Africa is well designed to support its operations. Similar to the results above, Obinda and Gichure (2017:2593) also established that communication between procurement personnel on supplier selection and poor channels of communication affects efficiency in the procurement department, and communication ensures that the right supplier is selected to meet emerging and planned need in Nairobi city, Kenya. Dzuke and Naude (2017:1) found that most problems in the public procurement sector in government departments in Zimbabwe are found in the advertising, bid evaluation and contract stages. These problems emanate from a poorly designed supply chain. Given the existence of strong SCD practices and frameworks available, the South African public sector may successfully design its supply chains in a way that improves their operations.

An analysis of the measures of the normality of data indicates a skewness range of -0.708 to -0.865 and a kurtosis range of 0.663 to 0.919. These values fall within the recommended cut-off values of -2 to +2 for skewness and -3 to +3 for kurtosis signifying a distribution close to normality.

6.6.7 Descriptive statistics for supply chain integration

The descriptive statistics for SCI are presented in Table 6.20.

Table 6.20: Descriptive statistics for supply chain integration

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
SCI2	Organisations in our supply chain create a compatible communication and information system.	1	7	**5.32**	1.084	-0.596	0.332
SCI3	Our organisation extends its supply chain beyond its suppliers and clients.	1	7	**5.19**	1.245	-0.706	0.801
SCI4	Our organisation participates in the sourcing decisions of its suppliers.	1	7	5.20	1.175	-0.728	0.708
SCI5	Our organisation's compensation and motivation mechanisms consist of factors that promote integration.	1	7	5.26	1.182	-0.732	1.070
SCI6	Our organisation's integration with the upstream and downstream supply chain members has increased the flexibility of its operations.	1	7	5.31	1.262	-0.970	1.559
SCI7	Our organisation has made supply chain agreements with some suppliers and clients to share risks.	1	7	5.24	1.091	-0.355	0.429
Overall scale				5.25	1.173	-0.681	0.816

Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree, 7=Strongly agree

Source: Author's compilation

Table 6.20 provides insights into the perceptions of respondents towards the six measurement items for SCI in the South African public sector. Item SCI2 attained a mean score of ($\bar{x}$=5.32: SD$\pm$1.084), which demonstrates that to a certain extent organisations in the public supply chain are creating a compatible communication and information system. Regarding item SCI3, a mean score of ($\bar{x}$=5.19: SD$\pm$1.245) was calculated, indicating that to a certain extent, public sector

organisations can extend their supply chain beyond their suppliers and clients. In item SCI4, a mean score of ($\bar{x}$=5.20: SD$\pm$1.175) was recorded, which suggests that public sector organisations are participating in the sourcing decisions of their suppliers.

Concerning item SCI5, a mean score of ($\bar{x}$=5.26: SD$\pm$1.182) was attained, confirming that the public sector organisations' compensation and motivation mechanisms consist of factors that promote integration. Regarding item SCI6, a mean score of ($\bar{x}$=5.31: SD$\pm$1.262) was calculated, illustrating that the ability of public sector organisations to integrate with the upstream and downstream supply chain members has increased the flexibility of its operations. In item SCI7, a mean score of ($\bar{x}$=5.24: SD$\pm$1.091) was achieved, which indicates that public sector organisations have made supply chain agreements with some suppliers and clients to share risks.

An overall mean score value of ($\bar{x}$=5.25: SD$\pm$1.796) was calculated for the SCI scale. This mean score value is close to the 'somewhat agree' position on the Likert scale. By implication, the public sector supply chain is integrated effectively with those of its business partners. In line with the results of the present study, Salema and Buvik (2016:1) conclude that strong buyer-supplier integration improves suppliers' logistics performance significantly in the public medicine supply system in Mailand, Tanzania. Mlimbila and Mbamba (2018:1) found that the use of information systems in the Dar Es Salaam port in Tanzania enhances the port's logistical performance. Also, Akbulut, Odagasi and Kuzu (2011:170) establish that there is a different perception of the integration of information and communication technologies in Turkish education faculties. Still, Msimangira (2012:1) concludes that SCI has a positive influence on cost reduction and order fulfillment in public hospitals in New Zealand. Another study by Syed, Li, Junaid, Ye and Ziaullah (2019:1) in the Pakistan Standard and Quality Control Authority (PSQCA) suggests that sustainable internal business process risks, sustainable supply risks and sustainable demand risks have a negative relationship with SCI. It is clear then that if implemented and integrated well, SCI adds value to the performance of public organisations.

Also, the data for SCI was subjected to the skewness and kurtosis test to check its normality. The results indicate a skewness range of -0.355 to -0.970 and a kurtosis range of 0.332 to 1.559. The average values for skewness and kurtosis were -0.681 and 0.816 which all fall into recommended

thresholds of -2 to +2 for skewness and -3 to +3 for kurtosis signifying a distribution close to normality.

6.6.8 Descriptive statistics for supplier performance

The descriptive statistics for SP are presented in Table 6.21.

Table 6.21: Descriptive statistics for supplier performance

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
SP1	Our suppliers provide us with the best prices given the desired quality of the items/services purchased.	1	7	**5.08**	1.370	-0.805	0.502
SP2	Our suppliers attempt to reduce the time between order receipt and delivery to as close to zero as possible.	1	7	**5.08**	1.404	-0.933	0.640
SP3	Our suppliers have the ability to meet quoted or anticipated delivery dates and quantities on a consistent basis.	1	7	**5.36**	1.074	-0.838	1.128
SP5	Our suppliers have the ability to provide high-quality products/services.	1	7	5.15	1.299	-1.023	1.160
Overall scale				5.17	1.287	-0.900	0.857
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree,7=Strongly agree							

Source: Author's compilation

Table 6.21 shows the descriptive results regarding the construct SP. Four items were used to measure the perception of SCM professionals in the South African public sector towards SP. Item SP1 recorded a mean score value of ($\bar{x}$=5.08: SD$\pm$1.370), which suggests that the suppliers to the public sector have been able to provide it with the best prices given the desired quality of the items/services purchased. Regarding item SP2 a mean score of ($\bar{x}$=5.08: SD$\pm$1.404) was computed, showing that the suppliers to the public sector have been somewhat successful at attempting to reduce the time between order receipt and delivery to as close to zero as possible.

Concerning item SP3, a mean score of ($\bar{x}$=5.36: SD$\pm$1.074) was achieved, demonstrating that the suppliers to the public sector can meet quoted or anticipated delivery dates and quantities on a consistent basis. Item SP5 recorded a mean score of ($\bar{x}$=5.15: SD$\pm$1.299), which indicates that the suppliers to the public sector can provide high-quality products/services.

Table 6.21 further reveals that the overall mean score for the SP scale was ($\bar{x}$=5.17: SD$\pm$1.287), which leans close to the 'somewhat agree' position on the Likert scale. This result implies that the performance of suppliers to the public sector is acceptable and sound. Consistently, a study by De Waal and Mulimbika (2017:1), which focused on Zambian government institutions concluded that to drive governmental sectors to better performance, government agencies should adopt high-performance management techniques both within the organisation and when choosing their partners. Thus, they need to adhere to rules and regulations in selecting suppliers who are able to meet their demands and expectations. Chepkesis and Keitany (2018:1) further highlight that proper planning on SP enhances value for money, enhances quality, encourages proper utilisation of resources, enables quick decision making and encourages innovations. Also, the study by Kabutura and Mulyungi (2017:79) in the Rwandan Ministry of Defence concluded that supplier competence has a significant effect on the performance of the organisation. These results suggest that certain conditions such as the evaluation of the supplier's commitment to quality, financial capacity and competence should be ascertained before a contract is awarded.

In addition, an analysis of the measures of the normality of the data indicates a skewness range of -0.805 to -1.023 and a kurtosis range of 0.502 to 1.160. The average values for skewness are -0.900 and kurtosis is 0.857. These values fall within the recommended cut-off values of -2 to +2 for skewness and -3 to +3 for kurtosis signifying a distribution close to normality.

6.6.9 Descriptive statistics for supply chain resilience

The descriptive statistics for SCR are presented in Table 6.22.

Table 6.22: Descriptive statistics for supply chain resilience

Item	Description Valid: (n=333)	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
SCR1	Our supply chain can quickly return to its original state after being disrupted.	1	7	**5.21**	1.130	-0.515	0.164
SCR2	Our supply chain can move to a new, more desirable state after being disrupted.	1	7	5.22	1.183	-0.621	0.340
SCR3	Our supply chain is well prepared to deal with financial outcomes of supply chain disruptions.	1	7	**5.25**	1.279	-0.821	0.693
Overall scale				**5.23**	1.796	-0.652	0.399
Likert scale: 1= Strongly disagree, 2= Disagree, 3=Somewhat disagree, 4=Neutral, 5=Somewhat agree, 6=Agree,7=Strongly agree							

Source: Author's compilation

Table 6.22 provides detailed results about the perceptions of SCM professionals towards SCR in the South African public sector. Only three items were used to measure SCR. Item SCR1 scored a mean score of ($\bar{x}$=5.21: SD$\pm$1.130), showing there are signs that the supply chain can quickly return to its original state after being disrupted. Regarding item SCR2, a mean score of ($\bar{x}$=5.22: SD$\pm$1.183) was calculated, indicating the public supply chain possesses the ability to move to a new, more desirable state after being disrupted. Concerning item SCR3, a mean value of ($\bar{x}$=5.25: SD$\pm$1.279) was recorded, suggesting that the public supply chain is well prepared to deal with the financial outcomes of supply chain disruptions.

The overall mean score for the SCR scale was ($\bar{x}$=5.23: SD$\pm$1.796), which inclines towards the 'somewhat agree' position on the Likert scale. This result signifies that the public supply chain possesses the resilience required to adapt to disruptive circumstances in its environment. These results resonate with a study conducted by Ahiauzu and Eketu (2015:82), which found acceptable

resilience in the public universities' supply chain in Nigeria. The study highlighted that the university awareness, vulnerability, and adaptive capacity is significantly influenced by innovations. Sweya, Wilkinson, Kassenga and Mayunga (2020:6) established that the Tanzanian water authority was implementing measures to improve the resilience of its supply chain. The study went further, establishing that the concept of resilience is new and needs to be incorporated into official policies and practices. Given the resources and the SCM frameworks involved in the South African public sector, it is evident that organisations have all the capabilities to be both proactive and reactive and be able to rebound back into full operations after disruptions.

Additionally, an analysis of the measures of the normality of data indicates a skewness range of -0.515 to 0.821 and a range of 0.164 to 0.693 for kurtosis. The average values for skewness and kurtosis were reported to be -0.652 and 0.399 respectively which signals a distribution close to normality as the values fall between -2 to +2 and -3 to +3 as recommended by Gravetter and Wallnau (2014:92) and Brown (1997:22).

The next section discusses the results of the analysis of the inferential statistics.

6.7 INFERENTIAL STATISTICS

This section presents the inferential statistics, which are the results related to the testing of the hypotheses suggested for this study.

6.7.1 Confirmatory factor analysis (CFA)

CFA is a statistical technique that focuses on modeling the relationship between manifest indicators and underlying variables (Gallagher & Brown, 2013:289). It aids in the testing of hypotheses between variables. This section presents the results of the CFA, the latter of which was designed to assess the psychometric properties of the measurement scales used in this study. These properties consist of the reliability, validity and model fit. This section also presents the CFA model (Figure 6.16), which indicates the relationship that each latent construct has with the observed constructs.
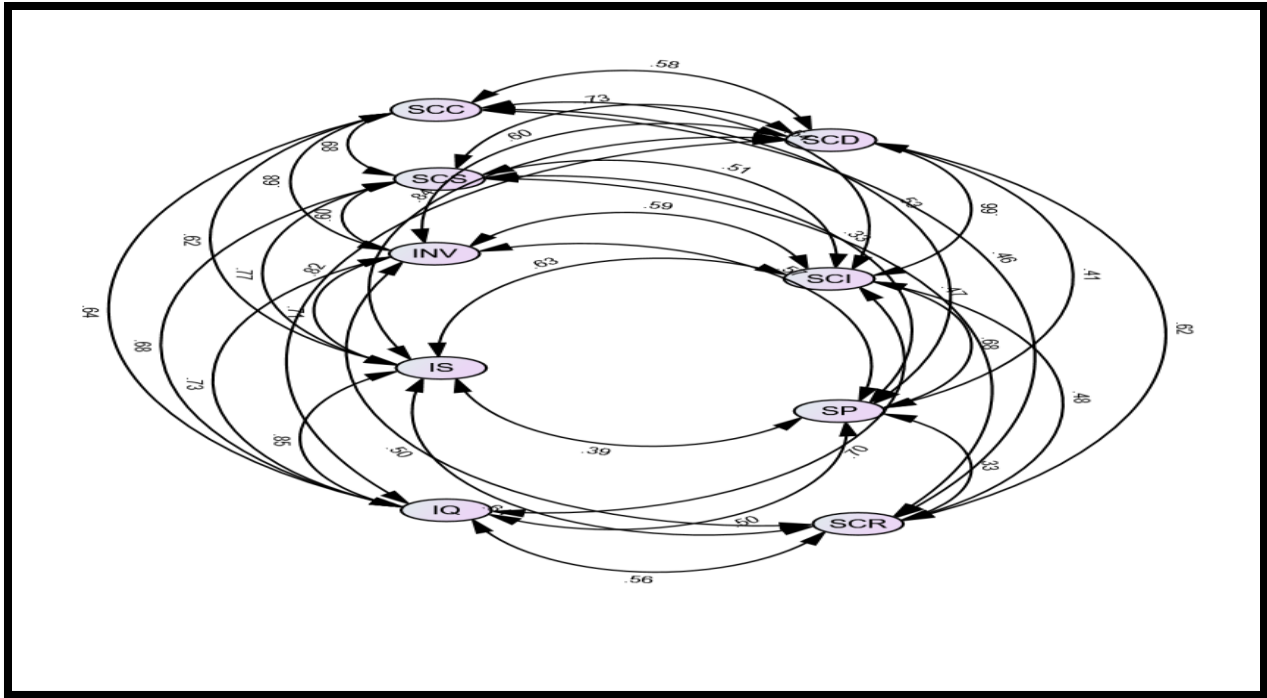
Figure 6.17: Confirmatory factor analysis model

Source: **Extracted from AMOS Graphics (Version 25.0)**

Figure 6.17 is the diagram of the CFA path diagram, extracted from the AMOS graphics software. It specifies the paths that make up the diagram. These paths are the standardised regression weights between the different latent (unobserved) constructs, ranged from β =0.33 (SCC↔SCR) and β =0.85 (IS↔IQ). The results of the CFA are presented in Table 6.23.

Table 6.23: Accuracy analysis statistics

Research constructs		Descriptive statistics		Cronbach's test		CR	AVE	HSV	Factor loading
		Mean	SD	Item-total	α Value				
SCC	SCC-2	5.23	1.142	0.763	0.859	0.86	0.95	0.47	0.796
	SCC-3			0.739					0.829
	SCC-4			0.701					0.838
SCS	SCS-1	5.39	1.104	0.619	0.801	0.81	0.91	0.59	0.773
	SCS-2			0.718					0.800

Research constructs		Descriptive statistics		Cronbach's test		CR	AVE	HSV	Factor loading
		Mean	SD	Item-total	α Value				
	SCS-3			0.608					0.710
INV	INV-4	5.28	1.164	0.658	0.845	0.85	0.91	0.54	0.725
	INV-5			0.737					0.829
	INV-6			0.650					0.737
	INV7			0.685					0.756
IS	IS-1	5.49	1.106	0.635	0.862	0.86	0.82	0.72	0.709
	IS-2			0.653					0.704
	IS-3			0.676					0.744
	IS-4			0.655					0.711
	IS-5			0.689					0.748
	IS-6			0.594					0.625
	IS-7			0.517					0.567
IQ	IQ-1	5.28	1.134	0.553	0.772	0.77	0.70	0.67	0.590
	IQ-2			0.528					0.622
	IQ-3			0.586					0.634
	IQ-4			0.467					0.542
	IQ-5			0.455					0.580
	IQ-7			0.520					0.646
SCD	SCD-1	5.40	1.131	0.570	0.820	0.83	0.83	0.71	0.653
	SCD-2			0.625					0.724
	SCD-3			0.624					0.687
	SCD-4			0.617					0.707
	SCD-5			0.593					0.681
SCI	SCI-2	5.25	1.173	0.556	0.793	0.81	0.59	0.51	0.669
	SCI-3			0.639					0.708
	SCI-4			0.655					0.718
	SCI-5			0.587					0.685
	SCI-6			0.476					0.532

Research constructs		Descriptive statistics		Cronbach's test		CR	AVE	HSV	Factor loading
		Mean	SD	Item-total	α Value				
	SCI-7			0.372					0.480
SP	SP-1	5.17	1.287	0.683	0.824	0.81	0.88	0.46	0.784
	SP-2			0.735					0.852
	SP-3			0.601					0.660
	SP-5			0.594					0.656
SCR	SCR-1	5.23	1.796	0.554	0.735	0.74	0.84	0.41	0.709
	SCR-2			0.600					0.749
	SCR-3			0.526					0.632

SCC= supply chain colloboration**; SCS=** supply chain synergies**; INV=** supply chain innovation**; IS=** information sharing**; IQ=** information quality**; SCD=** supply chain design**; SCI=** supply chain integration**; SP=** supplier performance**; SCR=** supply chain resilience
 CR= Composite Reliability**; AVE=** Average Variance Reliability. **SD=** Standard Deviation; **HSV=** Highest Shared Variance

Source: Author's compilation

To establish the relationship between latent constructs and their respective observed constructs, measurement items should be above 0.4 (Schreiber *et al.,* 2006:325). In this study, it was noted that all scales had factor loadings above 0.4, which then indicates consistency with the nature of the latent constructs.

6.7.1.1 Reliability analysis

Reliability has been defined as the degree to which a test measures something consistently (Salkind, 2017:62; Middleton, 2019:1). Babbie (2016:149) described reliability as a matter of whether a particular technique, applied repeatedly to the same object, yields the same result each time. Several scholars (Fornell & Larker, 1981:39; Fraering & Minor, 2006:284; Taber, 2018:1273) suggest that the checking of reliabilities is performed through the use of indicators such as a Cronbach's alpha test, Composite Reliability (CR) test, and item-total correlations. This study adopted these three suggested indicators.

6.7.1.1.1 Cronbach's alpha test

Cronbach's alpha refers to a measure of internal consistency of a test or scale (Tavakol & Dennick, 2011:53; Bonett & Wright, 2014:1). The degree of reliability of a variable should be confined between 0 and 1 to meet the sufficient reliability threshold (Cronbach, 1951:297; Tavakol & Dennick, 2011:53). Consistently, other scholars (Bagozzi & Yi, 1988:74; Padilla, Divers & Newton, 2012:331) state that a construct is deemed reliable when the Cronbach alpha result is equal to or greater than 0.7. The results in Table 6.22 illustrate that all the constructs of this study (SCC, SCS, SCI, IS, IQ, SCD, SCI, SP, and SCR) were reliable. They yielded Cronbach values above the 0.7 minimum threshold (SCC= 0.859; SCS=0.801; INV=0.845; IS=0.862; IQ=0.772; SCD=0.820; SCI=0.793; SP=0.824; SCR=0.735). These results, therefore, confirm the satisfaction of the criteria of reliability as emphasised by Ursachi, Horonic and Zait (2015:681).

6.7.1.1.2 Composite reliability test results

The determination of the reliability of the constructs in this study was a threefold process, consisting of Cronbach's alpha test, CR, and the item-to-total correlation test. Computation of CR values was performed using the following formulae provided by Fornel and Lacker (1981:39).

$$\textbf{(CR): CR}\boldsymbol{\eta} = \textbf{(}\Sigma\lambda\textbf{yi)}^2 \textbf{ / [(}\Sigma\lambda\textbf{yi)}^2 + \textbf{(}\Sigma\boldsymbol{\varepsilon}\textbf{i)]}$$

Composite reliability = (Square of the summation of the factor loadings) / [(square of the summation of factor loadings) + (summation of error variances)].

Table 6.24 presents a detailed calculation of the CR of each scale. It is paramount to note that factor loading values presented in Table 6.23 were used in the calculation of the CR of the scales.

Table 6.24: Composite reliability calculations

Composite reliability (CR) of supply chain collaboration (SCC) $(\Sigma\lambda yi)^2 = [(0.796+0.829+0.838)]^2 = (2.463)^2; (\Sigma\lambda yi)^2 = 6.07$ $(\Sigma\varepsilon i) = [(1-0.796^2) +(1-0.829^2) +(1-0.838^2)] = 0.98$ $(\Sigma\varepsilon i) = 0.98$ **Therefore, CR of SCC will be: [6.07/ (6.07+ 0.98)] = 0.86**
Composite reliability (CR) of supply chain synergies (SCS) $(\Sigma\lambda yi)^2 = [(0.773+0.800+0.710)]^2 = (2.283)^2; (\Sigma\lambda yi)^2 = 5.21$ $(\Sigma\varepsilon i) = [(1-0.773^2) +(1-0.800^2) +(1-0.710^2)] = 1.26$ $(\Sigma\varepsilon i) = 1.26$ **Therefore, CR of SCS will be: [5.21/ (5.21+1.26)] = 0.81**
Composite reliability (CR) of supply chain innovation (INV) $(\Sigma\lambda yi)^2 = [(0.725+0.829+0.737+0.756)]^2 = (3.047)\ 2; (\Sigma\lambda yi)^2 = 9.28$ $(\Sigma\varepsilon i) = [(1-0.725^2) +(1-0.829^2) +(1-0.737^2) +(1-0.756^2)] = 1.67$ $(\Sigma\varepsilon i) = 1.67$ **Therefore, CR of INV will be: [9.28/ (9.28+1.67)] = 0.85**
Composite reliability (CR) of information sharing (IS) $(\Sigma\lambda yi)^2 = [(0.709+0.704+0.744+0.711+0.748+0.625+0.567)]^2 = (4.808)^2; (\Sigma\lambda yi)^2 = 23.12$ $(\Sigma\varepsilon i) = [(1-0.709^2) +(1-0.704^2) +(1-0.744^2) +(1-0.711^2) + (1-0.748^2) + (1-0.625^2) + (1-0.567^2)] = 3.67$ $(\Sigma\varepsilon i) = 3.67$ **Therefore, CR of IS will be: [23.12/ (23.12+3.67)] = 0.86**
Composite reliability (CR) of information quality (IQ) $(\Sigma\lambda yi)^2 = [(0.590+0.622+0.634+0.542+0.580+0.646)]^2 = (3.614)^2; (\Sigma\lambda yi)^2 = 13.06$ $(\Sigma\varepsilon i) = [(1-0.590^2) +(1-0.622^2) +(1-0.634^2) +(1-0.542^2) + (1-0.580^2) + (1-0.646^2] = 3.82$ $(\Sigma\varepsilon i) = 3.82$ **Therefore, CR of IQ will be: [13.06/ (13.06+3.82)] = 0.77**
Composite reliability (CR) of supply chain design (SCD) $(\Sigma\lambda yi)^2 = [(0.653+0.724+0.687+0.707+0.681)]^2 = (3.452)^2; (\Sigma\lambda yi)^2 = 11.92$ $(\Sigma\varepsilon i) = [(1-653^2) +(1-0.724^2) +(1-0.687^2) +(1-0.707^2) + (1-0.681^2)] = 2.49$ $(\Sigma\varepsilon i) = 2.49$ **Therefore, CR of SCD will be: [11.92/ (11.92+2.49)] = 0.83**
Composite reliability (CR) of supply chain integration (SCI) $(\Sigma\lambda yi)^2 = [(0.669+0.708+0.718+0.685+0.532+0.480)]^2 = (3.792)^2; (\Sigma\lambda yi)^2 = 14.38$ $(\Sigma\varepsilon i) = [(1-0.669^2) +(1-0.708^2) +(1-0.718^2) +(1-0.685^2) + (1-0.532^2) + (1-0.480^2] = 3.38$ $(\Sigma\varepsilon i) = 3.38$ **Therefore, CR of SCI will be: [14.38/ (14.38+3.38)] = 0.81**
Composite reliability (CR) of supplier performance (SP) $(\Sigma\lambda yi)^2 = [(0.784+0.852+0.660+0.656)]^2 = (2.952)^2; (\Sigma\lambda yi)^2 = 8.71$ $(\Sigma\varepsilon i) = [(1-0.784^2) +(1-0.852^2) +(1-0.660^2) +(1-0.656^2)] = 1.98$ $(\Sigma\varepsilon i) = 1.98$ **Therefore, CR of SP will be: [8.71/ (8.71+1.98)] = 0.81**
Composite reliability (CR) of supply chain resilience (SCR)

$(\Sigma\lambda yi)^2 = [(0.709+0.749+0.632)]^2 = (2.09)^2; (\Sigma\lambda yi)^2 = 4.37$

$(\Sigma\varepsilon i) = [(1-0.709^2) +(1-0.749^2) +(1-0.632^2)] = 1.54$

$(\Sigma\varepsilon i) = 1.54$ **Therefore, CR of SCR will be: [4.37/ (4.37+1.54)] = 0.74**

Source: Author's own compilation

The results presented in Tables 6.23 and 6.24 reveal that the CR values of all constructs (SCC=0.86; SCS = 0.81; INV = 0.85; IS = 0.86; IQ = 0.77; SCD = 0.83; SCI = 0.81; SP= 0.81; SCR = 0.74) were above the recommended minimum cut-off value of 0.7, which was suggested by Hulland (1999:195) and Borsboom (2006:425).

6.7.1.1.3 Item-to-total correlation

As indicated in Section 6.6.2, item-to-total correlations were also used to determine reliability. Item-to-total correlation represents the degree to which differences among individual responses to the item are consistent. Scholars (Cristobal, Flavian & Guinaliu, 2007:317; Streiner, Norman & Cairney, 2015:84) submit that acceptable item-to-total correlation scores should be equal to or above 0.3. The loadings of all items met the minimum threshold of 0.3 with SCC ranging from 0.701 to 0.763, SCS from 0.608 to 0.718, INV from 0.650 to 0.737, IS from 0.517 to 0.689, IQ from 0.455 to 0.586, SCD from 0.520 to 0.625, SCI from 0.372 to 0.655, SP from 0.594 to 0.735 and SCR from 0.526 to 0.600. This further demonstrates that all measurement scales were internally consistent.

6.7.1.2 Computation of the highest shared variance

Highest shared variance is the maximum amount of variation that a construct is able to explain in another variable (Farrell & Rudd, 2009:4). Newsom (2008:1) defines it as the maximum amount that variations of the two variables tend to overlap. It is used in assessing the discriminant validity of the constructs and is represented by the square of the correlation between any two variables (constructs) (Farrell & Rudd, 2009:4; Essmui *et al.,* 2014:182). This section presents the results of the calculation of the highest shared variance (HSV) and are represented in Table 6.25.

Table 6.25: Computation of the highest shared variance

Constructs	Highest correlation with other variables	Highest shared variance
Supply chain collaboration (SCC)	0.683	0.47
Supply chain synergies (SCS)	0.771	0.59
Supply chain innovation (INV)	0.733	0.54
Information sharing (IS)	0.847	0.72
Information quality (IQ)	0.819	0.67
Supply chain design (SCD)	0.844	0.71
Supply chain integration (SCI)	0.703	0.51
Supplier performance (SP)	0.678	0.46
Supply chain resilience (SCR)	0.639	0.41

Source: **Author's own compilation**

As indicated in Table 6.25, the assessment of the HSV of a construct was calculated by squaring its highest correlation value with other constructs. The results demonstrate that IS had the highest shared variance of all constructs with a score of 0.72, followed by SCD (HSV=0.71), followed by IQ (HSV= 0.67), followed by SCS (HSV= 0.56), INV (HSV= 0.54), SCI (HSV= 0.51), SCC (HSV= 0.47), SP (HSV= 0.46) and SCR (HSV= 0.41).

6.7.1.3 Validity analysis

Validity refers to the point at which scale items measure what they intend to measure in a construct (Taherdoost, 2016:28). Babbie (2010:153) refers to validity as the extent to which the measure reflects the real meaning of the concept under consideration. Its prime purpose is to explain how well the collected data covers the actual area of investigation (Ghauri & Gronhaug, 2005:267). Validity tests are mainly divided into four types, namely, content validity, face validity, construct validity, and criterion-related validity (Creswell, 2005:256). To measure validity, this study used three types of indicators, namely, content, convergent and face validity.

6.7.1.3.1 Face validity

Face validity refers to whether a test appears to respondents to be measuring what it is supposed to measure (Labbe, 2011:76). Face validity ensures that there are no errors in the measurement and that the questions posed are clear to avoid interviewer bias (Ibid). In this study, face validity was established through consultation with a panel of academics from a selected university of technology. Additionally, the questionnaire was reviewed by the study promoters to ensure that the questions measure what they intend to measure. The reviewers made recommendations in areas such as the wording and grammar of questions, the length of the instrument and its technical layout. These recommendations were implemented prior to the pilot study.

6.7.1.3.2 Content validity

Content validity is a type of validity that requires that a measure represents all aspects of the conceptual definition of a construct (Neuman, 2014:216). Ruel *et al*. (2015:90) present content validity as the comprehensiveness, relevance, and representativeness of the measurement. In this study, the validity of the content of the constructs of the study was ascertained through a pilot study of the questionnaire. The questionnaire was piloted using a conveniently selected sample of 50 SCM professionals drawn from various public sector organisations in the Gauteng Province. The questionnaires collected from the pilot sample were analysed to check whether respondents had faced challenges in answering the questions. It appeared that respondents were comfortable with the questions and had managed to complete the response within the required time of 15 minutes. Data collected from the pilot sample were then subjected to a reliability test, using the SPSS statistical package. All measurement scales attained Cronbach alphas above 0.7 and item-total correlations above 0.3. As such,
 no items were removed from the questionnaire, as it showed that its content was valid and reliable. SCM professionals that participated in the pilot study were excluded from the main survey.

6.7.1.3.3 Construct validity

Construct validity refers to how well a research instrument measures what it is supposed to measure (Brown, 2010:9). Construct validity is measured using two components, namely, convergent, which seeks to establish how well the indicators of one construct converge, and discriminant validity, which determines how well the indicators of different constructs diverge (Neuman, 2014:217). Therefore, the two components seek to establish if the measures fit the appropriate and expected patterns of relationships with other constructs.

6.7.1.3.4 Convergent validity

Convergent validity has been defined as the degree to which items converge or share a high proportion of variance in common (Hair, 2011:96). To measure convergent validity, this study utilised the factor loadings derived from the CFA (refer to Table 6.22) as well as the Average Variance Extracted (AVE) (refer to Tables 6.22 & 6.25). The results of this study indicate that all factor loadings related to the items used in measuring each construct were higher than 0,4 as suggested by Marnburg and Luo (2014:39). All the items with factor loadings of less than 0.4 were discarded during scale purification as suggested by Hair (2011:97). SCC had item loadings ranging from 0.796 to 0.838; supply chain synergies ranging from 0.710 to 0.800; INV ranging from 0.725 to 0,829; IS ranging from 0.567 to 0.748; IQ ranging from 0.542 to 0.646; SCD ranging from 0.653 to 0.724; SCI 0.480 to 0.718; SP 0.656 to 0.852 and SCR ranging from 0.632 to 0.749, respectively. All items used in the data analysis in this study had factor loadings of above 0.4, which suggests that every accepted item met the criteria for convergent validity and measured at least 40 percent of what they intended to measure.

6.7.1.3.5 Calculation of average variance extracted

The AVE was applied as the second indicator for establishing convergent validity. AVE was designed to reflect the total variance observed in a construct (Fraering & Minor, 2006:284). To calculate the AVE index this study utilised the following formula proposed by Lacker (1981:39):

$$V\eta=\Sigma\lambda yi^2/ (\Sigma\lambda yi^2+\Sigma\varepsilon i)$$

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

Table 6.26 provides detailed steps followed in the calculation of the AVE of the research constructs. Again, it is imperative to note that the study made use of the factor loadings presented in Table 6.23 as part of the analysis.

Table 6.26: Average variance extracted calculation

Average variance extracted (AVE) of supply chain collaboration (SCC) $(\Sigma\lambda yi)^2 = (0.796^2 + 0.829^2 + 0.838^2) = 2.023$ $(\Sigma\varepsilon i) = \{(1\text{-}0.796)^2 + (1\text{-}0.829)^2 + (1\text{-}0.838)^2\}= 0.108$ $(\Sigma\lambda yi) = 0.108$ **Therefore, AVE of SCC will be**: [2.023/ (2.023+0.108)] = **0.95**
Average variance extracted (AVE) of supply chain synergies (SCS) $(\Sigma\lambda yi)^2 = (0.773^2 + 0.800^2 + 0.710^2) = 1.742$ $(\Sigma\varepsilon i) = \{(1\text{-}0.773)^2 + (1\text{-}0.800)^2 + (1\text{-}0.710)^2\}= 0.176$ $(\Sigma\lambda yi) = 0.176$ **Therefore, AVE of SCS will be**: [1.742/ (1.742+0.176)] = **0.91**
Average variance extracted (AVE) of supply chain innovation (INV) $(\Sigma\lambda yi)^2 = (0.725^2 + 0.829^2 + 0.737^2 + 0.756^2) = 2.328$ $(\Sigma\varepsilon i) = \{(1\text{-}0.725)^2 + (1\text{-}0.829)^2 + (1\text{-}0.737)^2 + (1\text{-} 0.756)^2\}= 0.234$ $(\Sigma\lambda yi) = 0.234$ **Therefore, AVE of INV will be:** [2.328/ (2.328+0.234)] = **0.91**
Average variance extracted (AVE) of information sharing (IS) $(\Sigma\lambda yi)^2 = (0.709^2 + 0.704^2 + 0.744^2 + 0.711^2 + 0.748 + 0.625^2 + 0.567^2) = 3.331$ $(\Sigma\varepsilon i) = \{(1\text{-}0.709)^2 + (1\text{-}0.704)^2 + (1\text{-}0.744)^2 + (1\text{-}0.711)^2 + (1\text{-}0.748)^2 + (1\text{-}0.625)^2 + (1\text{-}0.567)^2\}= 0.715$ $(\Sigma\lambda yi) = 0.715$ **Therefore, AVE of IS will be:** [3.331/ (3.331+0.715)] = **0.82**
Average variance extracted (AVE) of information quality (IQ) $(\Sigma\lambda yi)^2 = (0.590^2 + 0.622^2 + 0.634^2 + 0.542^2 + 0.580^2 + 0.646^2) = 2.184$ $(\Sigma\varepsilon i) = \{(1\text{-}0.590)^2 + (1\text{-}0.622)^2 + (1\text{-}0.634)^2 + (1\text{-}0.542)^2 + (1\text{-}0.580)^2 + (1\text{-}0.646)^2\}= 0.196$ $(\Sigma\lambda yi) = 0.196$ **Therefore, AVE of IQ will be**: [2.184/ (2.184+0.196)] = **0.70**
Average variance extracted (AVE) of supply chain design (SCD) $(\Sigma\lambda yi)^2 = (0.653^2 + 0.724^2 + 0.687^2 + 0.707^2 + 0.681^2) = 2.386$ $(\Sigma\varepsilon i) = \{(1\text{-}0.653)^2 + (1\text{-}0.724)^2 + (1\text{-}0.687)^2 + (1\text{-}707)^2 + (1\text{-}681)^2\}= 0.482$ $(\Sigma\lambda yi) = 0.482$ **Therefore, AVE of SCD will be:** [2.386/ (2.386+0.482)] = **0.83**

Average variance extracted (AVE) of supply chain integration (SCI)
$(\Sigma\lambda yi)^2 = (0.669^2 + 0.708^2 + 0.718^2 + 0.685^2 + 0.532^2 + 0.480^2) = 2.445$
$(\Sigma\varepsilon i) = \{(1-0.669)^2 + (1-0.708)^2 + (1-0.718)^2 + (1-0.685)^2 + (1-0.532)^2 + (1-0.480)^2\} = 1.754$
$(\Sigma\lambda yi) = 1.754$ **Therefore, AVE of SCI will be:** $[2.445/ (2.445+1.754)] = $ **0.59**
Average variance extracted (AVE) of supplier performance (SP)
$(\Sigma\lambda yi)^2 = (0.784^2 + 0.852^2 + 0.660^2 + 0.656^2) = 2.207$
$(\Sigma\varepsilon i) = \{(1-0.784)^2 + (1-0.852)^2 + (1-0.660)^2 + (1-0.656)^2\} = 0.303$
$(\Sigma\lambda yi) = 0.303$ **Therefore, AVE of SP will be:** $[2.207/ (2.207+0.303)] = $ **0.88**
Average variance extracted (AVE) of supply chain resilience (SCR)
$(\Sigma\lambda yi)^2 = (0.709^2 + 0.749^2 + 0.632^2) = 1.463$
$(\Sigma\varepsilon i) = \{(1-0.709)^2 + (1-0.749)^2 + (1-0.632)^2\} = 0.283$
$(\Sigma\lambda yi) = 0.283$ **Therefore, AVE of SCR will be:** $[1.463/ (1.463+0.283)] = $ **0.84**

Source: Author's own compilation

As presented in Table 6.26, the AVE values for the constructs (SCC = 0.95; SCS = 0.91; INV = 0.91; IS = 0.82; IQ = 0.70; SCD = 0.83; SCI = 0.59; SP = 0.88, SCR = 0.84) were greater than the required threshold of 0.4 as suggested by Lam (2012:1328). This once again supports the accepted degree of convergent validity.

6.7.1.3.6 Discriminant validity

Discriminant validity refers to the extent to which a construct is truly distinct from other constructs (Madhankumar & Sathyanarayan, 2014:22). Its purpose is to provide evidence that a construct is unique and captures some phenomena other measures do not. As suggested by several scholars (Bagozzi & Yi, 1988:74; Zait & Bertea, 2011:217), discriminant validity can be measured using the Q-sorting chi-square difference test, the AVE test and the use of correlations computed during the CFA. Fornell and Larcker (1981:39) further suggest that discriminant validity is ascertained by determining whether the value score of AVE is higher than the threshold of 0.4 and subsequently above the HSV score. In assessing discriminant validity, this study adopted two approaches, namely, the AVE test and correlation analysis. The results of the correlation analysis are presented in Table 6.27.

Table 6.27: Inter-construct correlations

Research construct	SCC	SCS	INV	IS	IQ	SCD	SCI	SP	SCR
SCC	1.00								
SCS	0.683	1.00							
INV	0.680	0.599	1.00						
IS	0.625	0.771	0.708	1.00					
IQ	0.644	0.675	0.733	0.847	1.00				
SCD	0.578	0.725	0.601	0.844	0.819	1.00			
SCI	0.536	0.506	0.586	0.631	0.703	0.657	1.00		
SP	0.532	0.326	0.572	0.388	0.504	0.409	0.678	1.00	
SCR	0.459	0.467	0.504	0.639	0.562	0.620	0.479	0.325	1.00
SCC= supply chain colloboration**; SCS**= supply chain synergies**; INV**= supply chain innovation**; IS**= information sharing**; IQ**= information quality**; SCD**= supply chain design**; SCI**= supply chain integration**; SP**= supplier performance**; SCR**= supply chain resilience									
***Correlation is significant at the 0.001 level (3-tailed)									

Source: Author's compilation

Table 6.27 presents the correlation matrix of the constructs considered in this study. It shows that there were positive correlations across the individual paired constructs, which were found to be below the cut-off value of 1.0 (r=0.683; p<0.01 to r=0.325; p<0.01), which confirms the adequacy of discriminant validity of the scale items as recommended by Bagozzi and Yi (1988:74).

As reported in Table 6.23, the AVE values of the constructs were 0.95 for SCC; 0.91 for SCS; 0.91 for INV; 0.82 for IS; 0.70 for IQ; 0.83 for SCD; 0.59 for SCI; 0.88 for SP and 0.84 for SCR. In contrast, HSV values were 0.47 for SCC; 0.59 for SCS; 0.54 for INV; 0.72 for IS; 0.67 for IQ; 0.71 for SCD; 0.51 for SCI; 0.46 for SP and 0.41 SCR. Comparing the above-stated results it was noted that besides being well above the recommended threshold of 0.4, AVE values were greater

than their corresponding HSV. This, as a result, confirms the acceptable discriminant validity of the scales.

6.7.1.4 Model fit analysis

Model fit analysis can be viewed as a statistical model that describes how well-set observations fit a theoretical observation (Lui *et al.,* 2016:276). As suggested by Hair, Anderson, Tatham and Black (2006:11), assessing the fitness of a research model requires a relationship with several indicators (indices) of fitness. To ascertain the fitness of a research model, indicators such as Chi-square value over degrees of freedom (χ^2/df); Goodness-of-fit Index (GFI); Comparative Fit Index (CFI); Incremental Fit Index; Tucker-Lewis Index (TLI); the Normed Fit Index (NFI); Relative Fit Index (RIF); Root mean square residual (RMR); and Root Mean Square Error of Approximation (RMSEA) are used (Adeyemi, 2009:49). Table 6.28 reports on the results of the model fit assessment.

Table 6.28: Model fit results for confirmatory factor analysis

Model fit indices	Accepted threshold values	Sources	Results obtained
χ^2/df	Between 1 to 3 [$\leq$ 3.0]	Schreiber, Stage, King, Nora and Barlow (2006:330)	2.4
RMSEA	Equal to or below 0.08 [$\leq$ 0.08]	Browne and Cudeck (1993:137)	0.067
CFI	Equal to or greater than 0.90 [$\geq$ 0.9]	Bollen (1990:256)	0.900
IFI	Equal to or greater than 0.90 [$\geq$ 0.9]	Bollen (1990:256)	0.900
TLI	Equal to or greater than 0.90 [$\geq$0.9]	Bollen (1990:256)	0.831
NFI	Equal to or greater than 0.90 [$\geq$0.9]	Bollen (1990:256)	0.760

| RFI | Equal to or greater than 0.90 [≥0.9] | Bollen (1990:256) | 0.722 |

Source: Author's own compilation

As indicated in Table 6.28, the accessibility of the model fit of this study was established by the chi-square value over the degree of freedom, which according to Schreiber, Stage, King, Nora, and Barlow (2006:330), should be between 1 and not more than 3. The study also used the values of the Comparative Fit Index (CFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), the Normed Fit Index (NFI), and the Relative Fit Index (RIF), which all should be equal to or above 0.9 and Root Mean Square Error of Approximation (RMSEA), which should be equal to or below 0.08 (Fan *et al.,* 2016:6).

As depicted in Table 6.28, the chi-square value over degrees of freedom ($\chi 2/df$) was 2.4, which falls within the required threshold of 3 as suggested by Schreiber *et al*. (2006:330). Furthermore, the RMSEA value was 0.067 which also falls in the recommended bracket of less than 0.08 (Browne & Cudeck, 1993:137). Other indices attained the following scores: CFI = 0.900; IFI = 0.900; TLI = 0.831; NFI = 0.760 and RFI = 0.722. While the values of the CFI and IFI were satisfactory, some of the outcomes fall short on the required threshold of equal to or greater than 0.9 as suggested by several scholars (Bollen, 1990:256; Bagozzi & Yi, 2012:28; Fan *et al.,* 2016:6). Although the indices (CFI, IFI, TLI, NFI, RFI) did not meet the required thresholds, the model fit was not absolute but close, owing to the values being close to their respective thresholds. Various authoritative scholars (Doll, Xia & Torzadeh, 1994:357; Baumgartner & Homburg, 1996:139; Forza & Pilippini, 1998:17; Greenspoon & Saklofske, 1998:965; Hair *et al*., 2010:96) posit that the threshold of equal to or greater than 0.9 means satisfactory fit while values greater than 0.8 are acceptable and suggest a good fit. Awang (2012:55) consents to this by suggesting that the choice of index thresholds to choose from depends on which literature is being referred to. In addition, the data fit the model theoretically since the measurement instruments adopted from several sources managed to meet the thresholds of all other measures such as the reliability, validity, and correlations.

In addition to the above, in literature, there is considerable controversy about fit indices as several scholars suggest different perspectives. Barret (2007:821) suggests that some researchers do not believe that fit indices add anything to the analysis and only the chi-square should be interpreted. They instead believe that the chi-square exact-fit test is the only substantive test of fit for SEM. However, Barret (2007:821) further submits that the chi-square's sensitivity to discrepancies from expected values at increasing sample sizes can be problematic if those discrepancies are considered trivial from an explanatory-theory perspective. Scholars Hayduk, Cummings, Boadu, Pazderka-Robinson, and Boulianne (2007:841) argue that cut-off values for a fit index can be misleading and subject to misuse. This resonates with the view submitted by Kenny (2015:2) that most analysts believe in the value of fit indices but caution against strict reliance on cut-offs. Kenny, Kaniskan and McCoach (2014:2) argue that fit indices should not be computed for small degrees of freedom models; rather for these models, the researcher should only locate the source of specification error. Also, Hu and Bentler (1999:27) suggest that it is models with more variables that tend to be difficult and tend to have relatively poor fit due to smaller values. Given all the insights above, the model fit indices attained in this study were not dismissed and discarded but were rather retained for information purposes even though they did not meet the suggested thresholds.

The next section discusses the path analysis results.

6.8 PATH ANALYSIS RESULTS

Path analysis refers to a form of multiple regression statistics that are used to evaluate causal models by examining the relationships between a dependent variable and two or more independent variables (Crossman, 2019:1). In this study, path analysis was used to test the eight hypotheses and establish their validation or non-validation based on the results obtained from SEM.

Model fit was also tested in the path analysis using the same indicators used in the CFA. The results are reported in Table 6.29.

Table 6.29: Model fit results for path analysis

Model fit indices	Accepted threshold values	Sources	Results obtained
χ2/df	Between 2.0 and 5.0 [≤ 0.5]	Wheaton, Muthen, Alwin and Summers (1997:84); Hooper, Coughlan and Mullen (2008:53)	4.112
RMSEA	Equal to or below 0.08 [≤ 0.08]	Browne and Cudeck (1993:137)	0.077
CFI	Equal to or greater than 0.90 [≥ 0.9]	Bollen (1990:256)	0.650
IFI	Equal to or greater than 0.90 [≥ 0.9]	Bollen (1990:256)	0.655
TLI	Equal to or greater than 0.90 [≥0.9]	Bollen (1990:256)	0.909
NFI	Equal to or greater than 0.90 [≥0.9]	Bollen (1990:256)	0.589
RFI	Equal to or greater than 0.90 [≥0.9]	Bollen (1990:256)	0.541

Source: Author's own compilation

In Table 6.29, the SEM model fit of this study was ascertained by combining a number of indices, namely: Chi-square value over degree of freedom (χ2/df), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), the Normed Fit Index (NFI), Relative Fit Index (RIF) and Root Mean Square Error of Approximation (RMSEA) (Hooper *et al.,* 2008:53). As indicated in Table 6.28, the Chi-square value over degree of freedom (χ2/df) was 4.112, which is below the upper threshold of 0.5 suggested by scholars such as Wheaton *et al*. (1997:84) and Hooper *et al*. (2008:53). In addition, the RMSEA value was 0.097, which is above the recommended cut-off value of 0.08 suggested by Browne and Cudeck (1993:137). Indices such as CFI, IFI, TLI, NFI and RIF had values of 0.650, 0.655. 0.609, 0.589, and 0.541, respectively. These values fall short of the acceptable thresholds of above 0.9 as recommended by Bollen (1990:256).

As demonstrated in the discussion above, the results of the RMSEA and TLI were acceptable. However, the CFI, IFI, NFI and RFI failed to meet the recommended thresholds, indicating that

the data collected was not able to fit the model of the study. However, the model was retailed since the RMSEA and TLI were satisfactory. Also, the Chi-square which is often regarded as the substantive test of the SEM model fit falls within the cut-off value (Barret, 2007:821). In support of this view, Hu and Bentler (1999:2) suggest that the Chi-square is the traditional measure for evaluating overall model fit and assesses the magnitude of discrepancy between the sample and fitted covariance matrices. Other scholars (Mulaik *et al*., 1989:430; Kline, 2005:448; Barret, 2007:815) highlights that the Chi-square is the one that is used to determine the lack of fit.

Additionally, SEM results were supported by an additional set of results obtained through regression analysis. These results compliment the SEM results and show similar outcomes, which confirms that both sets of results are useful.

The results for the path analysis are presented in the structural model in Figure 6.18.
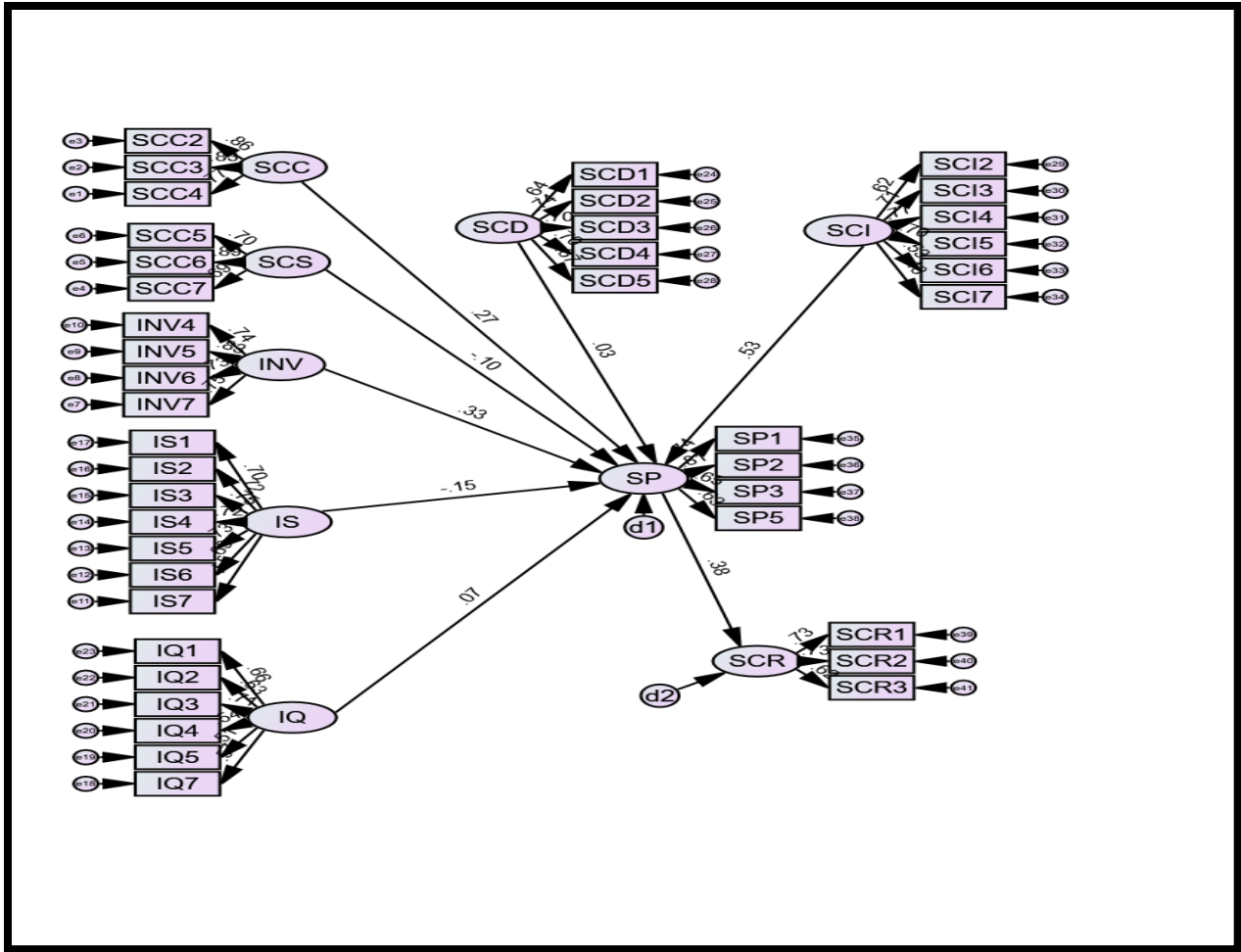
Figure 6.18: Structural path model

Source: Imported from AMOS graphics

The structural path model in Figure 6.18 shows the latent variables (SCC, SCS, INV, IS, IQ, SCD, SCI, SP, SRC), their associated observed variables and error terms. The unidirectional arrows between the latent constructs are the structural paths that were tested in this study and the figures attached are the path coefficients. For example, the path coefficient between IS and SP is -0.15. The highest path coefficient is between SCI and SP ($\beta = 0.53$). The factor loadings are the figures slotted in the arrows between the latent and observed variables.

6.8.1 Regression analysis

Regression analysis was also applied to test for predictive relationships between independent and dependent variables (Sarstedt & Mooi, 2014:194). In this study, regression analysis was performed to check the proposed relationships between the constructs as the connection of these constructs shows that relationships do exist (refer to Table 6.17). The regression analysis was applied using the 'enter' method in which the variables are entered into the model once in a single step. Two regression models were run since there are two types of relationships to be tested. In Regression Model 1, seven SCM practices (SCC, SCS, INV, IS, IQ, SCD, and SCI) were entered as independent variables, while SP was entered as the dependent variable. In Regression Model 2, SP was entered as the independent variable while SCR was entered as the dependent variable. Each regression model is presented in an Ordinary Least Squares (OLS) regression equation, presented in Table 6.30.

Table 6.30: Regression equations for all models

Regression model	Dependent variable	Independent variables	Equation
1	SP	SCC, SCS, INV, IS, IQ, SCD, SCI	$SP = \beta_0 + \beta_1(SCC) + \beta_2(SCS) + \beta_3(INV) + \beta_4(IS) + \beta_5(IQ) + \beta_6(SCD) + \beta_7(SCI)$
2	SCR	SP	$SCR = \beta_0 + \beta_1(SP)$
β_0 is the constant or intercept, and β_{1-3} are the coefficients of the independent variables			
SCC = supply chain collaboration; SCS = supply chain synergies; INV = supply chain innovation; IS = information sharing; IQ = information quality; SCD = supply chain design; SCI = supply chain innovation; SP = supplier performance; SCR = supply chain resilience			

Source: Author's own compilation

An assessment was made regarding the fulfilment of the assumptions of the regression analysis in this study. First, the sample size applied in this study (n=333) was considered adequate, based on the recommendation by Field (2005:620) and Hair *et al.* (2010:98). Second, the data used in this study were notably distributed as indicated through closely aligned standard deviations (refer to

Table 6.17). Third, computations performed regarding the Variance Inflation Factor (VFI) and Tolerance values indicated a limited threat of multicollinearity among the independent variables. If the VFI is greater than 10, then the collinearity of the independent variables is undesirable. On that score concerning the current study, the VFI value for the independent variables was above 2, which is in the acceptable range within the 10.0 upper cut-off point. Moreover, regression tolerance levels above 0.1 are desirable as they indicate that fewer challenges were encountered in multicollinearity. In the present study, the tolerance levels in all two models ranged from 0.1 to nearly 0.5, suggesting that the multicollinearity did not indicate a severe threat amongst the independent variables in the study. Therefore, the assumptions of the regression analysis were not violated in this study.

6.8.1.1 Regression Model 1

The results regarding Regression Model 1 are presented in Table 6.31.

Table 6.31: Regression Model 1

Independent variables: supply chain management practices		Dependent variable: Supplier performance							
		Unstandardised coefficients		Standardised coefficients	Sig.			Collinearity statistics	
		β	Std. error	Beta	t	p	Tolerance	VFI
Regression Model 1	(Constant)	.643	.343		1.873	.062		
	SCC	.225	.059	.217	3.788	.000	.530	1.888
	SCS	-.109	.067	-.097	-1.631	.104	.489	2.046
	INV	.268	.064	.246	4.199	.000	.504	1.986
	IS	-.179	.089	-.144	-2.003	.046	.335	2.987
	IQ	.073	.088	.054	.830	.407	.407	2.457
	SCD	.031	.079	.026	.395	.693	.411	2.434
	SCI	.559	.069	.440	8.129	.000	.591	1.693
R= 0.437; Adjusted R^2 = 0.425; F = 36.103 p<0.05*								

Analysis of Regression Model 1 (Table 6.31) indicates that the influence of SCM practices approximates to 43 percent (Adjusted $R^2 = 0.425$) of the variance of SP in public sector supply chains. The remaining 66 percent of the variance is thus explained through factors that were not considered in this study. The regression matrix indicates that SCC ($\beta = 0.217$; p = 0.000), INV ($\beta = 0.246$; p = 0.000), IQ ($\beta = 0.054$; p = 0.407), SCD ($\beta = 0.026$; p = 0.693), and SCI ($\beta = 0.440$; p = 0.00) contributes positively towards SP. However, SCS ($\beta = -0.097$; p = 0.104) and IS ($\beta = -0.144$; p = 0.046) were statistically insignificant and so did not contribute to SP. The results therefore, demonstrate that effective formulation and implementation of SCM practices (SCC, INV, IQ, SCD, and SCI) leads to SP in public sector supply chains. However, SCS and IS in this case did not influence SP.

6.8.1.2 Regression Model 2

The results regarding Regression Model 2 are presented in Table 6.32.

Table 6.32: Regression Model 2

Independent variable: supplier performance	Dependent variable: supply chain resilience						
	Unstandardised coefficients		Standardised coefficients	Sig.		Collinearity statistics	
	β	Std. error	Beta	t	p	Tolerance	VFI
Construct	3.919	.258		15.172	.000		
SP	.559	.069	.440	8.129	.000	.591	1.693
R= 0.274; Adjusted R^2= 0.072; F= 26.798; p< 0.05*							

Analysis of Regression Model 2 (Table 6.32) revealed that SP (Adjusted R^2 = 0.072) explained approximately 7 percent of the variance in SCR in public sector supply chains. SP (β = 0.440; p= 0.000) further contributed positively towards the resilience of public sector supply chains. This indicates that improved and better SP enhances the public sector supply chains prospects of being resilient.

The results of the regression analysis are generally consistent with those computed through the SEM approach. The differences, in which the regression results are slightly lower than the SEM results, are quite modest and can be disregarded. These differences are due to the fact that SEM is a more robust and complex form of analysis that relies on a good model fit between the data and the theoretical and structural model, providing more valid results. In view of this, the SEM results remain as the primary estimates of the proposed relationships between the latent variables in this study.

6.8.2 HYPOTHESES TEST RESULTS

The results of the hypotheses tests, based on SEM, are reported in Table 6.33.

Table 6.33: Results of structural equation model analysis

Path	Hypothesis	Path coefficient	Significance	Outcome
Supply chain collaboration → Supplier performance	H_1	0.269	***	**Supported and significant**
Supply chain innovation→ Supplier performance	H_2	0.332	***	**Supported and significant**
Information sharing → Supplier performance	H_3	-0.145	.008	**Supported and significant**
Information quality → Supplier performance	H_4	0.074	.184	**Not supported and insignificant**
Supply chain design → Supplier performance	H_5	0.030	.581	**Not supported and insignificant**
Supply chain integration → Supplier performance	H_6	0.534	***	**Supported and significant**
Supply chain synergies → Supplier performance	H_7	-0.100	.062	**Not Supported and insignificant**

Supplier performance → Supply chain resilience	H$_8$	0.375	***	**Supported and significant**
Structural model fits: χ^2/df=2.4; RFI=0.722; IFI=0.841; CFI=0.839; NFI=0.760; TLI=0.831; RMSEA=0.067				
significance level <0.001***				

Source: Author's own computation

As depicted in Table 6.33, eight hypotheses were tested in this study. The table shows that five hypotheses (H$_1$, H$_2$, H$_3$, H$_6$, H$_8$) were accepted whilst three hypotheses (H$_4$, H$_5$, H$_7$) were rejected. The discussion of the stated results is presented in the next section.

6.8.2.1 Discussion of results

This section discusses the results of the hypotheses tests performed in the current study to address the empirical objectives. The study utilised the two main criteria under SEM to validate and confirm each hypothesis. The first criterion included checking the path coefficients which are represented by a beta (β). For a hypothesis to be supported and deemed significant, the path coefficient must be positive or negative (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014:106). The second criterion constitutes the significant influence of the constructs. The significant influence constitutes three levels which are represented by stars also known as p-values. The levels of influence include values with at least three stars (***), which represent p-values less than 0.001, two stars (**) represent p-values less than 0.05, and one star (*) denotes a p-value less than 0.1.

The SEM shows the strength of the relationships that exist between variables, from the independent variables (SCC, INV, IS, IQ, SCD, SCI), the mediating variable SP through the outcome variable SCR. The results of the analysis are presented in Table 6.33 SCC (β= 0.269; p <0.001), INV (β= 0.332; p <0.001) IS (β= -0.145; p=0.008), SCI (β= 0.534; p<0.001) have an influence on SP whereas IQ (β= 0.074; p<0.184), SCD (β= 0.030; p <0.581) and SCS (β= -0.100; p <0.062) showed that they have an insignificant relationship with SP. The results indicate that SP indeed has a relationship with SCR with a path coefficient of (β= 0.375; p<0.001).

Comparing the weights and strength of the factors, the results show that SCI (β= 0.534) exerts more influence on SP preceded by INV which has a coefficient of (β= 0.332), followed by SCC (β= 0.269). IS attained the lowest path coefficient (β= -0.145).

6.8.2.1.1 Results for Hypothesis 1

H$_1$: Supply chain collaboration exerts a significant positive influence on supplier performance in the South African public sector

The results provided through the structural equation modelling analysis supported and accepted the stated hypothesis (H$_1$) that SCC has an influence on SP in the South African public sector. The relationship resulted in a path coefficient of (β= 0.269; ρ< 0.001). This result shows that there is a relationship between SCC and SP. This result illustrates that if SCC is increased, SP increases by a margin of 27 percent. These results also demonstrate that where there is SCC, the performance of suppliers is enhanced. Therefore, the existence of SCC predicts the SP in public sector organisations. The result also demonstrates that SCC is a vital SCM practice since it makes a 26.9 percent positive contribution to the performance of suppliers in public supply chains.

The results of this study suggest the ability of SCC to inspire confidence in suppliers to the public sector to perform better by being committed to relationships with their buying customers. In confirmation of this view, Inayatulla, Narain and Singh (2012:80) state that SCC boosts confidence and builds mutual trust between the two supply chain partners and enhances their performance. Also, the results of the present study infer that SCC has the potential to improve the performance of both the public sector and its supply chain partners. This view is shared in another study by Birungi (2017:7), which acknowledges the importance of collaboration in public sector supply chains towards the performance of both the organisation and its suppliers. Still, the current study points to the significant impact of SCC on actual performance levels of suppliers to the public sector. This impact is in terms of specific factors such as delivery schedules, quality of materials and services provided, and the total cost of ownership. By the same token, Ahimbisibwe, Azdah and Kalekyezi (2019:15) in their study confirmed that there is a positive relationship between buyer-supplier collaboration and supplier delivery performance. The results above are supportive of findings by other scholars like Ryu, Park and Min (2007:1225), and Kim, Shin and Yu

(2019:1137) who established that a link between collaborative initiatives and supply chain partners have a positive effect on SP.

6.8.2.1.2 Results for Hypothesis 2

H$_2$: Supply chain innovation exerts a significant positive influence on supplier performance in the South African public sector

The results of the path analysis indicate that INV influences SP in public sector organisations in South Africa. The results support and accept the stated hypothesis (H$_2$) as indicated in Table 6.33 with a path coefficient of ($\beta = 0.332$; $\rho < 0.01$). The result demonstrates that there is a relationship between INV and SP. This implies that when INV is increased in public sector organisations, there is also an increase in SP with a margin of 33 percent which shows that there is a significant relationship between these variables. The results also indicate that where there is INV the performance of suppliers increases.

The results of this study suggest that INV in public sector organisations enables public procurement systems to be flexible in terms of sourcing, manufacturing, and distribution, thereby providing suppliers an edge to reach their full competences and to excel in their duties. This result is in congruency with a study by Uyarra, Elder, Garcia-Estevez, Georghiou and Yeow (2014:638), which found that public institutions that are flexible and innovation-oriented assist their partners in terms of achieving their mandates as rigid and inflexible systems and ways of operations limit competences. The results of this study also suggest that public sector organisations that pursue all types of innovations such as product innovation, process innovation, and technological innovations increase strategic partnerships with both internal and external stakeholders and enable streamlined interaction with diverse suppliers and clients giving them an edge to perform better. In support of this view, Bianchini, Llerena and Patsali (2019:6) suggest that INV is an important factor in the performance of all organisational partners including suppliers, customers, and competitors. The results of this study also hint that INV in public sector organisations leads to sustainability in cost-saving, revenue generation, customer satisfaction, and strategic partnerships. Supporting evidence by scholars such as Tarigan, Siagian, Sutjianto and Panjaitan (2020:252), and Chepkesis and Keitany (2018:8) highlights that INV capabilities of public organisations enable suppliers to adapt

to market changes, respond to customers and disruptions. Consistently, Amjad, Kamil and Ehsan (2017:585) coined that innovation by suppliers in developing products, markets, knowledge, and new technologies improves SP within the supply chain. Hence INV is an essential factor in increasing SP.

6.8.2.1.3 Results for Hypothesis 3

H₃: Information sharing exerts a significant positive influence on supplier performance in the South African public sector

Regarding the results on (H₃), the study revealed that IS influences SP. However, the results reveal that the relationship between IS and SP is an inverse relationship with a coefficient of (β = -0.145; ρ=0.08). This result implies that if IS increases, the performance of suppliers decreases with a margin of 15 percent which shows that an inverse relationship exists between IS and SP. Hence IS does predict the performance of suppliers in the public sector, albeit negatively.

The negative prediction of SP by IS in this study is an interesting result. It may be an indicator of a lack of trust between public sector organisations and their supply chain partners. In support of this view is a study by Rockson, Owusu-Anane and Sey (2017:30) that concluded that the relationship in most public supply chains is the most common and basic type of buyer-supplier relationship, characterised by very little trust, hence sharing of information is difficult. There are other factors that may have led to the negative result between IS and SP. Bessick (2016:24) highlighted the lack of an information management policy in the South African public sector as one of the hindrances of sharing information in public institutions. In addition, lack of commitment, skills, fear of punishment by managers and lack of information technology capabilities are other factors that hinder the sharing of information in public sector supply chains in developing countries. For instance, some government ministers in Zimbabwe are alleged to lack the technical knowhow of using government portals (Mhlanga, 2018:1), and the trend is consistent in other African countries. Another example is the hacking of the South African parliamentary briefing meeting in 2020 during their online meeting, causing public officials to become skeptical of using information technology innovations in sharing information (Mahlati, 2020:1). Wickramanayake and Jayaratne (2016:159) resonate with Huan, Gaoping and Dan (2017:326),

who stressed the need and importance for IS in enhancing SP though they suggest that the need to share information stems from unsatisfactory SP or inadequate future capabilities.

Contrary to the views above, Squire, Cousins and Brown (2009:461) are of the view that the sharing of information between supply chain partners is vital as it adds value to SP. Zhixiang (2004:29) also posits that IS and communication reduce uncertainties and increase the synchronism of buyer and supplier operations thereby empowering suppliers with the necessary information to perform better. This view is in line with scholars such as Holweg, Disney, Holmstrom and Smaros (2005:170), and Barrat and Oke (2007:1217) who submit that sharing information between buyers and suppliers enables visibility in supplier organisations, which enables them to perform better.

6.8.2.1.4 Results for Hypothesis 4

H$_4$: Information quality exerts a significant positive influence on supplier performance in the South African public sector

Regarding the results for (H$_4$), it was established that IQ does not influence SP. The hypothesis had a path coefficient of (β =0.074; ρ=0.184), which is close to zero, thereby indicating that there is no relationship between IQ and SP. The p value is above 0.01, which denotes that one cannot have confidence in the results. This signifies that the sharing of quality information shared between supply chain partners does not determine or predict the performance of suppliers. The result shows that if IQ increases, SP increases by 7 percent, which is an insignificant margin. Thus, hypothesis (H4) as observed in Table 6.24, was neither supported nor significant.

The results of the study suggest that even if quality information is shared in public sector supply chains it does not impact the performance of suppliers. These results collaborate well with the remarks made by Marinagi, Trivellas and Reklitis (2015:473) who suggested that IQ has no direct and significant relationship on the overall performance of a supply chain. However, results from other studies suggest otherwise as they reflect that a relationship between IQ and SP does exist. For example, Zhixiang (2004:293) found that timeliness, accuracy, and frequency of information transfer enhances coordination and enhances SP. This connects with a study by Zailan and

Rajagopal (2006) that verified that when IQ is maintained, the overall supply chain performance is maintained. Paulraj (2008:423) found that effective information exchange between organisations and their suppliers positively impacts volume and scheduling flexibility, rapid responsiveness, and prompt delivery and also increase mutual trust. Consistently Mafini, Pooe, and Loury-Okoumba (2016:266) assert that effective exchange of up-to-date customer information in all sections of a firm's supply chain unit may enable each node of the chain to better coordinate its strategic actions and respond to customers' orders more effectively.

The results of this study indicate that IQ has no influence on SP in public supply chains. The reasons may be a lack of trust and confidentiality issues between public sector organisations and their suppliers. Another factor that may lead to public sector organisations not sharing quality information may be a lack of proper infrastructure for communication between buyer and supplier organisations. After all, even the sharing of information has a negative impact on SP, as shown when testing for H3. This implies that the results regarding IQ also resonate with the results regarding IS and SP.

6.8.2.1.5 Results for Hypothesis 5

H5: Supply chain design exerts a significant positive influence on supplier performance in the South Africa public sector

The results of the analysis reveal that the hypothesis, SCD influences SP, was not supported and found to be insignificant. The result showed that there is no relationship between SCD and SP, which is indicated by a path coefficient of (β =0.030; ρ=0.581). This result demonstrates that SCD does not predict the performance of suppliers in public sector supply chains. The results also indicate that if SCD increases in public sector organisations SP increases by a marginal 3 percent, which is almost negligible.

As indicated in Table 6.24, the results of this study did not support the hypothesis that SCD influences SP. Contrary to the results found in this study, studies by other scholars suggest the opposite. A study by Stuijts, Waterman and Schreijen (2008:1) found that lack of well-structured execution of strategic procurement processes in public institutions influences the performance of

supply chains. This infers that a lack of SCD in public sector organisations hinders supply chain partners from executing their duties as expected. A study by Chepkesis and Keitany (2018:7), refutes the results attained in this study as it suggests that properly designed procurement activities and planning enhance supplier's performance in service delivery. Another study by Amann, Roehrich, Essig and Harland (2014:355) indicates that a properly designed supply chain allows organisations to engage their suppliers in service delivery.

The results of this study propose that the design of public sector supply chains is of little importance in enhancing the performance of suppliers. These results may be attributed to the lack of planning the design in supply chains. Effective SCD is achieved through the expertise of skilled SCM professionals who understand the intricacies involved in the network design process. However, such expertise may be in short supply in South Africa, where there is a shortage of qualified SCM professionals (Ngobese, 2020:4) who can develop proper designs and architecture for their supply chains. It is possible then that necessary considerations within the SCD process, such as strategic network designs, the size, and locations of suppliers in public supply chains do not received adequate attention, resulting in deficiencies in the impact of SCD on SP. Such a lack of a properly aligned and functional SCD process can lead to a dysfunctional supply chain when it comes to achieving goals for growth and profits (Badenhorst-Weiss, 2010:200). Hence, in such a state, SCD has been ineffective in promoting the performance of public supply chains in South Africa.

6.8.2.1.6 Results for Hypothesis 6

H$_6$: Supply chain integration exerts a significant positive influence on supplier performance in the South African public sector

The results of the study through the path analysis reveal that SCI exerts a positive and significant influence on SP. Hypothesis 6 was therefore accepted due to the strong and positive relationship ($\beta = 0.534$; $\rho < 0.01$) that was found between the two constructs. The results as shown in Table 6.24 demonstrate that if SCI increases, SP, in turn, increases by 53 percent. This shows that a relationship exists between the two variables. The result also reveals that where there is SCI in public sector organisations, the performance of suppliers is enhanced. The result of this study

indicates that SCI is the leading driver of SP in the public sector in South Africa. Therefore, SCI predicts SP.

The results of this study suggest that SCI improves logistical performances in public sector supply chains. The results presented above are in alignment with Salema and Buvik's (2016:166) suggestion that early supplier integration improves supplier logistical performance. The results of this study also infer that SCI enables public sector organisations and its supply chain partners to commit to each other and increase efforts of cooperation. This is in line with the views made by Prahinski and Benton (2004:39), and Vivek, Sen, Savitskie, Ranganathan and Ravindran (2011:18) who opine that SCI leads supply chain partners to commit through communication and increased efforts of cooperation, which enables suppliers to improve their performance as they will be involved in the process. Moreover, the results of this study reveal that SCI increases visibility, flexibility, and causes supply chain partners to work together in reducing cost, sharing and mitigating the risks faced in businesses.   Msimangira (2010:179) made similar remarks by suggesting that SCI is a strong determinant for SP as it brings benefits such as flexibility, risk-sharing, and cost reduction in business. The results of the study also suggest that SCI increases supplier trust and enables them to be innovative in their operations. This is further highlighted by Tarigan *et al*. (2020:238) who argue that buyer-supplier integration is positively linked with SP as it increases supplier trust and innovativeness. In addition, Huang, Yen and Lui (2014:63) found that SCI has a significant positive effect on SP. This makes it evident that SCI and SP are positively linked together in a significant relationship.

6.8.2.1.7 Results for Hypothesis 7

H7: Supply chain synergies exert a significant positive influence on supplier performance in the South African public sector

The results in Table 6.24 reveal that a negative influence exists between SCS and SP. The result (β= -0.100; ρ=0.062) shows that there is no relationship between SCS and SP. Therefore, the hypothesis (H8) that SCS influences SP was rejected and not supported. The result demonstrates that the existence of SCS in public sector organisations does not predict SP. As indicated in Table

6.24, if SCS has increased, SP on the other hand decreases by -10 percent, which is an insignificant margin to be considered in determining a meaningful relationship.

It is interesting to note that evidence from previous studies suggests results that are contrary to those that were found in this present study. Previous studies suggest that there is a significant relationship between SCS and SP. Pooe, Mafini and Loury-Okoumba (2013:7) submit there is a positive and significant relationship between SCS and SP. Consistently, scholars such as Duffy and Fearne (2004:57) and Cao and Zhang (2011:175) concluded that synergistic collaborative initiatives have a positive bearing on the performance of suppliers. In agreement, Sheu Yen and Chae (2006:24) and Rockson *et al.* (2017:27) highlight that synergistic activities constitute one of the methods of ensuring that enterprises and their suppliers are moving in the same direction and enable them to achieve a required level of productivity and competitiveness. Another study by Parker, Zsidisin and Ragatz (2009:71) also suggests that suppliers' willingness to engage in synergistic-driven relationships has been described as effective in increasing their overall performance in terms of innovative capabilities and strategies.

The current study rejects the hypothesis that SCS has an influence on SP. The lack of a meaningful relationship may be a result of the absence of trust and commitment between public sector organisations and their suppliers. SCS cannot be found where trust and commitment do not exist between partner organisations. The results of this study may also be a manifestation of the fear to commit to a relationship between supplier organisations and public sector institutions. Also, other factors such as fear of changing organisational strategies and means of operation, organisational culture, and the lack of sharing knowledge and information repel public sector institutions from engaging in supply chain synergies with their suppliers.

6.8.2.1.8 Results for Hypothesis 8

H₈: Supplier performance exerts a significant positive influence on supply chain resilience in the South African public sector

The results of the analysis revealed that SP has a significant influence on SCR. This was shown by a strong positive path coefficient of ($\beta = 0.375$; $\rho < 0.01$), which exhibits that a relationship

exists between SP and SCR. Therefore, H7 was supported and significant. This result illustrates that if SP is increased in public sector supply chains, SCR, on the other hand, increases by a margin of 37 percent, which provides public sector organisations with an edge to revert to the original position of operation after a disruption. This indicates that there is a relationship between SP and SCR. The results of the study also reveal that where there is SP, public sector organisations' ability to be resilient is enhanced. Therefore, it can be concluded that SP improves the SCR of public sector organisations in South Africa.

The results of this study suggest that superior performance and high-quality provision by suppliers positively impacts on public sector organisations in managing risks and disruptions. This result confirms the view of Yeboah, Feng, Daniel and Joseph (2014:40), who submit that efficient logistical performance of suppliers and supplier quality impacts positively the performance of organisations in managing risks and disruptions. The results of this study also infer that the ability of public sector organisations to bounce back to full-scale operation after disruptions highly depends on the performance of its suppliers. This view is also shared by Gu and Huo (2017:162), who assert that the resilience of an organisation depends highly on the resilience of both its suppliers and customers. This view is also shared by several other scholars (Namdar, Li, Sawhney & Pradhan, 2017:2339; Shishodia, Verma & Dixit, 2019:465) who noted that the success of supply chains revolves around a sound and effective supply base. Christopher and Peck (2004:12) share the same sentiments as they report that no organisation is an island even the most carefully controlled processes are still only as good as the links and nodes that support them are lively. Thus, for organisations to survive they need their partners for their operations. Therefore, the performance of suppliers propels organisations to excel in their operatives.

The next section discusses the link between the results of the study and the research theory.

6.9 THE LINK BETWEEN THE RESULTS OF THE STUDY TO THE INSTITUTIONAL THEORY

This section discusses the linkage of the results of this study to the research theory, which is the Institutional theory. The Institutional theory was discussed in detail in Chapters One and Three.

As mentioned previously in these chapters, the theory is believed to have emerged in the 1970s and it aims to examine how external pressures influence organisations to adopt certain practices. At the core of the theory are two variants, namely, sociological and economic variables that influence organisational behaviour and culture (Kauppi, 2013:1119). The sociological variant suggests that those organisations are driven by legitimacy motives whereas the economic variant perceives organisations as economically motivated and driven by economic efficiency (DiMaggio & Powell, 1983:147; Suchmann, 1995:571; Rogers, Purdy, Safayen & Duimering, 2007:556; Rezaee, 2017:71). To achieve legitimacy and economic efficiency is the hypothesis of institutional isomorphism which predicts that firms operating in the same fields tend to have the same practices and structure for them to survive. According to the Institutional theory, the structure of organisations is influenced by sameness pressures, namely mimetic, which compel organisations to imitate strategies employed by others as a hedge against uncertainty about their relative efficiency, normative pressures, which include values and expectations that encourage the use of certain practices, and coercive pressures, as in regulatory constraints from stakeholders to force organisations to adapt and behave in a certain manner.

In this study, it was found that since the adoption and implementation of SCM as a means of improving the shortfalls in the public procurement system, much has not been achieved. Therefore, this study proposed that like in the private sector, public sector organisations should further adopt and implement SCM practices to increase their efficiency, effectiveness, and increase value for money to their customers. As the institutional theory proposes, the public sector needs to mimic private sector organisations, coerced through policies and regulations, or encouraged to adopt and implement SCM practices as normative values to increase their performance as well as resiliency in the everchanging environment.

In this study, it was found that SCC (β= 0.269; ρ< 0.001), INV (β = 0.332; ρ < 0.01), and SCI (β = 0.534; ρ <0.01) influence SP. This result is in line with the Institutional theory in the sense that the relationships between external (institutional) pressures drive the other parts to adopt or mimic the best practices that can lead to the cultivation of the relationship. Effective collaboration, innovation and integration between public sector organisations and their suppliers lead to organisational sustainability and exert pressure for them to adopt and institutionalise certain

practices that influence their performance. This is in line with the institutional theory view, which states that social/environmental initiatives and corporate measures ultimately reach a level of legitimisation and best practice whereby failure to adopt them is considered irresponsible and irrational (Rezaee, Tsui, Cheng & Zhou, 2019:31).

The results of the analysis confirmed the existence of a relationship between IS and SP. The results indicate that IS inversely influences the performance of suppliers ($\beta = -0.145$; $\rho < 0.01$). Though the relationship was confirmed, the relationship is weak and negative, and this can be attributed to lack of proper IS structures in public sector organisations. This resonates with the view of Bessick (2016:24), who maintains that the lack of an information management policy in public sector organisations militates against the sharing of information. The Institutional theory view which seeks to explain organisational communication in terms of shared pre-existing rules, beliefs, and norms in the external environment of the organisation, is thus satisfied in this manner.

The results of the study indicate that SP influences SCR. As highlighted by Namdar *et al*. (2017:2339), the ability of supply chains to revert to normality revolves highly on sound and effective supply base. In line with the Institutional theory, relationship pressures between organisations, (which suggests organisational pressure), serve to contribute to how they react to different operational contexts. Therefore, the involvement of public sector organisations and suppliers equips and enables them to respond quickly to disruptions.

In addition to the above, the study also confirms that social structures such as SCS and SCD, as well as IQ, do not affect and influence how suppliers perform if they are not instituted in public supply chains. These activities are marked with pressures of uncertainty that strike organisations if they partner with other organisations. In line with this, Kelling, Sauer, Gold, and Seuring (2020:2) submit that factors such as lack of trust, fear to commit, fear of changing organisational culture and new ways of operation hamper organisation to form mergers and share quality information. To overcome uncertainty pressures, the institutional theory suggests that organisations need to be coerced into mimicking and adopting the normative values that enable them to work fully with their partners.

Given the above discussion of the results of the study, it can be concluded that these findings are in line with the Institutional theory. The results of the study suggest that the adoption and implementation of SCM practices such as SCC, INV, IS, and SCI in public supply chains influences SP and public SCR. The study also revealed that practices such as IQ, SCS, and SCD do not influence the performance of suppliers in public supply chains.

6.10 CHAPTER SUMMARY

Chapter Six provided insights into all the activities related to the collection of data and its analysis as presented in Chapter Five. Subjects addressed in this chapter include the response rate, descriptive analysis of the results, inferential statistics of the collected data where the CFA was used to establish the reliability and validity of the data and structural equation modelling (SEM) was used to assess the relationship between the variables. Descriptive analysis weighed up the demographic profile of the respondents and their organisations. It also explored the mean scores and standard deviation of the constructs to show the averages of the responses on the constructs. The descriptive analysis also showed the skewness and kurtosis to highlight the distribution of data.

The results of the mean scores indicated that most of the responses leaned towards the agree side of the scale. After the descriptive statistics, the collected data was subjected to the EFA procedure to test the factor structure. A new construct, named SCS was extracted in this process, with the rest of the variables being unidimensional. Lastly, the SEM procedure was also employed to assess the psychometric properties of the constructs and examine the hypotheses dependencies, where five hypotheses were supported and accepted whilst three were unsupported. Those relationships that went unsupported include SP and three predictors, namely, SCS, IQ and SCD. The next chapter focuses on the conclusions and recommendations of the study.

CHAPTER 7

CONCLUSIONS, RECOMMENDATIONS, LIMITATIONS AND IMPLICATIONS FOR FUTURE RESEARCH

7.1 CHAPTER OVERVIEW

This chapter aims to provide a final analysis of the study. The chapter first provides an overview of the whole study. Secondly, it provides conclusions to each theoretical objective set for the study. The third purpose is to present conclusions based on empirical objectives. The chapter also presents recommendations that can be adopted by public sector organisations to increase the influence of SCM practices on SP and SCR. Moreover, the chapter explores both theoretical and practical contributions to the study. Subsequently, it outlines the limitations, suggestions for further studies, and the overall conclusion of the study.

7.2 REVIEW OF THE STUDY

The main aim of this study was to examine the relationship between SCM practices, SP, and SCR in the South African public sector. The thesis developed from the study is divided into seven chapters. The first chapter was divided into nine sections that discussed the introduction, background to the study, outlined the problem statement, research objectives, a summary of research hypotheses, the research model, a brief discussion of the research hypotheses, a brief research methodology, statistical analysis, ethical considerations, definition of terms and chapter outline.

The second chapter of the study which reviewed the literature on the history of public SCM in South Africa was divided into eight sections. The first section discussed the introduction of the chapter, the second section reviewed the literature on public SCM in South Africa before 1994. This was preceded by the third section which reviewed the literature on public SCM after 1994 when South Africa attained its independence. The fourth section reviewed the literature on the development of public SCM after 1994 whereas section five reviewed literature on the legislative

framework for public SCM in South Africa. Section Six reviewed the literature on the achievements and successes of public SCM in South Africa. Section Seven discussed the challenges in public SCM in South Africa while Section Eight discussed the conclusion of the chapter.

The third chapter which reviewed the literature on SCM practices was divided into twelve sections. Section One covered the introduction to the chapter while Section Two revealed literature on the research theory utilised in this study. Section Three of the chapter discussed the conceptualisation of SCM practices. Section Four reviewed the literature on the antecedents and benefits of SCC as a practice. Section Five discussed the drivers (antecedents), and the benefits of INV as an SCM practice. Section Six reviewed the literature on IS as a practice. The section analysed the drivers to IS and the benefits of implementing IS as a practice in the public supply chain. More so, Section Seven reviewed literature on IQ as an SCM practice. The section discussed literature concerning the factors influencing (antecedents), and benefits of IQ in public sector supply chains. Section Eight reviewed the literature on the factors influencing and benefits of SCD in public sector supply chains. Section Nine discussed literature on the antecedents to and benefits of SCI as an SCM practice in public supply chains. Section Ten reviewed literature on SCM practices that are in the South African public sector supply chain while Section Eleven discussed the conclusion of the chapter.

Chapter Four, which discussed the conceptual framework and hypothesis formulation was divided into six sections. Section One discussed the introduction of the chapter. Section Two reviewed the literature on the antecedents to and the benefits of managing SP. Section Three discussed literature on the drivers and the benefits of SCR in public supply chains. Section Four outlined the conceptual framework of the study, while Section Five focused on hypothesis development and Section Six discussed the conclusion of the chapter.

In the fifth chapter (Chapter Five), the methodology employed in this study was discussed in great depth. The chapter was divided into fourteen sections, in which the first section discussed the introduction while the second section discussed the models of reasoning that influence research studies. The second section also highlighted the reasoning model that was employed in this study.

The third section of the chapter discussed research paradigms that influence research on the type of methodology used in collecting research data. The fourth section focused on the research approach whereas the fifth section discussed the time horizons (dimension) that was adopted in this present study. The sixth section discussed the research design of the study while Section Seven discussed the research strategy that was adopted. Section Eight of the chapter focused on the appraisal of the previous literature review chapters. Section Nine of the chapter discussed the empirical part of the methodology that constitutes the sampling design, sampling techniques, research population, sample size, and sampling frame. The tenth section discussed the procedures that were to be used for data collection and research instruments whereas Section Eleven of the chapter focused on discussing data analysis and statistical approaches. Furthermore, Section Twelve discussed the methods of reliability and validity whilst Section Thirteen divulged the ethical considerations. Lastly, Section Fourteen presented the chapter summary.

Chapter Six of the study, which focused on data analysis and interpretation was divided into nine sections. The first section discussed the introduction of the study whilst the second section focused on calculating the response rate of the study. The third section of the study divulged the descriptive analysis of respondents and their organisations. The fourth section focused on testing whether the data collected was factorable and if it was well distributed. This was realised through the exploratory factor analysis and the skewness and kurtosis test. Section Five of the chapter discussed the descriptive statistics of the research constructs whereas Section Six of the chapter focused on discussing the inferential statistics and testing of construct relationships through the confirmatory analysis. This section also discussed the reliability and validity of the test and the model fit of the study. Section Seven focused on discussing the path analysis results, regression analysis, and hypothesis test results. Section Eight of the study discussed the link between the research theory and the results of the study while Section Nine of the chapter presents the summary and conclusion of the chapter.

The seventh chapter is the final episode of the study and discusses the conclusion and recommendations. Chapter Seven is divided into seven sections in which the first section provides the introduction of the chapter. The second section presents the review of the study whereas the third section focuses on presenting conclusions based on the theoretical objectives of the study.

The fourth section presents conclusions based on empirical objectives whilst the fifth section presents the recommendations. Section Six of the chapter presents the contributions of the study and lastly, Section Seven presents the limitations of the study.

7.3 CONCLUSIONS BASED ON THE THEORETICAL OBJECTIVES

This section discusses the conclusions based on the theoretical objectives of the study. As indicated in Chapter One (refer to Section 1.3), the following theoretical objectives were set for the study:

i. to conduct a literature review on SCM in the public sector;

ii. to conceptualise SCM practices, namely, supply chain collaboration, supply chain innovation, information sharing, information quality, supply chain design and supply chain integration from literature;

iii. to review the literature on the institutional theory;

iv. to explore the literature on supplier performance; and

v. to analyse literature on supply chain resilience.

7.3.1 Conclusions based on the literature review of supply chain management in the South African public sector

The first theoretical objective focused on conducting a literature review on SCM in the South African public sector. This objective was achieved in the second chapter of the current thesis. The review acknowledges the importance of SCM as an initiative intended to address the needs of public sector procurement shortfalls and to ensure fiscal prudence in all procurement activities. The review also pointed to the imbalance of the procurement system that was discriminatory and favoured only the minority. In addition, it sheds light on the transitions made by the country soon after attaining its independence in 1994, in transforming and modifying the procurement policy in terms of implementation and regulation that sought to address social imbalances. Apart from addressing the social imbalances of the past, the chapter also stresses that SCM in the South African public sector is aimed at ensuring fiscal prudence and making sure that public funds are

efficiently and effectively used in providing service delivery by promoting transparency and accountability as well as terming out corrupt activities by public officials.

From the literature review, it also emerged that public SCM in South Africa is guided by an avalanche of legislation that ensures that the implementation and performance are improved. The literature review further indicated that there are notable successful achievements that have been seen since the adoption and implementation of SCM in the South African public sector. Such achievements include the establishment of the office of the chief procurement officer, improved inventory management, and the launching of a central database and a central e-tender portal. In this chapter, it has also emerged that public SCM is hindered from performing satisfactorily by a myriad of challenges. Two of the major challenges are a lack of human capital with SCM skills and a lack of understanding of the concept of SCM within the public sector supply chain. In addition, non-compliance with policies and regulations, inadequate measures for monitoring and evaluation as well as rampant corruption, fraud, and lack of accountability emerged as significant challenges. The study acknowledges that the objectives of the South African public supply chain can be realised if the challenges hindering its performance are addressed. Given all this, it is clear that the public sector in South Africa is aware of its mandate and expectations by its citizens regarding the implementation and performance.

7.3.2 Conclusions based on supply chain management practices under consideration

The second theoretical objective of this study focused on reviewing the literature on the conceptualisation of SCM practices. This objective was addressed in the third chapter of the current thesis. The chapter reviewed the literature on the nature of SCM, the antecedents that drive the practices, and the benefits associated with implanting the SCM practices in the public sector. The SCM practices under consideration in this study include SCC, INV, IS, IQ, SCD, SCI and SCS.

In the literature review, it was indicated that SCM practices include all operational functions or activities that are aimed at improving the effectiveness and efficiency management of organisations and their supply chains. It pointed out that SCM practices consider the internal

processes of an organisation and link them with the external operations of members in the entire supply chain. Also, the literature review on the aforementioned SCM practices indicated that their implementation in the public supply chain is aimed at enhancing performance throughout the supply chain by integrating both internal cross-functional activities and external integration with suppliers and customers.

Regarding SCC, the literature review revealed that it concerns the partnering of two or more supply chain members in working together to create a competitive advantage and to satisfy their customer needs. From the literature review, it has emerged that SCC activities are influenced by both internal and external forces such as product characteristics, market characteristics, relationship characteristics, information and technology characteristics, to mention a few. It has also emerged that collaborating with other organisations accrues benefits such as timely replenishment and inventory reduction as well as cost reduction.

Concerning INV, the literature stressed that innovation in supply chains is imperative and it is a multi-dimensional construct, incorporating production, process, and technological innovation. Furthermore, the literature review indicated that INV is associated with various benefits such as the enhancement of product quality, improved service delivery, and efficient supply of goods. This section also revealed that factors such as market domain and technological development act as drivers to INV.

Regarding IS, it was shown that there are various types of information that propel organisations and supply chains to success. From the literature, it was affirmed that IS is essential and plays a significant role in both public organisations and the entire supply chain. It was also established that factors such as technologies, trust, and commitment, among others, spur organisations on to share information in the supply chain.

Moreover, from the literature review, it was established that supply chains owe their success to the quality of information shared. Therefore, IQ has emerged as one of the most significant SCM practices that need to be implemented in all supply chains. It was established that IQ, apart from

increasing competitive advantage, enables organisations to reduce uncertainty and improves proper planning. Thus, it plays a critical role in the effectiveness of supply chains.

Concerning SCD as a management practice, the study revealed that the supply chain structure and design play an imperative role in the performance of supply chains. It also emerged that SCD is influenced by various drivers, ranging from customer-related drivers, market-related, and organisational-related drivers. Additionally, the study established that if implemented effectively in supply chains, it results in benefits such as improved performance, improved responsiveness to customer needs, and flexibility of operations in supply chains.

From the study, it further emerged that the practice of SCI can be divided into four multifaceted activities, namely, supplier integration, customer integration, internal integration, and information integration. It also appeared that most integrations in supply chains are influenced by drivers such as social interactions, mutual adaptations, and information and communication technology developments. Moreover, factors such as trust, commitment, and mutuality were identified as the factors influencing SCI. The literature further clarified that SCI, if implemented effectively in supply chains is associated with many benefits. Examples include rapid access to required information, increased market share, and customer satisfaction, to mention a few.

Moreover, from the literature review, it has emerged that in the South African public sector supply chain, various SCM practices have been implemented. Such practices include information sharing, strategic supplier relationship management, strategic sourcing, and just-in-time delivery systems to mention a few. Considering the above information, it can be concluded that it is imperative for the South African public sector to adopt and implement SCM practices in order to enjoy the numerous benefits linked to such practices as they lead to improved service delivery.

7.3.3 Conclusions based on the literature review of the institutional theory

The third theoretical objective was intended to review literature on the institutional theory. This objective was addressed in the third chapter of the current thesis. The literature stressed that for organisations to prosper, they must adopt and institutionalise certain best practices from the

environment that surrounds them. Organisations do not operate in isolation and owe their success to the influence of other entities within their environment. It was established that at the core of the institutional theory are two variables, namely, sociological and economic variables that influence organisational actions. Also, it was determined that organisations operating in the same environment tend to have similar practices and the structure of organisations is influenced by equivalent forces such as mimetic and coercive pressures. The literature further noted that for public organisations and their supply chains to be effective and efficient in their mandate, they must mimic the best practices from the private sector or be coerced to adopt them through various pieces of legislation. It is therefore concluded that it is essential for public sector supply chains in South Africa to adopt, adapt to, and implement SCM practices to improve service delivery and ensure fiscal prudence in procurement activities, in line with the tenets of the institutional theory.

7.3.4 Conclusions based on the literature review of supplier performance

The fourth theoretical objective focused on exploring the literature on SP. This objective was achieved in the fourth chapter of the current thesis. The literature revealed that SP pertains to how well a supplier provides the required products to the buyer. The study revealed that for organisations to succeed and achieve their intended goals, it is critical to have vibrant and well-performing suppliers. The literature review also revealed that SP is triggered and influenced by certain activities and initiatives such as information sharing, institutional trust, exchange of quality up-to-date information as well as willingness to collaborate. Besides, from the literature it became clear that measuring the performance of suppliers results in paybacks such as reducing order cycle times and inventory, uncovering and removing hidden costs and reducing risks. It is therefore concluded that it is essential for public sector organisations to measure and keep abreast with the performance of their suppliers to ascertain if the latter can continue to fulfil their essential roles within their supply chains.

7.3.5 Conclusions based on the literature review of supply chain resilience

The fifth theoretical objective was intended to analyse literature on SCR. This objective was addressed in the fourth chapter of the current thesis. From the study, it emerged that SCR has

ultimately become predominant in the supply chain domain because of increased disruptions. It has been conceptualised as the ability of the organisation or supply chain to absorb changes, adapt, recover, and return to the original state after disruptions. From the literature review, it was also established that organisations, in dealing with disruptions can either be reactive or proactive. Factors such as flexibility, visibility, information sharing, velocity, and trust emerged as primary influencers of resilience in supply chains and organisations. The literature review further established that SCR leads to beneficial outcomes such as improved service delivery, cost-reduction, risk avoidance, and a quick bounce back to full-scale operation after disruptions. Therefore, SCR is a vital practice in SCM as it enables organisations to cope with the various dynamics and disruptions within the environment.

The next section provides the conclusions based on the empirical objectives of the study.

7.4 CONCLUSIONS BASED ON EMPIRICAL OBJECTIVES

This section discusses the conclusions based on the empirical objectives of the current study. As indicated in Chapter One (refer to Section 1.3), the following empirical objectives were set for the study:

  i.   to determine the perceptions of SCM professionals towards the implementation of SCM practices in the South African public sector.
  ii.   to explore the perceptions of SCM professionals towards the levels of SP in the South African public sector.
  iii. to explore the perceptions of SCM professionals towards the degree of SCR in the South African public sector.
  iv.   to determine the influence of SCM practices on SP in the south African public sector.
  v.   to establish the relationship between SP and SCR in the South African public sector; and
  vi.   to develop a model for managing SCM practices, SP and SCR in the South African public sector.

7.4.1 Conclusions regarding perceptions of supply chain management professionals towards the implementation of supply chain management practices in the South African public sector

The first empirical objective was aimed at determining the perceptions of SCM professionals towards the implementation of SCM practices in the South African public sector. To achieve this objective, descriptive statistics in the form of minimum and maximum values, mean scores, and the standard deviation were applied to each construct and the results were then analysed.

7.4.1.1 Perceptions regarding supply chain collaboration

Regarding SCC, SCM professionals in the South African public sector perceived that there are satisfactory levels of SCC in both public sector organisations and their supply chain partners. SCM professionals indicated that public sector organisations in their collaborations, jointly develop strategic objectives with their supply chain partners and have been able to monitor the performance of their suppliers besides utilising the information in their future businesses. They further confirmed that the relationships between public sector organisations and their supply chain partners are governed by principles of shared rewards and risks. Therefore, this study concludes that the South African public sector has applied meaningful efforts towards implementing supply chain collaborative initiatives with its supply chain partners.

7.4.1.2 Perceptions regarding supply chain synergies

Concerning the practice of SCS, SCM professionals accepted that synergistic activities and initiatives exist between their organisations and their suppliers. Besides, the SCM professionals perceived that public sector organisations and their supply chain members have a culture of sharing value-added resources and cross-functional processes to improve their business operations. They further confirmed that public sector organisations have joint decision-making activities with their suppliers which aids them in maintaining their relationships. Given all these views, the study concludes that the South African public sector has demonstrated an ability to develop, implement

and maintain synergistic relationships with its supply chain partners to improve the efficiency and effectiveness of service delivery.

7.4.1.3 Perceptions regarding supply chain innovation

With regards to INV, SCM professionals perceived that there are decent levels of innovation in the South African public sector's supply chains. They further acknowledged that public sector organisations are constantly experimenting with new ideas and pursuing continuous innovations in their core processes. Furthermore, SCM professionals confirmed that public sector organisations and their supply chain partners have been able to focus on process innovations which allow them to work effectively and efficiently. Also, they substantiated that public sector organisations are pursuing new technological innovations. In light of the above information, this study concludes that public sector organisations in South Africa have developed innovative capabilities from which various desirable outcomes may be realised if utilised fully.

7.4.1.4 Perceptions regarding information sharing

Regarding IS, SCM professionals in the South African public sector perceived that meaningful levels of IS exist between the public sector and its supply chain partners. From the results, it emerged that public organisations believe that sharing information with supply chain partners is a critical activity. Besides, the SCM profession affirmed that managers from departments across public sector organisations are expected to share proprietary, confidential information with other internal and external stakeholders. They further indicated that public sector organisations and their partners inform each other in advance of changing needs and events that may affect them. The study therefore concludes that public sector organisations in South Africa have demonstrated reasonable levels of IS, which enables them to meet their mandates and improve service delivery.

7.4.1.5 Perceptions regarding information quality

With regards to IQ, SCM professionals perceived that quality information is exchanged between public organisations and their supply chains. Specifically, they confirmed that public sector

organisations and their supply chain partners exchange adequate, up-to-date, timely, reliable and accurate information. Moreover, SCM professionals feel that the quality of the exchanged information with their key supply chain partners adds value to their organisational requirements. However, they additionally revealed that factors such as a lack of commitment and trust militate against the exchange of quality information between them and their partners. The study thus concludes that it is critical for public sector organisations and their supply chain partners to develop and implement interventions for improving the quality of information and overcoming the challenges hindering them from exchanging high-quality information.

7.4.1.6 Perceptions regarding supply chain design

Concerning SCD, SCM professionals professed that the public supply chain in South Africa is well designed to support its operations. They perceived that both the number of suppliers and their capacities are sufficient to handle any possible needs from their customers. They further indicated that supplier selection criteria are well defined and proximity to suppliers is an important consideration to their organisations. The study additionally revealed that SCM professionals feel that distribution channels in their supply chains can sufficiently serve both the current and potential service delivery areas. Also, they confirmed that logistical activities between them and their suppliers are well-coordinated to minimise problems in service delivery. Accordingly, this study concludes that SCDs in the South African public sector are well-coordinated and supported by existing robust frameworks, and it is imperative for the public sector to improve SCD efforts by carefully considering and utilising all the frameworks available to them.

7.4.1.7 Perceptions regarding supply chain integration

Regarding SCI, SCM professionals in the South African public sector perceived that the public sector supply chain is strongly and effectively integrated with those of their business partners. From the study, it was revealed that public sector organisations and their supply chain partners create compatible communication and information systems. SCM professionals also professed that public sector organisations participate in the sourcing decisions of their suppliers. They further affirmed that the public organisations extended their supply chains beyond their suppliers and

clients and made agreements with some suppliers and clients to share risks. They also indicated that the upstream and downstream integration with supply chain members has increased the flexibility of public organisations' operations. Moreso, public organisations have in place compensation and motivation mechanisms that consist of factors that promote integration, which add value to the performance of public organisations. Under these circumstances, this study concludes that the public supply chain in South Africa is well integrated and is more flexible.

7.4.2 Conclusions regarding perceptions of supply chain management professionals towards the levels of supplier performance in the South African public sector

Concerning SP, SCM professionals perceived that there are acceptable and sound levels of SP in the public supply chains in South Africa. They professed that their suppliers have been able to provide them with the best prices given the quality of the items and services purchased. They also indicated that their suppliers always make attempts to reduce the time between order receipts and delivery and they can meet anticipated delivery dates and quantities constantly. Additionally, they affirmed that their suppliers have the capacity to provide high-quality products and services. From the study, it further emerged that proper planning and evaluation of commitment to quality, financial capacity, and competence should be ascertained before a contract is awarded as these are crucial in the performance of suppliers. In light of this, this study concludes that the levels of SP in the South African public sector are commendable though they need to continually evaluate the performance of their suppliers.

7.4.3 Conclusions regarding perceptions of supply chain management professionals towards the degree of supply chain resilience in the South African public sector

With reference to SCR, SCM professionals perceived that public supply chains in the South African public sector possess the resilience required to adapt and react to disruptive circumstances. They affirmed that their supply chains possess abilities to quickly return to the original state after being disrupted. They further indicated that public supply chains in South Africa possess the ability to move to a new or more desirable state after being disrupted. They professed that public supply chains in South Africa are well prepared to deal with the financial outcomes of supply chain

disruptions. However, the study also revealed that the concept of resilience is still new and needs to be incorporated fully into official policies and practices that guide public sector organisations. In light of these results, it is evident that the public sector organisations in South Africa possess the necessary capabilities that they require to be proactive and reactive to disruptions that can affect their operations.

7.4.4 Conclusions regarding the influence of supply chain management practices on supplier performance in the South African public sector

The fourth empirical objective focused on determining the influence of SCM practices on SP in the South African public sector. This objective was addressed by analysing SEM results to test the hypothesised relationships between the seven SCM practices under consideration, namely, SCC, SCS, INV, IS, IQ, SCD, SCI and SP.

7.4.4.1 Conclusions Regarding the influence of supply chain collaboration on supplier performance

The first hypothesis (H$_1$) sought to investigate the influence of SCC on SP in the South African public sector. The results of the study indicate that SCC influences SP and the relationship is significant and positive ($\beta = 0.269$). This result demonstrates that SCC is one of the predictors of SP in public sector supply chains. This leads to the conclusion that effective and increased collaborative initiatives between the public sector and its supply chain partners in supply chains increases the performance of suppliers. Also, SCC is one of the enablers of SP in the South African public sector.

7.4.4.2 Conclusions regarding the influence of supply chain innovation on supplier performance

Regarding the second hypothesis (H$_2$), the results of the study indicate that a relationship exists between INV and SP. The results demonstrated that INV significantly and positively influences SP ($\beta = 0.332$). This then leads to the conclusion that INV is a predictor for SP and that innovative

processes and outcomes such as information and technological innovations lead to flexibility and enhanced SP. The results also lead to the conclusion that innovation is an essential factor in the performance of all organisational aspects including that of suppliers.

7.4.4.3 Conclusions regarding the influence of information sharing on supplier performance

Concerning the third hypothesis (H$_3$), pointing to the influence of IS towards the performance of suppliers in the supply chains in the South African public sector, interesting results were realised. The study reveals that IS exerts a significant negative influence on the performance of suppliers which implies that if IS increases, SP decreases, and vice versa (β = -0.145). Interestingly these results are contrary to the information revealed in the review of literature in Chapter Three where IS is presented as one of the practices critical in adding value to the performance of suppliers and leads to improved relationships in the supply chain. Considering the results of the study, it is concluded that the performance of suppliers in the South African public sector is inversely proportional to the amount of information shared with other supply chain partners.

7.4.4.4 Conclusions regarding the influence of information quality on supplier performance

With reference to the fourth hypothesis (H$_4$), which stressed the influence of IQ on SP, the results of the study revealed that there is no relationship between IQ and SP. This was depicted by an insignificant margin that measured the strength and predictive power of the relationship (β = 0.074). This leads to the conclusion that the quality of the information exchanged between public sector organisations and their supply chain partners has no bearing on the performance of suppliers. Therefore, the sharing of quality information in the public sector in South Africa neither predicts nor influences the performance of its suppliers.

7.4.4.5 Conclusions regarding the influence of supply chain design on supplier performance

With regards to the fifth hypothesis (H$_5$), which proposed that SCD influences SP, the study reveals no relationship between the two constructs. The results specifically show that SCD does not significantly predict the performance of suppliers in the South African public sector (β =0.030).

Notably, this result contradicts the insights gained from the literature review where it was revealed that well-designed supply chains influence the performance of both public sector organisations and their supply chain partners. The present study therefore concludes that the design and structuring of supply chains is of little importance in enhancing the performance of suppliers in the South African public sector.

7.4.4.6 Conclusions regarding the influence of supply chain integration on supplier performance

Regarding the sixth hypothesis (H_6), which points to the relationship between SCI and SP, the results of the study indicate that SCI influences and predicts SP. The results indicate that SCI is one of the foremost predictors of SP ($\beta = 0.534$). Given this result, it is concluded that SCI is a crucial practice that shapes and enhances the performance of suppliers in the South African public sector. It is further stated that since SCI exerted the highest impact on SP when compared to the other SCM practices considered in the study, it is the most important antecedent of SP in the South African public sector.

7.4.4.7 Conclusions regarding the influence of supply chain synergies on supplier performance

With reference to hypothesis seven (H_7), which pointed to the influence of SCS on the performance of suppliers in the South African public sector, the results of the study revealed that there is no relationship between the two constructs. Specifically, SCS neither influenced nor predicted the performance of suppliers ($\beta = -0.100$). These results are contrary to the observations drawn from the review of the literature concerning the benefits of SCS in supply chains, which indicated that synergistic activities are vital as they constitute one of the methods of ensuring that the activities of enterprises and their suppliers are aligned. In line with this result, the study concludes that SCS has marginal or insignificant importance to the performance of suppliers in the South African public sector as it does not enhance or add value to their performance.

7.4.5 Conclusions regarding the relationship between supplier performance and supply chain resilience in the South African public sector

Regarding hypothesis eight (H_8), which focused on the relationship between SP and SCR in the South African public sector, a relationship between the two constructs was observed. The results of the study showed that SP exerts a significant positive influence on SCR ($\beta = 0.375$). This leads to the conclusion that the performance of suppliers is a critical determining factor on how public sector organisations in the South African public sector react and adapt to various changes and disruptions occurring in their environments.

7.4.6 THE MODEL DEVELOPED
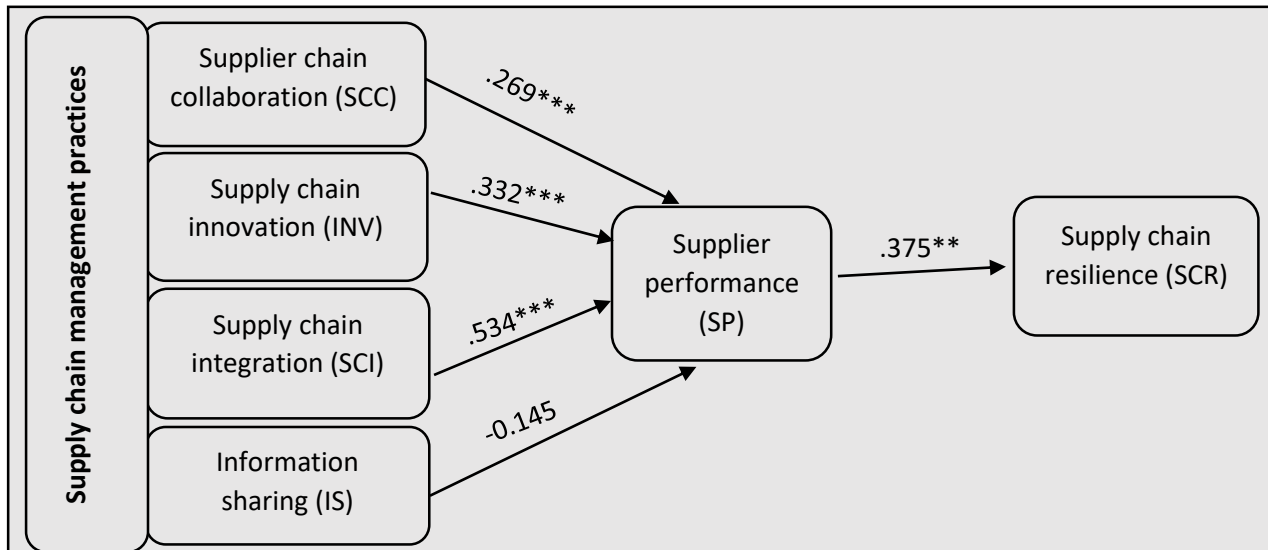
Figure 7.1: The Model for SCM practices, SP and SCR in the South African public sector
Source: Author's own compilation

The model developed in the study (Figure 7.1) illustrates that SCC, INV and SCI are the three factors central to the improvement of SP in the South African public sector. This view is premised by the significant positive relationships between these three factors and SP. As the model further shows, a decrease in the information shared with supply chain partners would also enhance the performance of suppliers. This view is based on the significant negative relationship observed

between IS and SP. However, as noted in the discussion of the results of hypothesis three (H3) (refer to Section 6.7), it is necessary to consider the unconventional result regarding IS and SP further to ensure that a stimulation of the information exchanges between public sector organisations in South Africa and their supply chain partners will result in the improvement of the performance of suppliers. Moreover, the performance of suppliers is essential to the resilience of the public sector supply chain as supported by the significant positive relationship between SP and SCR. Thus, superior performance from suppliers has a stimulus effect on the ability of public sector organisations in South Africa to adapt and respond to environmental dynamics.

7.5 RECOMMENDATIONS

The primary objective of this study was to determine the influence of SCM practices on SP and SCR. In the process of determining these relationships, the study suggests several recommendations that can be taken into consideration to improve the performance of public sector organisations in South Africa in meeting their mandated objectives. These recommendations are intended to benefit all government departments and organisations in the South African public sector and can be applied to other organisations in developing countries elsewhere.

7.5.1 Recommendations regarding supply chain management practices

The results of the study suggest that SCM practices lead to improved performance in public sector organisations in delivering their services and ensuring transparency and accountability in the use of public resources. It is, therefore, necessary to suggest some recommendations that public sector organisations may adopt and implement in their various supply chains.

7.5.2 Recommendations regarding the influence of supply chain collaboration on supplier performance

As observed in the study, SCC pertains to the partnering of two or more members to work together to achieve an objective. However, it has emerged that most collaborative relationships between public organisations and their suppliers end up being ineffective because of the lack of

commitment, trust, lack of information sharing, lack of incentives, behavioral issues, and fear of collusion. From the study, it has emerged that SCC influences SP. Despite that, it is essential to explore strategic means to understand how the relationship between these two variables can be enhanced. These strategic means include the following, among others:

7.5.2.1 Promote and reward a culture of sharing critical information

It is critical for public sector organisations to reward the sharing of critical information with their suppliers to increase trust and commitment. From the study, it has emerged that public organisations and officials are skeptical of sharing information with their supply chain partners. Therefore, public sector organisations, by rewarding the effective exchange of information by their SCM professionals, could encourage them to share and disseminate information with their partners. The rewards can be through various incentives for super performers in this area, such as through annual awards and other associated recognitions.

7.5.2.2 Promote clear consistent communication

To nurture long-term effective relationships with suppliers, public sector institutions should communicate with suppliers constantly on an equal partnership. It is also vital for public sector organisations to note that aggressive negotiation activities with suppliers will likely undermine trust and turn the relationship into a combative and resentful one. Therefore, public sector organisations should treat and consider suppliers with respect and as an extension of the internal organisation.

7.5.2.3 Promote good behavioural practices

Public organisations should evaluate their behaviour towards their suppliers. Suppliers require the assurance that they are and will be paid fairly and in a timely fashion for the product or service they provide. In other words, public sector organisations should honour their contracts and promote acceptable work ethics that encourage constructive contract relationships. This is essential since a healthy contract relationship enables both parties to understand and uphold their obligations.

7.5.2.4 Build and develop the right capabilities

To create successful collaboration programs, public sector organisations should develop new capabilities such as cost engineering, quality management, supplier development, trend scouting, and partnership influence. Cost engineering is the analysis of supplier's products and processes to gain insight into the economics of the extended organisations. Quality management capabilities revolve and focus on quality issues across the whole supply chain and cover both products and associated services. Trend-scouting capabilities revolve around identifying new technologies and supply options as they emerge while supplier development focuses on ways to improve supplier capabilities and their processes. Partnership influence focuses on getting multiple suppliers to work together to improve the performance of critical supply chain components. Building and developing the right capabilities will therefore assist public organisations in assessing their supplier capabilities, their suppliers' work and to identify opportunities for improvement.

7.5.2.5 Leverage technology

Public sector institutions should exploit the lever of technology for mutual benefits with their suppliers. One of the examples is to create a technological platform that promotes and supports transparency and efficiency. It is, for example, essential to create and develop a central portal where both the suppliers and buyers can review purchased orders, update contact information, submit invoices, and respond to requests for quotes and queries. This helps in developing transparency as well as creating an audit trail of activities that facilitate the preempting of any misunderstandings between supply chain partners.

7.5.3 Recommendations regarding the influence of supply chain innovation on supplier performance

The results of the study revealed that INV significantly and positively influences SP in this study. To increase and enhance the influence of innovation on SP, several interventions can be utilised. These may include the following:

7.5.3.1 Adopt advanced technological innovations

Public sector organisations should adopt and implement new information and technological innovations to stay afloat with worldwide developments. This allows them to institutionalise various initiatives that facilitate the effective sharing of information with their suppliers and customers. Adopting innovations also cultivates relationships with suppliers as organisations may be compelled to offer capacity building schemes to train each other on the new technology that is coming up and how they can best make use of it. Moreover, adopting new technologies presents public organisations with better means to engage with their suppliers and provides opportunities to innovate.

7.5.3.2 Reward innovative initiatives

Public sector organisations should allow, protect and appreciate, as well as value new ideas that benefit the organisation from both employees and suppliers. Employees with failed ideas should not be punished and the failure of the program must be treated as part of learning. Offering protection and rewarding innovation preserves the intellectual property of both buyer and supplier organisation, which helps in reducing the fear of being punished and improves trust, commitment, and performance. Innovations and ideas must be appreciated openly to motivate others to be creative. Also, valuing in-house innovations in the organisation creates the desire and dedication to innovate.

7.5.3.3 Institute integrated software systems

Today's supply chains base their functionality on sophisticated software solutions that allow for more streamlined networks. For public supply chains to reach their full potential, they should use advanced software systems that can collect, integrate and analyse data so that it can be distributed to all stakeholders. This allows informed decisions at all levels to be made, as effective IS is enabled. The use of advanced software enables organisations to gain an accurate picture of their suppliers, which in turn is necessary for anticipating their value. Additionally, the automation process of public supply chains through advanced high-quality software helps public sector

organisations to reduce the strain on the workforce, cuts down the margin of error in processes, and allows more effective use of resources. Moreover, the central source of data ensures that all parties are viewing the same data and averts miscommunications.

7.5.3.4 Supplier involvement

Supplier involvement is one of the best ways to increase supplier innovation in businesses. Early involvement of suppliers in product lifecycle processes, encourages them to share information, assist in planning, and provide design suggestions. This enables them to use their skills and expert product development as they will feel valued and take the initiative as their own. Involving suppliers early in business process and product development has benefits such as shortened product development cycle times, low cost, and high-quality end products. Given that, public sector organisations should ensure that their suppliers are integrated earlier in their initiatives and processes to enable them to contribute fully to the planning and design of the product or service they will be providing. Furthermore, involving suppliers earlier gives suppliers time to show their innovative capabilities, which can benefit buying organisations.

7.5.3.5 Create a climate of trust

Creating a climate of trust between buyers and suppliers plays a critical role in increasing innovations within a supply chain. Most innovations come with the exchange of confrontational ideas between supply chain partners. To earn the trust of suppliers, public organisations should communicate their plans and expectations and be willing to share their technology road maps with suppliers. Moreover, open and honest communication creates a supportive and trusting environment that facilitates and increases the supplier's commitment to the relationship. Along these lines, public sector organisations should ensure that an enabling environment that increases trust with suppliers is created for them to perform as expected. Additionally, creating such an environment encourages suppliers to become open and free to share meaningful information, both positive and negative, as well as reducing the fear of being punished if they miss agreed timelines.

7.5.4 Recommendations regarding the influence of information sharing on supplier performance

From the study, it was revealed that IS exerts an inverse influence on SP in the South African public supply chains. To turn this situation around and ensure that the influence of IS on SP is positive, several strategies can be employed. Such strategies, among others, include:

7.5.4.1 Reward information sharing

Public sector organisations should reward information sharing both within the organisation and externally. From the study, it has emerged that one of the most dominant challenges in sharing information in public sector organisations is the fear of victimisation after the information has leaked into the public domain. Therefore, to reduce the fear of victimisation and encourage IS, organisations should ensure that employees are protected, and relevant incentives should be put in place as rewards to those who manage to share information. Rewarding employees who take the risk of sharing information may help public sector organisations to get rid of information stewards who view and feel that information is power and are therefore unwilling to share it for fear of losing that power.

7.5.4.2 Ensure information security

One of the most serious threats in today's business is the spillage of critical information into the public either by a leakage in the system or through hackers. Therefore, to encourage the sharing of information in public supply chains, information security must be guaranteed. Organisations should prioritise awareness programs to increase vigilance in the face of such threats. Information security features such as passwords, antivirus software and firewalls could be applied as solutions. Moreso, training should be provided, focusing on how to code and decode encrypted messages to ensure that critical information about the organisation is safe in the event that it leaked. Other organisations have even established some anti-spyware departments to deal with information security issues. These departments are manned with information and technology specialists.

7.5.4.4 Promote buyer-supplier collaboration

The formation of buyer-supplier collaborations is one of the other ways that encourages the sharing of information and improves the performance of suppliers. Collaborative initiatives increase trust and commitment between partners. To improve and cement their relationships, they are compelled to share information that is relevant to their core businesses. Therefore, to increase IS in public supply chains, public sector organisations should ensure that collaborative mechanisms with suppliers are in place. This will increase trust, and commitment, and allow them to not view their suppliers as vendors but as equal partners.

7.5.4.5 Adoption of advanced technologies

With the advent of the information and technology era, sharing information using the internet has become necessary. This being the case, for public sector organisations to share information effectively with their partners, they should adopt and make use of technological advancements. This enables them to solve complex problems in service delivery through their various agencies. Adopting and making use of information technology ensures the flow of information and allows the receiving organisation to respond in time which is critical in today's business.

7.5.5 Recommendations regarding the influence of information quality on supplier performance

The results of this study showed that IQ exerts no influence on SP in public sector organisations. To create a positive relationship between IQ and SP, several strategies can be employed. Such strategies could include the following:

7.5.5.1 Create a system for accurately inputting data

Among other things, IQ is also determined by how data is coded into systems and how it is stored. From the study, it was evident that most public sector organisations in South Africa still lag in the adoption and use of technology. For instance, they still prefer manual filing methods to digital (e-

filing) and many of them are still in transition. To ensure that the quality of information is improved, recent IT-based systems that guarantee the accurate inputting of data and timely transfer of information should be created. Data and information entry guidelines must be clearly stated and distributed to all employees. This helps in ensuring that the information stored and shared is accurate, up-to-date and timely.

7.5.5.2 Conduct a quality data audit

Conducting quality data audits is one of the strategies that can be utilised to ensure that the information shared between buyers and suppliers is of a high quality. Auditing the information to be shared helps in ensuring that the information is accurate, up-to-date and free of errors. Public sector organisations should timeously conduct information and data quality audits to ensure that the information that is shared with their suppliers is up-to-date and relevant. Information audits also enable organisations to detect errors and allow them to fix them before the information has been shared.

7.5.5.3 Establish an information steward role

Quality information is one of the factors that determine the performance of suppliers in a supply chain. The sharing and transfer of outdated, irrelevant, and inaccurate information impacts negatively on the relationship between organisations and their suppliers as it does not indicate a lack of respect only but also a lack of value. To improve the quality of information shared in supply chains, public sector organisations should establish the office of an information and data steward. This will ensure that the information being exchanged is relevant, accurate and up-to-date, as the office of the information steward will be playing not only the role of guiding the improving and maintaining of high-quality data but also analysing information on business needs, processes, and ongoing reviews.

7.5.5.4 Management commitment to data quality

The commitment of top managers to quality information influences the quality of data that are shared and captured in an organisation. Their commitment determines the quality of information shared in and out of the organisations to suppliers. The commitment of top managers to the sharing of quality information breeds a fertile ground for trust between their parent organisations and suppliers. Therefore, managers in public sector organisations should set the tone for sharing quality information both within and out of the organisation. This may increase supplier trust and enhance their performance and commitment as they will have assurance of quality information from top managers themselves.

7.5.6 Recommendations regarding the influence of supply chain design on supplier performance

From the results of the study, it was revealed that SCD does not influence the performance of suppliers in the South African public supply chains. Despite that, it is necessary for public sector organisations to develop and implement SCD strategies to influence the performance of their suppliers. Such strategies include the following, among others:

7.5.6.1 Performance evaluation

Evaluating SP is generally a strategic issue as it contributes to obtaining, keeping and improving the competitive advantage of organisations. Evaluating performance helps in identifying areas of weakness and strength that help organisations in decision-making. It also helps in the selection of suppliers for activities and areas where organisations need to help their suppliers to reach the expected standard. Besides, evaluating the performance of suppliers gives both organisations a sense of responsibility, implying that they should do better to meet or surpass the expected standard. Therefore, public sector organisations should develop and design methods for evaluating the performance of their supply chain partners to influence them to perform better.

7.5.6.2 Supplier development programs

Instituting supplier development programs is another method that can be utilised by public sector organisations to improve the performance of their suppliers. These programs should aim at strengthening the performance of critical suppliers by enabling them to acquire the skills and capabilities required to make them competitive.

7.5.6.3 Joint management of supplier improvement initiatives

After assessing and identifying grey areas where suppliers should improve, it is necessary that public sector organisations together with their suppliers jointly manage initiatives to remedy and improve their performance. This enables both organisations to track improvement initiatives and ensures that suppliers account for their improvement interventions. It also allows buying organisations to give feedback on the progress made on the interventions on a timely basis. By jointly managing supplier improvement initiatives, both organisations actively work together, which in turn strengthens their relationship and the need to meet and satisfy each other's needs.

7.5.6.4 Reward excelling suppliers

To encourage suppliers to improve their performance, public sector organisations should incentivise and reward suppliers who are excelling in their performance. Rewards and incentives can be in the form of more contracts, positive referrals, performance bonuses or certificates, and awards for being the best supplier of the year. This encourages them to keep on achieving as they know that they will be appreciated. Rewarding best-performing suppliers motivates them to keep improving the standard of their services or products.

7.5.6.5 Develop a culture of site visits

To improve the performance of suppliers, public sector organisations should develop a culture of site visiting before a contract is awarded to any supplier. Visiting supplier's sites would assist

public organisations in ascertaining the capacity of the suppliers to provide the materials or services. It prevents the possibility of being short-changed by bogus suppliers who profile false information in their bids.

7.5.7 Recommendations regarding the influence of supply chain integration on supplier performance

SCI was found to have the strongest relationship with SP in this study. Strategies that can be used to enhance or increase SCI include the following:

7.5.7.1 View suppliers as organisational extensions

In today's world, suppliers have become one of the most valued assets of an organisation. Therefore, to improve the relationship and influence of SCI on SP, public sector organisations should view suppliers as assets that provide several value-added benefits. They must treat them with respect in the same fashion they treat organisational workers. Through regarding them as extensions of their institutions, suppliers will feel that they have a responsibility to satisfy their customers by ensuring that they provide quality products or services, which leads to effective and efficient service delivery.

7.5.7.2 Early supplier integration

To improve the relationship between SCI and SP, public sector organisations should involve suppliers at an early stage in their activities. Integrating suppliers early in organisational activities enables them to add their input (voice) in the timely design of a new product as they are the ones that understand how critical it is to have conforming parts or materials supplied. Also, the involvement of suppliers in the early phases of a new product or introduction of a new service helps the purchasing organisation to eliminate excessive baggage in terms of suppliers who are not suitable because they are limited in capacity to serve the organisation, they are too distant, not aligned with organisational policies or they are simply not interested in developing a relationship.

Moreover, the early integration of suppliers enables public sector organisations to identify suppliers who are willing to go the extra mile in creating a strong, long working relationship.

7.5.7.3 Effective communication

Increased communication with suppliers on operational issues gives the impression that they are valued and respected. Effective communication between buyers and suppliers helps in conflict resolution and brings a sense of belonging to suppliers, propelling them to boost their efforts as they see the product or service as theirs. This also helps in creating strong partnerships in which confidential information is shared. Therefore, public sector organisations should have systems in place that ensure that effective communication is maintained in the whole supply chain.

7.5.7.4 IT integration

Investing in information and technology is one of the strategies that can be used to improve the relationship between SCI and SP. Generally, a strong relationship involves technology and employee transfer with the supplier. Investment in technologies such as supplier management software helps organisations to keep track of information about its suppliers. Integrating information and technology in supply chains helps public sector organisations to create, process, and track purchase orders. It also aids organisations in assessing and evaluating the performance of their suppliers and identifying areas where suppliers are lacking. This additionally makes it easy for organisations to communicate with their suppliers as well as help development them into prominent role players.

7.5.7.5 Adopt strategic alliance approaches

In order for public sector organisations to strengthen their relationships with suppliers, they should adopt and form strategic alliance ventures. These ventures allow them to share knowledge and expertise as well as reducing cost and risks. This helps in strengthening relationships in areas such as new product development and obtaining new technologies. Strategic alliance approaches also

increase the dependability of the supply and influence suppliers in optimising their performances in quality and delivery schedules.

7.5.8 Recommendations regarding the influence of supply chain synergies on supplier performance

The results of the study indicated that SCS does not influence SP in public sector organisations in South Africa. Various underlying causes such as lack of trust, commitment, and poor planning were identified. However, some strategies can be used to build and influence a positive relationship between the two variables, and these strategies include following:

7.5.8.1 Establishing supplier relationships

Creating partnerships with suppliers enables organisations to think of suppliers on a long-term basis not only when a transaction is completed, and an order is shipped. Partnerships also compel organisations to strengthen their relationships as they require close, more open, and frequent communication. Furthermore, partnerships encourage the supplier's top management to be more involved in maintaining and further developing the relationship, and dedicated to ensuring that the quality of the products or services being provided is satisfactory through the use of statistical quality controls. For instance, most organisations have introduced a problem escalation program when it comes to supplier quality where the quality of the product must improve within a specified period. If there is no improvement, the problem escalates to the top managers of the organisation who must deal with the issues raised.

7.5.8.2 Effective communication

Effective communication levels the ground and covers the bridge between buying organisations and their suppliers. Communication must be mutual. It is essential for suppliers to feel at ease when communication is open, rather than perceiving that they are being commandeered or given directives. For effective communication, public sector organisations should reduce the number of contacts and middlemen and create a checklist to set clear quality requirements. In other words,

seamless communication channels and structures should be developed to facilitate effective communication. Communication will create transparency on both sides of the channel and prevent interruptions or missteps.

7.5.8.3 Encouraging the sharing of risks and costs

Encouraging the sharing of risks is another method that enables the formation of synergies between supply chain partners. The sharing of risks provides suppliers with a sense of belonging, boosts the feeling that they are not alone in their business, and improves their commitment as they want to minimise the risks. Encouraging the sharing of risks also compels organisations and their suppliers to devise clear mechanisms of considering cost risks and the profits they accrue along the way. Therefore, public sector organisations should ensure that risk-sharing and cost-sharing mechanisms are clearly outlined and communicated to their supply chain partners for them to fully commit, as transparency adds value to every partnership.

7.5.8.4 Shifting to a shared value mindset

To increase partnerships between suppliers and buyers, public sector organisations should shift from the traditional methods of business that benefit buying organisations only, such as cost-saving and reduced purchase price. They instead should focus on the win-win approach that generates and adds value to both the buyer and the supplier. Therefore, public sector organisations should develop strong interactions with their suppliers to ensure that procurement policies are formulated in a way that does not exert pressure on saving costs only but instead on empowering their suppliers to become better business partners. This will help in the development and performance of suppliers.

7.5.9 Recommendations regarding the relationship between supplier performance and supply chain resilience

From the study, it was revealed that SP influences the SCR of public sector organisations in South Africa. To increase the influence of SP on SCR, various strategies can be used. These strategies among others can include the following:

7.5.9.1 Increase flexibility

Increasing flexibility in the supply chain is one of the ways public sector organisations increase their resilience capabilities. Public sector organisations should increase their flexibility by adopting standardised processes that allow them to master the ability to reallocate resources where the need is greatest. They can also use other strategies such as aligning procurement strategies with supplier relationships and using concurrent instead of sequential processes. By increasing supply chain flexibility, public sector organisations will be able to withstand significant disruptions and respond more effectively to demand fluctuations.

7.5.9.2 Diversify suppliers

Diversifying sources is one of the steps in dealing with supply chain risks and building resilience in organisations and supply chains. Public sector organisations should eliminate their dependence on sourcing from a single supplier, region or country. Diversifying suppliers helps public sector organisations to broaden their supplier bases, which allows competition and alternatives in cases where the main supplier fails to deliver. One of the strategies that can be utilised by public sector institutions to diversify their supplier base is by having a combination of near-shore and offshore suppliers for each material or component. Broadening and diversifying suppliers lessens risks and offers organisations alternatives in times of need.

7.5.9.3 Advance technology capabilities

Advancing technology capabilities is another strategy to increase SCR in the public sector. Technology helps organisations complete their tasks more easily and accurately. Communication is made simpler and faster. Also, increasing technological capabilities facilitates the improvement of processes such as resource planning, real-time analytics, and decision support tools as well as supplier-commodity analysis, which provides enriched data sets that help public sector organisations to better understand the dynamics of the procurement processes. Increasing technology capabilities also aids public sector organisations to make informed decisions related to

customer/client needs, logistics, and delivery requirements, to anticipate upcoming challenges, including shortages, and respond quickly to market shifts.

7.5.9.4 Promote organisational cultural change

Corporate culture is another factor that determines how an organisation responds to changes and disruptions. For public sector organisations to strive and survive in this volatile and complex environment, they should change their cultures in terms of how they conduct their businesses. They have to be more adaptive, agile, and promote continuous IS within and out of the organisation. A change in culture in terms of growth targets, performance, transparency, accountability, and incentives needs to be emphasised and ensured in the organisations and supply chain to improve the performance of both the employees and suppliers. Therefore, public sector organisations should promote values that enable their supply chains to function and perform effectively.

7.5.9.5 Increase visibility

For public sector organisations to increase resilience, they should improve their supply chain visibility which allows organisations the ability to track and monitor supply chain events and patterns, enabling them to be proactive in their actions. Increasing visibility enables organisations to monitor the performance of their suppliers and compliance with rules and regulations as well as contract clauses. Visibility also gives organisations the ability to monitor the flow of material from their suppliers to end-users as well as providing the line of sight into end-user consumption and usage patterns. Therefore, by increasing visibility in their supply chains, public sector organisations can track and monitor the performance of their suppliers, activities, events, and patterns, which enables them to be proactive in their operations.

7.5.9.6 Form collaborations

Collaborative activities also act as means through which public sector organisations can increase SCR. Collaborations provide sector organisations with the ability to develop mutually reciprocal

and trust-based relationships with supply chain partners and other key strategic networks. Therefore, collaborations inspire organisations to collaboratively plan with suppliers, as well as collaborate in designing products by incorporating customer demands and supplier capabilities. It also allows access to end-to-end supply chain inventory data and supplier capacity constraints. Collaborations enable public organisations and suppliers to work together, share costs and risks as well as respond to disruptions quickly.

7.6 CONTRIBUTIONS OF THE STUDY

The contributions of this present study are both theoretical and practical. Theoretical contributions concern the applicability and benefits of the cited literature while practical contributions are aligned with the benefits of the results of the study to supply chain managers, professionals and other public supply chain stakeholders.

7.6.1 Theoretical contributions

Theoretically, the present study contributes to the existing body of knowledge since it is an addition to the available literature on the implementation of SCM practices in the South African public supply chains. The study contributes to the existing literature on the conceptualisation, drivers, and benefits of SCM practices, namely, SCC, SCS, IS, IQ, SCD, SCI, as well as SP and SCR.

Furthermore, the study provides a specific conceptualisation of the relationship between SCM practices and SP, which is the mediating construct. This provides a platform for the applicability of the theory to the South African public sector where previously no such study had been conducted.

In addition, the study contributes to the literature concerning the determination of the relationship between SP and SCR. From the study, it was revealed that indeed a relationship exists between SP and SCR. This was also supported by various examples of cases of previous results that were drawn from other countries. Thus, this study is critical in understanding the relationship between the practice of SP and SCR.

This study is also crucial to future studies as it can be a source of information on research methodology for studies in SCM.

7.6.2 Practical contributions

Practically the results provided in this study are beneficial to SCM professionals in the public sector regarding the improvement of the performance of public sector service delivery. The study revealed the importance of SCM practices in improving the performance of the public supply chain. SCM professionals in the South African public sector can take note and ensure that SCM practices are effectively implemented in their organisations to improve their performance.

The study also revealed the importance of SCM practices in steering the performance of suppliers. The study suggests that it is imperative that SCM professionals in the South African public sector take note that the performance of their suppliers highly depends on the implementation of SCM practices that positively impact on SP, which are SCC, INV, and SCI. Hence, where the performance of the suppliers to the public sector is below par, improvements can be made through an adjustment to these three factors. Most significantly, greater attention should be directed to SCI, which exerts a higher influence on SP than the other two factors.

Furthermore, the study revealed that SCM practices such as SCC, IS, and IQ have very little or no influence on the performance of suppliers because of deficiencies in areas such as trust, commitment, and mutual understanding, among others. Therefore, SCM professionals in the South African public sector still face the challenge of harnessing these three factors to add value to the performance of suppliers.

Moreover, the ability of the organisations to be resilient in reacting and bounce back to their original normal operations after disturbances, rests on the performance of their suppliers. It is therefore essential for SCM professionals in the public sector to ensure that programs and activities aimed at improving the performance of suppliers are devised and implemented.

From the study, it can also be stated that it is imperative for SCM professionals in the South African public sector to assess the performance of their suppliers on a timely basis and develop methods to help them reach their maximum output to increase the performance of the entire network.

7.7 LIMITATIONS OF THE STUDY

The current study provided some useful in-depth insights regarding the hypothesised relationships between SCM practices, SP, and SCR in the South African public sector. Despite the valued contributions made, various limitations should be highlighted for future reference. The first limitation is that the study did not test for the moderating effect of factors such as the salary of respondents or gender of the respondents, among others. Measurement of the impact of demographic factors such as gender, position, and salary on the proposed relationships could have further cemented the results of the study by showing how such factors moderate the proposed relationships.

The second limitation is that of the setting of the study. The study limited the scope of the study to one province in South Africa, which is the Gauteng province. This could be viewed as a drawback given that the public sector domain is broad and calls for a more extensive and broader geographic scope. An expansion of the scope of the study to two or three more provinces such as the Western Cape and North West provinces, given their economic contributions and size, could have yielded more informative results.

The third limitation is that the study was restricted to a sample size of 333 respondents who are based in one geographical location which is the Gauteng province and their participation was based on the approval of their organisation. Even though applications seeking permission to conduct research were sent, some organisations did not respond while others declined, thereby reducing the number of respondents. Also, the sample size was reduced by an increased difficulty in identifying eligible respondents since there exists no universal list for SCM professionals in the South African public sector. This prompted the researcher to use convenience and judgmental sampling techniques which also increased the susceptibility of the research sample to sampling bias. Hence, caution should be exercised when generalising the results of the study.

The fourth limitation is that the accuracy of the responses could not be ascertained because respondents had to complete the questionnaires in their own time in the absence of the researcher, which made the study susceptible to response bias. The researcher did not sit with each respondent to monitor the completion of the questionnaires. Another limitation is that the study did not test the relationship between SCM practices and SCR, which is the outcome variable of the study.

7.9 SUGGESTIONS FOR FURTHER RESEARCH

Having highlighted the limitations of the current study, several implications for further research are suggested. Firstly, since this current study was inclusive of various public sector departments, future studies should consider specific government entities such as state-owned entities, municipalities, constitutional entities, and public universities and technical colleges, among others. As alluded to in the previous section, one of the unexplored areas for future studies would be to test the direct relationship between SCM practices and SCR. Such an investigation may produce interesting results regarding the impact of the four factors that were statistically insignificant in this study, namely, IS, IQ, SCD and SCS. It may also be worthwhile to test the relationship between SCM practices themselves as this might reveal how these activities influence each other.
Moreover, since the current study utilised the quantitative methodology, a different view would be to perform similar research using a mixed methods approach, which involves the qualitative approach where interviews are conducted. The results of such a study would prove to be informative since the views of respondents can be included and compared.

Additionally, on variables such as IS, IQ, SCD and SCS where relationships were not found, future studies could be conducted to check if the pattern is still consistent with the results of this study. Furthermore, scholars may include other SCM practices that were excluded in this study. Examples of such practices include just-in-time, total quality management, risk management, supplier development, green supply chain management and lean supply chain management, among others. It would be interesting to measure how such factors influence both SP and SCR in the public sector.

Another area where future studies could be conducted could be the testing of moderation influences where studies test the moderating influence of demographic factors of SCM professionals such as gender, salary, or race, among others. Mean differences based on these demographic factors could also be analysed using t-tests and analysis of variance techniques.

Lastly, as highlighted in the previous section, the current study focused on the public sector departments in the Gauteng province only. An expansion on the scope of the study to different provinces could have provided another view of the study. For instance, conducting the same study in other provinces of South Africa could provide different results, which would provide a basis for comparison.

7.10 CHAPTER SUMMARY

This chapter serves as the final chapter of the study. It provides the overall overview of the study, and the conclusions based on the theoretical and empirical objectives of the study. The current study shows that the South African public sector faces many challenges that could be resolved through the implementation of SCM practices. The results of the study provided statistical evidence that there is a relationship between SCM practices, SP and SCR in the public sector in South Africa. The study revealed that IQ, SCD, and SCS have no influence and relationship with SP whilst IS has an inverted relationship with SP. Additionally, the results of the study show that SP plays an essential role in steering SCR in public supply chains. The chapter also presents various recommendations for improving SP through SCM practices and for enhancing SCR through SP. The chapter further reveals that the study makes several important contributions to both theory and practice. Finally, the chapter indicates that although the study is limited in various ways, several suggestions for further research can be drawn, paving the way for more focused research attempts in the future.

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Faculty of Management Sciences
Research conducted by
Mr Shephard Mugwenhi
Cell: 062 048 9805
Home: 016 427 1201
Email:shephard.mugwenhi@gmail.com

Dear Respondent,

You are requested to participate in an academic research study conducted by Mr Shephard Mugwenhi, a PhD student from the Department of Logistics at the Vaal University of Technology. The purpose of the study is to gather information on supply chain management practices, supplier performance and supply chain resilience in the public sector. You have been chosen to participate in the study based on your experience of working in the public sector. I therefore believe that you will provide relevant information.

Please note the following:

1. This study will provide an anonymous survey. Your name will not appear on the questionnaire and the answers you give will be treated as strictly confidential. You cannot be identified in person based on the answers you give.

2. Your participation in this study is very important to us. You may, however, choose not to participate and you may also stop participating at any time without any negative consequences.

3. Please answer the questions in the attached questionnaire as completely and honestly as possible. This should not take more than 20 minutes of your time.

4. The results of the study will be used for academic purposes only and may be published in an academic journal. We will provide you with a summary of our findings on request.

5. Please contact my supervisors, Prof. Chengedzai Mafini, chengedzaim@vut.ac.za or Prof. Joy Bhadury, jbhaduy@radford.edu if you have any questions or comments regarding the study.

Please sign this letter to indicate that:

- You have read and understand the information provided above.

- You give your consent to participate in the study on a voluntary basis.

_____   _____

Respondent's signature   Date

SECTION A: DEMOGRAPHIC PROFILE

This section has questions that focus on your background information. Please indicate your answer by crossing (X) in the appropriate block or by filling in your answer.

A1	**Your gender**	Male				Female	

A2	**Your age group**	25 years and below	26-33 years	34-41 years	42-49 years	50 years and above

A3	**Race**	Black	White	Indian	Mixed Race	Other (Specify)…………..

A4	**Highest qualification**	Matric	Certificate	Diploma	Degree	Postgraduate	Other (Specify)…………

A5	**Employment period in organisation**	Less than 1 year	1-2 years	3-5 years	6-9 years	10 years and above

A6	**Experience as a supply chain management professional**	Less than 1 year	1-2 years	3-5 years	6-9 years	10 years and above

A7	**Type of employment**	Permanent	Contract	Internship	

A8	**Department where you are based: Please indicate**	

A9	**Your position in the organisation: Please indicate**	

SECTION B: SUPPLY CHAIN MANAGEMENT PRACTICES

We would like to find out a little more about your views regarding the implementation of supply chain management practices in the public sector. Please indicate the extent to which you agree or disagree by ticking the corresponding number between 1 (Strongly disagree) and 7 (Strongly agree). A rating of (4) points towards a neutral view of the statement. Supply chain management practices consist of six factors under consideration, which are supply chain collaboration, supply chain innovation, information sharing, information quality, supply chain design and supply chain integration.

SUPPLY CHAIN MANAGEMENT PRACTICES		Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
Supply chain collaboration								
SCC1	Our organisation shares resources to help suppliers improve capabilities, e.g. innovation.	1	2	3	4	5	6	7
SCC2	Strategic objectives are jointly developed by supply chain partners.	1	2	3	4	5	6	7
SCC3	Supplier performance is monitored and is the basis for future business.	1	2	3	4	5	6	7
SCC4	The principle of shared rewards and risks governs supply chain relationships.	1	2	3	4	5	7	5
SCC5	Value-added resources are shared among supply chain members.	1	2	3	4	5	6	7
SCC6	Our organisation has joint decision-making activities with its supply chain partners.	1	2	3	4	5	6	7
SCC7	Our organisation shares cross-functional processes with its supply chain partners to make improvements.	1	2	3	4	5	6	7

Supply chain innovation								
INV1	Our organisation's management actively seeks innovative technologies, processes, techniques, and/or product ideas.	1	2	3	4	5	6	7
INV2	Our organisation is known as an innovator among others in the public sector.	1	2	3	4	5	6	7
INV3	Our organisation investigates and secures funds needed to implement new ideas.	1	2	3	4	5	6	7
INV4	Our organisation constantly experiments with new ideas.	1	2	3	4	5	6	7
INV5	Our organisation pursues continuous innovation in core processes.	1	2	3	4	5	6	7
INV6	Our organisation focuses on process innovations.	1	2	3	4	5	6	7
INV7	Our organisation pursues new technological innovations.	1	2	3	4	5	6	7
Information sharing								
IS1	Most people within my organisation believe that sharing information is important.	1	2	3	4	5	6	7
IS2	Managers from departments across the organisation are expected to share information with others.	1	2	3	4	5	6	7
IS3	Our organisation shares the knowledge of core business with its supply chain partners.	1	2	3	4	5	6	7
IS4	Our organisation shares proprietary information with its supply chain partners.	1	2	3	4	5	6	7
IS5	Our organisation and supply chain partners exchange confidential information.	1	2	3	4	5	6	7
IS6	Our organisation and its supply chain partners keep each other informed about events or changes that may affect them.	1	2	3	4	5	6	7
IS7	Our organisation informs its supply chain partners in advance of its changing needs.	1	2	3	4	5	6	7

Information quality								
IQ1	Information exchange between our organisation and its supply chain partners is reliable.	1	2	3	4	5	6	7
IQ2	Information exchange between our organisation and its supply chain partners is adequate.	1	2	3	4	5	6	7
IQ3	Information exchange between our organisation and its supply chain partners is up-to-date and timely.	1	2	3	4	5	6	7
IQ4	Information exchange between our organisation and its supply chain partners is accurate.	1	2	3	4	5	6	7
IQ5	Information exchange between our organisation and its supply chain partners is complete.	1	2	3	4	5	6	7
IQ6	Our organisation and its supply chain partners exchange relevant information.	1	2	3	4	5	6	7
IQ7	The quality of the exchanged information with our key suppliers adds value for our organisational requirements.	1	2	3	4	5	6	7
Supply chain design								
SCD1	Proximity to suppliers is an important consideration for our organisation.	1	2	3	4	5	6	7
SCD2	Our organisation's supplier selection criteria are well defined.	1	2	3	4	5	6	7
SCD3	The number of suppliers and their capacities are sufficient to handle any possible needs of our clients.	1	2	3	4	5	6	7
SCD4	Distribution channels in our supply chain can sufficiently serve the current and potential service delivery areas.	1	2	3	4	5	6	7

SCD5	Logistical activities in our supply chain are coordinated to minimise problems in service delivery.	1	2	3	4	5	6	7
Supply chain integration								
SCI1	Organisations in our supply chain establish more frequent contact with each other.	1	2	3	4	5	6	7
SCI2	Organisations in our supply chain create a compatible communication and information system.	1	2	3	4	5	6	7
SCI3	Our organisation extends its supply chain beyond its suppliers and clients.	1	2	3	4	5	6	7
SCI4	Our organisation participates in the sourcing decisions of its suppliers.	1	2	3	4	5	6	7
SCI5	Our organisation's compensation and motivation mechanisms consist of factors that promote integration.	1	2	3	4	5	6	7
SCI6	Our organisation's integration with the upstream and downstream supply chain members has increased the flexibility of its operations.	1	2	3	4	5	6	7
SCI7	Our organisation has made supply chain agreements with some suppliers and clients to share risks together.	1	2	3	4	5	6	7

SECTION C

We would like to find out a little more about your views regarding supplier performance in the public sector. Please indicate the extent to which you agree or disagree by ticking the corresponding number between 1 (Strongly disagree) and 7 (Strongly agree). A rating of (4) points towards a neutral view of the statement.

Supplier performance	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

		Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
SP1	Our suppliers provide us with the best prices given the desired quality of the items/services purchased.	1	2	3	4	5	6	7
SP2	Our suppliers attempt to reduce the time between order receipt and delivery to as close to zero as possible.	1	2	3	4	5	6	7
SP3	Our suppliers have the ability to meet quoted or anticipated delivery dates and quantities on a consistent basis.	1	2	3	4	5	6	7
SP4	Our suppliers have the ability to provide the ordered quantities on a consistent basis.	1	2	3	4	5	6	7
SP5	Our suppliers have the ability to provide high-quality products/services.	1	2	3	4	5	6	7
SP6	Our suppliers adhere to specifications relative to industry norms.	1	2	3	4	5	6	7
SP7	Our suppliers adhere to specifications relative to our requirements.	1	2	3	4	5	6	7

SECTION D

We would like to find out a little more about your views regarding supply chain resilience in the public sector. Please indicate the extent to which you agree or disagree by ticking the corresponding number between 1 (Strongly disagree) and 7 (Strongly agree). A rating of (4) points towards a neutral view of the statement.

Supply chain resilience		Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
SCR1	Our supply chain can quickly return to its original state after being disrupted.	1	2	3	4	5	6	7
SCR2	Our supply chain can move to a new, more desirable state after being disrupted.	1	2	3	4	5	6	7
SCR3	Our supply chain is well prepared to deal with financial outcomes of supply chain disruptions	1	2	3	4	5	6	7

SCR4	Our supply chain has the ability to maintain a desired level of control over structure and function at the time of disruption.	1	2	3	4	5	6	7
SCR5	Our supply chain has the ability to extract meaning and useful knowledge from disruptions and unexpected events.	1	2	3	4	5	6	7
SCR6	Our organisation is fairly sensitive to the opportunities and threats in the business environment.	1	2	3	4	5	6	7
SCR7	One of the organisation's important criteria for finding collaborative partners is their agility and ability to react.	1	2	3	4	5	6	7

Thank you for taking time to complete this questionnaire. Your views are much appreciated.

APPENDIX 2

LETTER OF REQUEST FROM THE HEAD OF DEPARTMENT

Vaal University of Technology
Your world to a better future

VUT

TO: Whom it May Concern

FROM: Prof C Mafini

DATE: 25 January 2019

SUBJECT: REQUEST TO CONDUCT A SURVEY FOR POSTGRADUATE RESEARCH

This letter serves to request permission to conduct a survey which is part of a doctoral study being conducted by Mr Shephard Mugwenhi who is registered in the Faculty of Management Sciences at this institution. The purpose of the study is to investigate how supply chain management practices contribute to supplier performance and supply chain resilience in the South African public sector. The survey involves the completion of a questionnaire which takes between 10 and 15 minutes to complete and is targeting public service employees. The research will assist the public sector in improving its supply chain management practices, which can result in significant cost savings. I trust that you will find this information in good order.

Should you have any further inquiries about this survey, please feel free to contact the undersigned.

Kindest regards

Prof C Mafini
Faculty of Management Sciences Research Professor (Acting)
Ext: 9520
Email: chengedzaim@vut.ac.za

Vanderbijlpark Campus - Private Bag X021 - Vanderbijlpark - 1911 - Andries Potgieter Blvd
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APPENDIX 3

CONFIRMATION OF STUDY APPROVAL FROM THE UNIVERSITY

Vaal University of Technology

Your world to a better future

VUT

TO: Whom it May Concern

FROM: Prof C Mafini

DATE: 30 January 2019

SUBJECT: CONFIRMATION OF THE APPROVAL OF DOCTORAL STUDIES

This letter serves to confirm that Mr Shephard Mugwenhi is registered for the PhD degree in Business Administration in the Faculty of Management Sciences at this institution. The title of his study reads as SUPPLY CHAIN MANAGEMENT PRACTICES AND SUPPLY CHAIN RESILIENCE IN THE SOUTH AFRICAN PUBLIC SECTOR. This study was approved by the higher degrees committee of this university on 7 December 2017.

The study includes a survey that involves the completion of a questionnaire which takes between 10 and 15 minutes to complete and is targeting public service employees. The research will assist the public sector in improving its supply chain management practices, which can result in significant cost savings. I trust that you will find this information in good order.

Should you have any further inquiries about this survey, please feel free to contact the undersigned.

Kindest regards

Prof C Mafini
Faculty of Management Sciences Research Professor (Acting)
Ext: 9520
Email: chengedzaim@vut.ac.za

Vanderbijlpark Campus - Private Bag X021 - Vanderbijlpark - 1911 - Andries Potgieter Blvd
South Africa - Tel: +27(0)16 950 9000 - Fax: +27(0)16 950 9999 - www.vut.ac.za

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APPENDIX 4

APPLICATION TO PUBLIC SECTOR DEPARTMENTS

House 14 Hans Van Rensburg Street

Vanderbijlpark 1911

SE 7

31 January 2019

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH WITHIN YOUR ORGANISATION

My name is Shephard Mugwenhi, and I am a PhD candidate at the Vaal University of Technology, Vanderbjilpark Campus. The research I wish to conduct for my Doctoral thesis involves "SUPPLY CHAIN MANAGEMENT PRACTICES AND SUPPLY CHAIN RESILIENCE IN THE SOUTH AFRICAN PUBLIC SECTOR". This project will be conducted under the supervision of Professor Chengedzai Mafini (VUT, South Africa).

I am hereby seeking your consent to do a survey study in your organisation. I will be doing a quantitative research study; therefore, I will make use of questionnaires which take between 10 and 15 minutes to complete. I have provided you with a copy of my proof of registration, and a copy of a letter of approval for my thesis topic. Upon completion of the study, a copy of the full research report will be provided upon your request.

If you require any further information, please do not hesitate to contact me on 062 048 9805, email: shepherd.mugwenhi@gmail.com or contact my Head of Department, Professor C. Mafini at: chengedzaim@vut.ac.za.

Thank you for your time and consideration in this matter.

Yours sincerely,

Shephard Mugwenhi

Vaal University of Technology.

APPENDIX 5
LANGUAGE EDITOR CERTIFICATION

CERTIFICATION OF LANGUAGE EDITING

Dr. Andrea Garnett
English language editing services
SATI membership number: 1001674
Tel: 083 662 1728
E-mail: andreagarnett@yahoo.com

27 September 2020

To whom it may concern

This is to confirm that I, the undersigned, have English language edited the completed research of Mr Shephard Mugwenhi for the PhD degree in Business Administration and the thesis titled: *Supply chain management practices, supplier performance and supply chain resilience in the South African public sector.*

The responsibility of implementing the recommended language changes rests with the author of the thesis.

Yours truly,

Andrea Garnett

SHEPHARD MUGWENHI PHD THESIS

8%	7%	2%	5%
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