

**SUPPLY CHAIN RISK MITIGATION STRATEGIES IN
THE ELECTRICAL ENERGY SECTOR IN SOUTH AFRICA**



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Thesis submitted in fulfilment for the degree of
Doctoris Technologiae: Business

In the
Faculty of Management Sciences
At the
Vaal University of Technology

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August 2018

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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ACKNOWLEDGEMENTS

In acclaim of God the Almighty, for allowing me the capacity to continue effectively with this study. This thesis appears in its present shape due to the backing and guidance of a few people. I would therefore, like to express my sincere appreciation to all of them.

Above all else, my sincere gratitude goes to my promoter, Prof. Chengedzai Mafini, for the exceptional support and continued tolerance amid my candidature, and furthermore for his insightful guidance and valuable suggestions that brought this thesis to its present content and form. My special thanks likewise go to my co-promoter, Prof. Joy Bhadury, for giving direction that was indispensable for this study. May God lavishly favour both of you, and may our future professional journey go from strength to strength.

My research was supported by the Vaal University of Technology, so I want to say thank you to them for giving me this opportunity and providing the grant to proceed with and complete my study. Some dependable individuals are in the background, especially the friendly staff at the Higher degrees office who assisted with the annual registrations as well as the installation and training of the research tool.

This study would have lacked substance if it were not for the time and effort granted by the participants who took part in both the group discussions and the in-depth interviews. Thank you for your time and valuable contributions when they were needed. IT has become the order of the day, thank you to Wendy Jackson and Rendall Leite for assisting with all the IT requirements. This gives me the opportunity to express my heartfelt appreciation to all my colleagues at Eskom Holdings Limited - your encouragement has contributed to this level.

A special thanks to my lovely wife, Linda and our sons Jaycee and Jamian for your patience and for giving me the potential to complete this study and for creating a suitable study atmosphere. Words cannot express my feelings, gratitude and respect for my mom, all my siblings, nephews, nieces, uncles, aunts, the broader family and supportive friends. This thesis is dedicated to my late father; Peter Elijah Jonathan, may his soul rest in peace.

ABSTRACT

Interferences to supply chains, regardless of whether they are regular, unplanned or intentional, are progressively distorting supply chain execution. Given that such disruptions are probably not going to diminish, for the time being, supply chain risk mitigating solutions will assume an undeniably critical part of the management of supply chains. This research acknowledges the existence of an extensive variety of approaches to mitigate risks across supply chains, yet argues that most methodologies may not be reasonable if the culture of an organisation does not support them.

Supply Chain Risk Management (SCRM) has rapidly become of significance to the world economy. Though the supply of electrical energy in Southern Africa affects the economies of nations around the globe, it has received too little consideration from the literary community. The focus of this thesis is to expand the field of SCRM by analysing how different risk assessment and management concepts and practices are comprehended, construed and employed through the region.

The majority of developed supply chain management and risk management models are currently entrenched in the US and Europe. Consequently, this research is of high significance since its essential aim was to investigate these concepts and models, in particular, one focused on Africa. This approach enabled the thesis to examine and test components related to SCRM, such as risk categories, risk assessment and risk strategies, in the electrical energy sector in South Africa. The study in this manner offers knowledge that was not otherwise accessible in earlier research.

In pursuit of meeting the requirements of the research questions, the supply chain department in the electrical energy supplier was researched. This study adopted the non-probability sampling approach utilising the purposive sampling technique to choose the sampling components from the target population. Data was collected by way of conducting semi-structured interviews and researcher observation, as well as additional documentation in various forms was collected. Interviews were transcribed and evaluated in conjunction with additional data collected during meetings and triangulated using researcher observation. Data interpretation and codification thereof was done using ATLAS.ti 8 by which, twenty-five themes emerged from this study.

Supply chain risks comprise value streams; information and affiliations; supply chain activities; and external situations. Among these, information and relationships risks were found to produce self-upgrading risk loops, thereby generating consequent risk impacts after disturbances. To mitigate these risks, the case firm must engage in local and international supply chain implemented strategies, such as building a stable supply chain network, leveraging supply chain information, leveraging outsourcing contracts and developing supply-chain risk collaboration partnerships, although the level of implementation depends on the business context. Among the ten identified themes, building a stable supply chain and developing supply chain collaboration strategies can be useful in strengthening both robustness and resilience in supply chain risk management. Customer orientation had positive impacts on all themes, but disruption orientation and quality orientation influenced only certain types of strategies.

The study makes ten recommendations, which can be implemented by the case firm; the results of the interviews are evidence that all the tools are available. The thesis concludes with a summary of overall findings and areas for further research are also highlighted.

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CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

South Africa is a major electricity supplier to several countries in Southern Africa. Almost 90 percent of South Africa's electricity is generated by coal-fired power stations. Koeberg, a sizeable nuclear station near Cape Town, provides about five percent of capacity. A further five percent is provided by hydroelectric and pumped storage schemes (Department of Energy, 2016:1). The electricity supply industry in South Africa consists of the generation, transmission, distribution and sales, as well as the importing and exporting of electricity (Eskom Holdings Ltd, 2015:1). South Africa, which has always been heavily dependent on coal, is looking at ways to diversify its power-generating capacity (Brand South Africa, 2012:1). This situation is likely to remain until at least 2020 (Eskom Holdings Ltd, 2016:1). South Africa produces an average of 224 million tons of marketable coal annually, making it the fifth largest coal producing country in the world. The country is thus a significant contributor to the continent's CO_2 emissions. In the past 40 years, South Africa has made some progress in utilising nuclear and hydroelectric generation as alternative sources of energy (Hipkin, 2013:626). As coal plays such a massive part in the production of electricity in South Africa, this research will include the sourcing of coal by other user countries as well as the sourcing of alternative energy, both in South Africa and in other parts of the world.

Eskom Holdings Limited (Eskom) is a South African electricity public utility, established in 1923 as the Electricity Supply Commission (ESCOM) by the government of South Africa regarding the Electricity Act of 1922 (Brand South Africa, 2012:1). This utility is the most significant producer of electricity in Africa and is among the top seven utilities in the world regarding generation capacity and the top nine regarding sales. Eskom supplies about 95 percent of South Africa's electricity (South Africa Info, 2012:1), with the remainder coming from small inputs from local authorities (Davidson, Kenny, Prasad, Nkomo, Sparks, Howells, Alfstad & Winkler, 2011:145).

During the period 1 November 2007 to 31 January 2008 load shedding occurred, mainly due to generating capacity and energy constraints experienced by Eskom (NERSA, 2010:1). Thus, the

challenge of supplying South Africa with a regular supply of power seems highlighted on a daily basis in the press.

South Africa's steady economic growth as it increasingly focuses on industrialisation, together with its mass electrification programme to take power into deep rural areas, has seen a steep increase in the demand for electricity (Brand South Africa, 2012:1). The many challenges of sustainable development such as environmental degradation, climate change, resource depletion and fair worker treatment are increasingly being addressed in academic and practitioner literature (Blignaut, Inglesi-Lotz & Weideman, 2015:1). Public sectors internationally represent substantial demand; therefore, supply chains in public sectors have the potential to influence markets regarding, for example, production and consumption trends in favour of environmentally friendly, socially responsible and innovative products and services on a large scale (Lember, Kalvet & Kattel, 2011:1373). In 2008, South Africa started a process to introduce Renewable Energy Feed-In-Tariffs (REFIT) to ease the introduction of renewable energy into the power system. This approach was informed by international experience, where feed-in-tariffs were successfully used in countries such as Germany to encourage renewable energy uptake (Department of Energy - RSA, 2015:1). This approach has ensured the importance of the supply chain in the public sector. This study also looked at the progress and the supply-chain risks in renewable energy and how much progress the South African government has made with the procurement thereof.

The degree of strategic sourcing risk faced by manufacturers, distributors and retailers has risen dramatically in the past three years and is only expected to grow with the globalisation of supply chains (Brady, 2015:1). Supply chain trends such as offshore manufacturing, global outsourcing and lean sourcing continue to influence the supply chain. Business is becoming riskier nowadays because of the increasing use of outsourcing, globalisation of supply chains and shorter product life-cycles (Christopher, Mena, Khan & Yurt, 2011:67; Waters, 2011:35). In fact, supply chain risk management has taken centre stage as a vital risk management priority (Waters, 2011:222). Risk makes supply chains more complicated and more time-sensitive than ever before, and therefore companies within a supply-chain need to cooperate strategically with their key suppliers and customers to survive, compete and prosper (Zhao, Huo, Sun & Zhao, 2013:115). Effective Supply-Chain Risk Management (SCRM) is essential to a successful business. It is also a competency and capability many enterprises have yet to develop. In some areas, both problems

and practices are well defined while in others, problems are defined, but practices are still evolving (Supply Chain Risk Leadership Council, 2011:1). When it comes to managing supply chains, South Africa is considered one of the best in the Brazil, Russia, India, China and South Africa (BRICS) association of nations, but the country still lags far behind the developed countries. South Africa's performance is benchmarked against approximately 180 countries by organisations such as the World Bank (WB) and the International Monetary Fund (IMF) who look at supply chain components, which are planning, sourcing, manufacturing, delivery and return of goods and services (Kumar, 2013:1).

1.2 BACKGROUND TO THE STUDY

South Africa experienced a severe electricity supply crisis during 2007/2008 with extensive blackouts or load shedding. The damaging consequences on the economy were vast. The National Energy Regulator of South Africa (NERSA) estimated that approximately ZAR50 billion (approximately USD5 billion) was lost during this crisis (Blignaut *et al.*, 2015:1). In the third week of January 2008, more than twenty percent of South Africa's electricity-generating capacity was out of commission. Eskom, which also owns and runs the national electricity grid, dominates the generation of electricity. While the economy suffers from a lack of power, hundreds of billions of Rands will have to be invested rapidly to get South Africa's electricity capacity back to a level that comfortably meets demand (Saylor, Agilonu & Pichard, 2011:1). Many possible reasons have been given to explain the crisis, such as the lack of capacity for generation and reticulation of electricity (Inglesi, 2010:197) and the lack of research on electricity topics and energy in general. However, the more fundamental impact is that on investor confidence. The blackouts have highlighted the acute shortage of skills and resources to drive South Africa's R420 billion infrastructure plan, which includes government and parastatal expenditure over the next three years (Saylor *et al.*, 2011:1).

Internationally, coal is now the most widely used primary fuel accounting for approximately 36 percent of the world's electricity production. South Africa, which has always been heavily dependent on coal, is looking at ways to diversify its power-generating capacity (Brand South Africa, 2012:1). The Development Bank, the Treasury and Eskom are working on a renewable-energy programme that involves independent power producers (South Africa Info, 2012:6). The

Department of Energy's (DoE's) Renewable-Energy Energy Independent Power Producer Procurement Programme (REIPPPP) has seen companies invest over R168 billion in the renewable energy industry. Eskom envisages a more prominent role for itself in the nascent renewable energy industry in South Africa (Njobeni, 2016:1). Renewable energy has a long way to go to overtake South Africa's reliance on coal (Barbee, 2015:10).

Following an extensive survey by the Business Continuity Institute published in 2014, 80 percent of the 550 organisations from over 60 countries have experienced at least one disruption in 2014, while 50 percent of these disruptions originated from suppliers that produced high volumes of metallic products (Alcantara, 2014:10). Amongst the sample, the disruptions led to a loss in productivity of just under 50 percent of the participating organisations, while 32 percent of the organisations lost revenue due to supply chain disruptions (Alcantara, 2014:10).

The underlying reality is that disruptions to businesses, and therefore supply chain networks, are on the increase (Lemke, Clark & Wilson, 2011:846). Even though not all incidents are directly relevant to all organisations at the same time, their connectedness through their supply chain network raises the relevance and potential of disruptions through partners. Thus, while the number of incidents is gradually increasing, the impact of conflicts is also becoming more relevant to firms, even though they may not be directly affected. Given the changing nature of the operating environments of supply chains, it is fair to deduce that supply chain risks are becoming increasingly relevant and topical for organisations.

Research in this area shows that the immediate aim of such investments is targeted at the development of strategies and techniques to enable the identification, impact forecasting, mitigation and preparation for supply chain risks (Khan & Zsidisin, 2012:60). While solutions can be brought-in or implemented by consultancies on behalf of an organisation, the organisation's workforce can only deliver the application and improvement of these solutions (Alcantara, 2014:10). Thus, the tricky part exists in the continuous motivation of staff, the training and the generation of a culture that is conducive to these organisational needs. Moreover, organisations often strive to become highly competent at risk-management by installing new systems or bringing in consultants while the organisation's staff sometimes lack the intuitiveness, knowledge and autonomy to deal with risks as they arise.

1.3 THEORETICAL FRAMEWORK

Overall, the goal of this study is to contribute to theory building of supply-chain risk management, resulting in a framework and propositions for further study. While supply-chain management research has become more theoretically rich and methodologically rigorous, there are numerous opportunities for additional advancing theory, methodology and the managerial relevance of future inquiries (Carter & Easton, 2011:46). Using a risk framework and the outcome of the research, this study aimed to support the general theory and specifically prescribe an approach to the management of risk that explicitly incorporates the role of time. This could serve as the basis for further field validation and can be assessed for its impact on theory building in related fields of supply chain risk management. The specific goal is to understand a company's response to disruption. The study will seek to analyse, outline and categorise factors that underlie response. Supply chains have often been oversimplified as linear and static chains reaching from source to sink, including the suppliers' suppliers and the customers' customers. However, a supply chain is a complex web of changes; coupled with the adaptive capability of organisations to respond to such changes (Wieland & Wallenburg, 2012:887). Strategies to manage supply chains must incorporate these inherent properties. The argument in this regard is that, due to this very nature of supply chains, both proactive (preventive) and reactive strategies need to be implemented. Both strategy types must be invested in *ex-ante*, but proactive instruments are cause-related and lead to directly observable effects (for example, increased buffer stock), while reactive instruments are effect-oriented and can only show their impact *ex-post* (Thun & Hoenig 2011:242). Supply Chain Risk Management (SCRM) is defined as the implementation of strategies to manage both every day and exceptional risks within the supply chain, based on continuous risk assessment, with the aim of reducing vulnerability and ensuring continuity. Thus, SCRM extends traditional risk management approaches by integrating risks of partners upstream and downstream of the supply chain (Wieland & Wallenburg, 2012:887). The recession caused by the monetary crisis has vividly illustrated the importance of Supply Chain Resilience (SCRES) in today's interdependent global economy. However, the concept is still in its infancy and has not received the same attention as its counterparts, SCRM and Supply Chain Vulnerability (SCV) (Jüttner & Maklan, 2011:246).

1.4 LITERATURE REVIEW

Inconsistent research output makes critical literature reviews crucial tools for assessing and developing the knowledge base within a research field. Literature reviews in the area of Supply-Chain Management (SCM) are often considerably less stringently presented than other empirical research (Ghadge, Dani & Kalawsky, 2012:313).

Where the value of accustomed literature reviews is that they are generated by experts with detailed knowledge of the issues in a field, traditional reviews are often unbalanced in their selection of discussion material (Stolte, 2014:22). Moreover, the past twenty years have seen an explosion in the publication of research as well as the sources available to researchers.

The section begins with the reviewed nature of the electrical energy sector, and the changes supply chains have experienced over the last decades. It examines the differences between traditional and modern supply chains. It outlines the changes in the electrical energy sector in various parts of the world, and how it influences the operating environments of supply chains and how, because of this, supply chains have changed over time. Dong, Kouvelis and Su's (2013:437) study of the global sourcing problem under demand and exchange rate run risks when there are local competitors that have the advantage to produce after demand is realised. Following this background, the review proceeds to outline the risks supply chains face in the current electrical energy sector. It considers how, not only the changing market environment poses risks for supply chains, but also how actions taken by supply chains and companies imply further risks for the supply chain (Stolte, 2014:22).

To bring about the understanding of the complexities and risks that modern supply chains face, it was considered necessary to consider the nature of the supply chains of the past.

In the past, supply chains were characterised by long periods of relative stability (Christopher & Holweg, 2011:64), low levels of customer power and supply chains, and compared to those of today, were shorter and thus more "manageable" (Stolte, 2014:22).

A literature review was conducted, and the results are presented in Chapters two, three and four. The literature review aims to close areas where copious amounts of research exist and to show areas where research is desired.

1.4.1 Supply chain risk management

Supply Chain Risk Management (SCRM) is a nascent area emerging from a growing appreciation for supply chain risk by practitioners and researchers. However, there is a diverse perception of research in supply chain risk, because researchers have approached this area from different domains (Sodhi, Son & Tang, 2012:1). The effect of SCRM on the performance of a supply chain stays unexplored. The assumption is that SCRM helps supply chains to cope with vulnerabilities both proactively by supporting robustness, and reactively by supporting agility. Both dimensions are assumed to have an influence on the supply chain's customer value and business performance (Wieland & Wallenburg, 2012:887).

In a recent supply chain survey among executives, more than two-thirds of the respondents reported increased risk over the past three years, and nearly as many expect that risk will continue to rise. This observation is consistent with the "era of turbulence," proclaimed by Christopher and Lee (2014:388) and a statement by Wieland and Wallenburg (2012:887): "With the increasing level of volatility, the days of static supply chain strategies are over." For supply chains, this translates into everyday risks such as fluctuating demand and in exceptional threats such as the 2010 Eyjafjallajökull volcano eruption in Iceland or the 2011 Tōhoku earthquake in Japan.

As will be shown, both proactive (that is robust) and reactive (that is agile) supply chain strategies reduce the vulnerability of global supply chains and are in that manner very necessary. There is, however, a lack of research about how and to what extent a structured SCRM approach will function. That involves the identification, assessment, controlling and monitoring of possible risks within the supply chain (Ghadge, Dani & Chester, 2013:523). It also fosters improved agility and robustness and, in turn, better performance, especially since the need for similar empirical work has been pointed out (Thun & Hoenig, 2011:242). While anecdotal evidence points to the fact that SCRM practices allow supply chains to react faster (increased agility) and to withstand adverse events (increased robustness), virtually no empirical research exists that reveals the underlying mechanisms (Wieland & Wallenburg, 2012:887).

In this study, Supply Chain Risk Management (SCRM) is discussed in Chapter four, as well as the application of SCRM in different business sectors and the entire value chain. As part of SCRM, the chapter further examines supply chain risk factors, with a focus on the supply risk, the demand

risk and the operational risk in the electrical energy sector. Furthermore, the chapter discusses the supply chain risks from a global perspective, looking at countries in the European Union (EU), and their stances on the type of products used to supply electrical energy. The EU has set a target of expanding the use of renewable energy to 27 percent by 2030. The EU is reliant on China for most of the products to achieve this goal.

A discussion on the supply chain risks in Africa details the situation in the Nigerian economy, discussing how the electrical energy situation has crippled the country. The discussion concludes with the supply chain risks in South Africa's power utility and looks in-depth at the building of two power stations.

1.4.2 Strategic sourcing

A supply chain encompasses all the activities associated with the process of moving goods through a network of facilities and distribution channels, from suppliers to manufacturers to distributors to retailers to final consumers (Katz, Labrou, Kanthanathan & Rudin, 2011:1). Supply chain agility has received increasing attention over the last decade due to two significant developments. Firstly, firms have increasingly been competing in business environments characterised by short product life cycles, globally extended supply chains and volatile demand patterns. Secondly, issues relating to supply chain disruption risk have been gaining prominence. Given such developments, the cultivation of supply chain agility has been suggested as a useful response strategy (Chung-Yean Chiang, Canan & Kocabasoglu-Hillmer, 2012:49). The strategic sourcing as a part of the entire supply chain function has a significant task, which is the analysis and goal-oriented creation respectively that is influencing sourcing-relevant factors (Bensch & Schrödl, 2011:100). In current literature, a multitude of contributions for the strategic sourcing of products or services can be found. However, as the economic importance of pure products and services tends to decrease because of the lack of differentiation, combinations of physical products and services being offered as bundles become increasingly crucial to the industry. These combinations are called value bundles and are a combination of physical products and services as well as immaterial values such as guarantees. These combinations are specially tailored to solve an individual customer problem (Bensch & Schrödl, 2011:100). Sourcing is intended for the strategic sourcing group of an enterprise, which is concerned with long-term decision-making about which materials to source, from which suppliers and under what contract terms (Katz *et al.*, 2011:1). This means long-term

relationships as well as lesser out of stock situations. This process can also plan for future risk situations, as the supplier knows the market and can give warnings well in advance.

This study discusses strategic sourcing in Chapter three whereby the various steps in strategic sourcing as well as general processes and procedures followed to set up strategic partnerships are outlined. The research emphasises strategic sourcing in the electrical energy sector. Strategic sourcing is sometimes portrayed as a seamless supply chain process. This chapter discusses the challenges in the electrical energy sector. Supply chain policies and procedures guide the buying company on how to obtain specific products and from whom to buy.

1.4.3 Supply chain risk mitigation

Global sourcing can bring many benefits to organisations but it can also expose them to some risks (Christopher *et al.*, 2011:67). Most companies do not have a structured supply chain risk management and mitigation system. Nevertheless, they do use some informal approaches to cope with risk (Christopher *et al.*, 2011:67). Suppliers with a high probability of risk event occurrences can have a substantial impact on an organisation's revenue stream (Lockamy III & McCormack, 2010:593). A common mitigation strategy is for the buying firm to expend effort, improving the reliability of its supply base. (Wang, Gilland & Tomlin, 2010:489). In some instances this can also create panic within the industry. The event through which a supply chain risk materialises is known as supply chain disruption. In contrast to risk, disruption is a manifested circumstance. It has been defined as the combination of:

- (i) an unintended and unexpected triggering event that occurs somewhere in the supply chain or the supply-chain environment, and
- (ii) a consequential situation which significantly threatens the ordinary course of business operations of a focal firm (Bode, Wagner, Petersen *et al.*, 2011:864).

The disruptions to the material, information and financial flows of a firm's supply chain have become the norm because globalisation has inevitably generated complex and tightly coupled inter-organisational networks (Bode *et al.*, 2011:864) where a disruption at one link in the chain diffuses across the entire chain.

However, Chapter four shows that the managers of supply chain risk have collected a large body of information from supply chain professionals and practitioners, due to the damaging effects that supply chain anomalies or interruptions can have on supply chain performance.

In summary, the review from the literature highlights that scholars have begun to integrate the sustainability concept into supply-chain risk management research. This study endeavours to discuss the research gap concerning managers' approaches to assessing and mitigating supply chain risk in a global context. Surveys suggest that supply chain risk is a growing issue for executives and that supplier reliability is of concern. Risks with effects on the energy sector in South Africa are not directly discussed, other than the risks that affect the developed countries directly.

1.5 PROBLEM STATEMENT

Today's supply chains are very complex inter-dependable structures due to the multitude of (partly globally) suppliers, service providers and customers taking part. Understanding and managing risk circulating supply chains is a critical issue in business and a complicated problem. Identification of supply chain risks is the first step in the risk-management process. However, transparency across the risk potential along the supply chain is not the only prerequisite for successful (in the sense of practical) risk management. The selection of appropriate (mitigation or prevention) measures builds on the structural assessment and the “impact area” of the various types of risks (Pfohl, Gallus & Thomas, 2011:839). Supply chain managers must be aware of the risks that emanate from their supply chains. Due to outsourcing, global sourcing and environmental turbulence, supply chain risks have recently gained much attention from practitioners, and supply chain risk management has evolved into one of the most active fields within supply-chain management research (Hofmann, Busse & Bode, 2014:160). Much of the work in supply chain risk management has focused on handling risks on firms' supply side (the upstream supply chain) such as supplier quality problems, delivery failures and supplier financial defaults (Bode *et al.*, 2011:864). The characteristic feature of these risks is that they materialise due to a disruption somewhere in the supply chain, which subsequently obstructs the interconnected flow of materials, funds or information among supply chain entities (Bode *et al.*, 2011:864). Previous literature concerning supply chain risk management has presented many examples of best practices, guidelines and concepts of how to either minimise the causes of disruptions (cause-oriented risk

management) or to mitigate the adverse effects induced by disruptions (effect-oriented risk management) (Hofmann *et al.*, 2014:160).

Against the background of globalised communication, information regarding, for example, labour and working conditions or environmental protection within a firm's upstream supply chains can spread rapidly. Although this may constitute a significant source of risk, the discussion of supply-chain risk management has primarily neglected these sustainability issues within supply chain operations, despite a few notable exceptions (Foerstl, Reuter, Hartmann & Blome, 2010:45; Christopher *et al.*, 2011:67). A supply-chain disruption can be set off by events that occur inside (for example, suppliers, customers) or outside (for example, natural disasters) a supply chain and can vary significantly in their magnitude, attributes and effects (Sodhi *et al.*, 2012:1). Some researchers suggest that supply chain exposure to risk has increased in recent decades due to higher demand, globalisation of markets, market saturation and increased competition as well as shorter product life cycles (Christopher & Lee, 2014:388). Nevertheless, recent studies have revealed a lack of implementation of supply chain risk management (Chadist, 2012:75). Moreover, the literature on supply chain risk is quite limited, due in part to ambiguous taxonomy. Many publications attempt to clarify the definition of relevant terms in the area of applied risk management and security (Chadist, 2012:77). However, all the supply chain risks discussed in the many kinds of literature reviewed do not explicitly mention the energy sector in South Africa.

1.6 RESEARCH OBJECTIVES

For this study, a primary objective, four theoretical objectives and three empirical objectives have been formulated.

1.6.1 Primary Objective

The primary objective of this study is to investigate supply chain risks and mitigation strategies in the energy sector in South Africa.

1.6.2 Theoretical objectives

In order to achieve the primary objective the following theoretical objectives are set for the study:

- to conduct a literature review on the electrical energy sector;

- to conduct a literature review on supply chain risk management;
- to conduct a literature review on strategic sourcing; and
- to conduct a literature review of strategic sourcing risk mitigation factors.

1.6.3 Empirical objectives

The following empirical objectives were set for the study:

- to examine supply chain risks in the energy sector in South Africa;
- to determine the effects of supply chain risks in the energy sector in South Africa; and
- to establish the strategies of mitigating supply chain risks in the energy sector in South Africa.

1.7 RESEARCH DESIGN AND METHODOLOGY

This study adopted a qualitative research design. Research paradigms discuss the philosophical dimensions of social sciences. A research paradigm is a set of fundamental assumptions and beliefs as to how the world is perceived, which then serves as a thinking framework that guides the behaviour of the researcher (Tracy, 2010:837). Qualitative research seeks to understand a given research problem or topic from the perspectives of the local population it involves. Qualitative research is especially useful in obtaining culturally specific information about the values, opinions, behaviours and social contexts of particular populations (Creswell, 2014:156). Many issues can affect sample size in qualitative research; however, the guiding principle should be the concept of saturation. This has been explored in detail by some authors but is still hotly debated, and some say, little understood (Mason, 2010:20). Other researchers have also expounded further supplementary factors that can influence a qualitative sample size, and, therefore, saturation in qualitative studies (Creswell, 2014:150). Qualitative samples must be large enough to ensure that most or all the perceptions that might be important are uncovered, but at the same time, if the sample is too large, data becomes repetitive and, eventually, superfluous (Creswell, 2014:155). As a result of the numerous factors that can determine sample sizes in qualitative studies, many researchers shy away from suggesting what constitutes a sufficient sample size (in contrast to quantitative studies, for example) (Creswell, 2014:165). Sample sizes in qualitative studies are

primarily associated with the search for knowledge, especially in the sciences and technological fields (Creswell, 2014:178). Design, in contrast, deals with the act of planning and communicating a course of action to others, usually through the creative exploration of an area of interest (Faste & Faste, 2012:8).

The essence of qualitative research is to show the characteristics and structure of phenomena and events examined in their natural context. Subsequently, these characteristics are brought together to form a mini-theory or a conceptual model. Conducting qualitative research requires an "open" attitude to understand how others experience their situation (Jonker & Pennink, 2010). The design, implementation, analysis, and interpretation of qualitative research make it unique and uniquely suited to go beyond survey research to study the complexities and meaning of the human experience (Mason, 2010:20).

1.7.1 Literature review

A literature study of the various available supply-chain risk management issues was undertaken. The research gathered and integrated secondary data to expound definitions, importance, types, activities and trends of the energy sector. During this phase of the study, textbooks, journals, magazines, newspapers and the Internet were utilised as data sources. For the study, literature related to procurement policies, procedures and documents used in the energy sector, as well as other information related to supply-chain management and risk management, were reviewed.

The literature was sourced from Internet sources such as Scopus, ScienceDirect, EBSCOHost, Web of Science, ACM Digital Library, ProQuest, Emerald Insight and JSTOR as well as magazines, and textbooks searches. Chapter two focuses on the electrical energy sector and covered topics such as the utilisation and production of renewable energy and fossil fuels in both the developed and developing countries. Chapter three focuses on strategic sourcing in the electrical energy sector as well as general processes and procedures followed to set up strategic partnerships. Chapter four focuses on supply chain risk management in the global electrical energy sector, such as supply chain risk factors, with a focus on the supply risk, the demand risk and the operational risk.

1.7.2 Empirical study

The empirical study involves the following:

1.7.2.1 Selection of participants

When sampling strategies for social research are described, a fundamental distinction is made between probability and non-probability sample approaches (Ritchie & Lewis, 2011:95). As far as the choice of participants is concerned, this study will make use of a non-probability approach in the form of purposive sampling. In a non-probability approach, units are deliberately selected to reflect features of groups within the sampled population. The approach is not intended to be statistically representative; the chances of selection for each element are unknown, but instead, the characteristics of the population are used as the basis of selection (Tracy, 2010:837). Purposive sampling is a group of different non-probability sampling techniques. Also known as judgmental, selective or subjective sampling, purposive sampling relies on the judgement of the researcher when it comes to selecting the units (for example, people, cases/organisations, events, pieces of data) that are to be studied. Usually, the sample being investigated is quite small, especially when compared with probability sampling techniques (Mason, 2010:20).

The participants in this research were managers and practitioners from various sections in the supply chain department of the South African national power utility stationed at Eskom SOC Ltd, in the Gauteng Province in South Africa. The participants have vast experience and knowledge about the number of supply chain developments and practices in the South African energy sector. Members of the sample were chosen with the “purpose” of representing a type of a critical criterion (Ritchie & Lewis, 2011:27). Many issues can affect the sample size in qualitative research. In this study, the guiding principle in determining sample size is the concept of saturation (Mason, 2010:20). In the current study, the sample was drawn from the database of the South Africa National Electricity Utility supply chain department’s professionals, with more than five years’ working experience in the supply chain environment.

Saturation of data means that the study reached a point in the analysis of data that sampling more data would not lead to more information related to the research questions (Fusch & Ness, 2015:1408). Therefore, participants were selected until that point when the views that emerged began to be repetitive, showing that there was no need to continue interviewing more participants. Failure to reach data saturation has an impact on the quality of the research conducted and hampers content validity (Kerr, Nixon & Wild, 2010:269). According to Onwuegbuzie and Leech (2010:881), research can be conducted in such a manner to attain data saturation by collecting rich

(quality) and thick (quantity) data (Dibley, 2011:13), although an appropriate study design should also be considered. Using a data collection methodology that has been used before (Porte, 2013:10) can be seen as confirmation that data saturation has been reached; moreover, evidence of the process followed to achieve data saturation must be correctly documented (Kerr *et al.*, 2010:269). Participants were interviewed until the point of saturation was reached at fourteen interviews.

1.7.2.2 Data collection methods

For this study, primary data was collected through focus groups and semi-structured in-depth interviews. Interviews and focus groups remain the most widely recognised methods for data collection in qualitative research. They are utilised with expanding recurrence in supply chain and management research, especially to access areas not amenable to quantitative methods and where profundity, knowledge, and comprehension of specific phenomena are required (Golicic & Davis, 2012:726).

For this study, the data was collected by utilising two main avenues of inquiry, namely, focus group discussions and in-depth interviews. The decision for using a particular interview technique depended on the need to access individuals that have practical experience with the explored issue. Focus group discussions were selected since they coordinate contentions of the reality with the utilisation of inductive rationale; in-depth analysis of the object (case) and interaction between researcher and the question of research (Yin, 2013:157).

1.7.2.3 Focus group discussions

Focus groups are a form of qualitative data collection technique that is commonly used in research. A group of individuals – usually six to twelve people – are brought together in a room to engage in a guided discussion of a topic (Crossman, 2016:1). Making use of fewer than six participants tends to limit the conversation, because there is not enough diversity to spark energy and creativity, while, a group larger than twelve gets to be unwieldy, and voices get lost (Nagle & Williams, 2013:1). The idea behind focus group methodology is that group processes can aid researchers to explore and clarify their views in ways that would be less easily accessible in a one-on-one interview. When group dynamics work well, the participants work alongside the researcher, taking the research in new and often unexpected directions (Sagoe, 2012:1).

In this study, three focus group discussions were held with participants who are based in the Gauteng Province in South Africa, close to the head office of the utility provider. As noted earlier, it is common that attitudes and opinions will differ from group to group as well as individuals, regardless of the homogeneity. Because of the subjective nature of focus group discussions, the study hosted three focused discussions with each of the critical stakeholder segments, to confirm any findings. The planning of the discussions must be tailored in such a manner that it discusses the empirical objectives of the study. Crossman (2016:1) further recommends digital recordings during the discussions which will eliminate the exclusion of relevant information. As recommended, a digital voice recorder was used during the focus group discussions for this study. Permission to record the discussions was requested from the participants, before commencement.

An optimal focus group has five questions; in the development stage, the researcher should brainstorm to develop a list of questions and then prioritise which issues are most important. The questions should be open-ended because the focus group intends to promote discussion. Yes/No questions or questions that are too specific can limit discussion and decrease the value of a focus group (Nagle & Williams, 2013:1). Due to time constraints, Brink (2013:1) found that a focus group would last for little more than one or two hours, and that the researcher would only have time for four to seven questions. He further suggests that researchers should include one or two initial or warm-up questions and they should get to the more fundamental questions that get at the heart of the purpose later.

The focus groups were drawn from the supply chain department, which is officially known as Group Commercial, as shown in Table 5.1. The focus group approach can be descriptive, exploratory or explanatory given the study objective. In this study, the focus group method was adopted for exploring the risks, as well as the mitigation in the electrical energy sector. This affords a proficient categorisation for similar analysis, considering there is little empirical research on the topic (Gullick & West, 2012:532). The venue and time for focus group discussions were chosen in such a manner as not to disturb participants' working hours and to ensure optimal participation without any disturbance during the sessions.

1.7.2.4 In-depth interviews

In-depth or unstructured interviews are one of the leading methods of data collection used in qualitative research (Dworkin, 2012:1319). The first key feature of the in-depth interview is that it is intended to combine structure with flexibility (Ritchie & Lewis, 2011:200). Qualitative research methods are often concerned with garnering an in-depth understanding of a phenomenon or are focused on meaning (and heterogeneities in meaning) which are often centred on the how and why of a particular issue, process, situation, subculture, scene or set of social interactions (Dworkin, 2012:1319). In-depth, semi-structured interview data constitutes the empirical backbone of much qualitative research in the social sciences (Campbell, Quincy, Osserman & Pedersen, 2013:294). With the semi-structured interview approach, participants are always asked same questions, but the questions are worded so that responses are open-ended, which allows the participants to contribute as much detailed information as they desire (Turner III, 2010:754). This informal environment allows the researcher the opportunity to develop a rapport with the participants so that the interviewee will be able to ask follow-up or probing questions, based on their responses to pre-constructed questions (Turner III, 2010:745).

Participants may also be invited to put forward ideas and suggestions on a particular topic and to propose solutions for problems raised during the interview (Ritchie & Lewis, 2011:210). The interviews were held at designated sites after consent as well as permission from crucial stakeholders had been obtained. It was envisaged that each interview would run for periods ranging between 30 and 50 minutes. The emphasis on depth, nuance and the interviewee's known business language as a way of understanding meaning, implies that interview data needed to be captured in its natural form (Ritchie & Lewis, 2011:215). This means that interview data was recorded, making use of a digital voice recorder, since note taking by the researcher would change the form of data. The researcher requested permission to record the proceedings from each participant before the interviews.

The purposive sampling method was used to select the 12 senior managers from the supply chain department, whereby semi-structured interviews were conducted with each respondent. The interviews were held at the meeting room at the Johannesburg offices of the case study company. All participants provided, as asked, signed consent and permission forms before the commencement of the in-depth interviews shown to the participants.

1.7.3 Data analysis and interpretation of results

Qualitative data analysis is a complex and challenging part of the research process which has received only limited attention in the research literature (Dierckx de Casterlé, Gastmans, Bryon & Denier, 2012:360). The crux of understanding how data can be analysed and presented in a particular approach is to provide more profound insights on what shapes and influences the collected observations, conversations or existing documents (Grbich, 2010:194). It is crucial that every interview and discussion be meticulously transcribed verbatim immediately by the interviewing researcher, including the non-verbal signals (Dierckx de Casterlé *et al.*, 2012:360). Additionally, a short report about the interviewee's characteristics and contextual characteristics of the interview is made (Dierckx de Casterlé *et al.*, 2012:360) to help the researcher comprehend the interview within its particular context. The transcript is thoroughly read at various times by the researcher, for the researcher to be familiarised with the data and so he/she may get a sense of the interview. Each interview is read as many times as necessary to apprehend its essential features (Creswell, 2014:220) without the researcher feeling pressured to move forward analytically when compiling the report. The meaning of some words or passages as interpreted tentatively by the researcher, or thoughts or reflections evoked by some readings are noted in the margins next to the text. A basic kind of analysis begins at this stage.

The concepts of the conceptual interview schemes are further tested and developed through comparison with the schemes and data of the other interviews. New themes and concepts discovered in new interviews are checked for their presence in the previous interviews (Dierckx de Casterlé *et al.*, 2012:360). The conceptual interview schemes are adapted to and refined, based on these new insights. This allows the researcher to find the essential and universal themes and concepts gradually throughout the interviews which are consequently described in a familiar and overarching conceptual interview scheme (Elo, Kääriäinen & Kanste, 2014:1). These constant forward-backwards movements with reflection on and adjustments of the common themes and concepts are carefully reported (using memos) and will guide the researcher during the process of further data collection and analysis (Dierckx de Casterlé *et al.*, 2012:360). This information can be useful in allowing the researcher to chart the development of ideas throughout the analytical process and helps provide evidence of why particular decisions were made during the process (Elo *et al.*, 2014:1) It also helps to show how a concept has been developed. In-depth, semi-structured

interview data constitutes the empirical backbone of much qualitative research in the social sciences (Campbell *et al.*, 2013:294). A concern highlighted by Strang (2010:46) is regarding the reliability of coding when one person is doing it without the assistance of the current technology available. During this research, the latest version of the ATLAS.ti software package was used to collect data. The capacity of ATLAS.ti to create visual portrayals of data assisted this study with the analysis and conceivably would assist potential readers to profoundly comprehend the interpretations (Rademaker, Grace & Curda, 2012:1).

There is usually a desire when conducting qualitative interviews for many transcripts to be produced. The modern software utilised by researchers has helped the coding and added some credibility to the results. This study followed the steps as detailed by the ATLAS.ti manuals for coding of data, detailed as follows:

- Step 1: Creating of multiple codes;
- Step 2: Merging of codes;
- Step 3: Producing labelling codes and links in graph format; and
- Step 4: Generating a table of codes count.

The coding process included the NCT analysis, described by Rademaker *et al.* (2012:1) as the essential segments of the analysis procedure which are: Noticing things, Collecting things and Thinking about things. The transcripts added in ATLAS.ti can be viewed in a window called the primary document manager. The evaluation of inter-coder reliability and agreement formed part of the development of coding schemes for qualitative data to satisfy researchers that the data was sound. This stage ended in an increased conceptual understanding of the research data as a whole, retaining the integrity of each case but taking into account the characteristics of other cases (Dierckx de Casterlé *et al.*, 2012:360). It is from the themes that conclusions and recommendations shall be drawn.

The validity of the gathered information is vital to the entire process. Incorrect or misinterpreted data could undermine the study.

Accordingly, qualitative researchers use a variety of techniques to set up validity, briefly discussed as follows:

- **Peer debriefing:** needs the researcher to work together with one or several colleagues who hold impartial views of the study. The impartial peers examine the researcher's transcripts, final report and general methodology. Afterwards, feedback is provided to enhance credibility and ensure validity (Krogh, Bearman & Nestel, 2016:1);
- **Member check:** an essential component of validation in qualitative research. During this process, the participants who provided information can determine if the researcher has accurately reported their stories; the focus is on the content of the participant's experiences, emotions, and thoughts (Koelsch, 2013:168); and
- **Bracketing:** entails researchers setting aside their pre-understanding and acting non-judgmentally. Skilled and experienced researchers are needed to use bracketing in unstructured qualitative research interviews, which adds scientific rigour and validity to any qualitative study (Sorsa, Kiikkala & Åstedt-Kurki, 2015:8).

Codes that had comparable substance were converged under a typical higher totalled code label. After this procedure of part and conglomerating, the code system formed twelve original class codes and their sub-codes up to two levels, profoundly signifying a total number of 176 codes. This procedure was repeated until a point of saturation was achieved, which is the point at which the themes started to appear repeatedly, and consequently, the information being drawn is improbable to change. (Hennink, Kaiser & Marconi, 2017:591). This helped the identification of common themes that were pervasive in the data. These universal themes were distinguished as the findings of the study.

1.8 MEASURES OF TRUSTWORTHINESS

The trustworthiness of qualitative content analysis is often presented by using terms such as credibility, confirmability, transferability and dependability. It is essential to scrutinise the trustworthiness of every phase of the analysis process, including the preparation, organisation and reporting of results (Elo *et al.*, 2014:1). Together these phases should give a reader a clear sign of the overall trustworthiness of the study. The trustworthiness of qualitative content analysis is regularly introduced by utilising terms, such as, for example, credibility, conformability, transferability, dependability and authenticity.

1.8.1 Credibility

The success of data collection should be assessed according to the specific research questions and study aims. The preparation phase also involves the selection of a suitable unit of analysis, which is equally essential for ensuring the credibility of content analysis (Elo *et al.*, 2014:1). The researcher's necessary attitude needs to be as unprejudiced as possible (some even say as blank as a white sheet of paper) in an attempt to achieve a full and almost "pure" understanding of people's behaviour in certain situations (Tracy, 2010:837). Credibility needs for the research to be linked to the study's findings with reality, to show the truth of the exploration study's findings. In this study, credibility was shown using a purposive sample, which guaranteed that only those individuals who had information related to the aim of this study were recruited as participants. To be specific, the sample was composed of managers drawn from the supply chain department of the electrical energy utility. This ensured that they had in-depth information about the operations of the organisation concerning issues such as risk management, which is the subject of scrutiny in this study.

1.8.2 Confirmability

Confirmability of findings means that the data accurately represents the information that the participants provided and that the interpretations of this data are not invented by the inquirer (Grbich, 2010:194). This is particularly important if the researcher decides to analyse the latent content (noticing silence, sighs, laughter, posture, etc.), in addition, to manifest content (Esmaili, Dehghan-Nayeri & Negarandeh, 2013:265), as it may result in over-interpretation (Dierckx de Casterlé *et al.*, 2012:360). Confirmability alludes to the objectivity, that is, the potential for consistency between at least two independent individuals about the information's meticulousness, importance, or significance (Miles, Huberman & Saldaña, 2014:365). All interviews were audio recorded, each participant signed a consent form, which method was followed to ensure confirmability with an audit trail. In the audit trail, all fourteen interview transcripts were e-mailed back to several participants to confirm their trustworthiness and to thank them for taking part in the research.

1.8.3 Transferability

Transferability refers to the degree to which the results of qualitative research can be generalised or transferred to other contexts or settings. Transferability depends on the rationale that findings

can be generalised or exchanged with different settings or groups (Brick, 2011:872). Transferability is recognised by giving scholars evidence that the study's findings could be relevant to different settings, circumstances, times, and populations. This data collections process took place at one office block, in various meeting rooms. The in-depth interviews were conducted in closed offices occupied during the day by the senior manager as workstations. These offices are locked by either the manager or the secretary who are the only other persons with access to the offices. The experience and qualifications were considered when selecting the samples. In this study, transferability was found through analysing the specific details of the study conditions and methods and then contrasting them with similar circumstances, which are more recognisable within the electrical energy sector. In this case, the specifics of the electrical energy industry in Gauteng and other South African regions were considered similar. This confirms that the findings of this study may be transferred (generalised) to the electrical energy industry in other regions of South Africa.

1.8.4 Dependability

Dependability of study findings requires researchers to make judgments about the "soundness" of the research, about the application and appropriateness of the techniques embraced and the integrity of the conclusions (Mero-Jaffe, 2011:231). Subjective research is as often as possible censured for lacking logical meticulousness with the inadequate support of the strategies received, the absence of transparency in the analytical methodology and the discoveries being merely an accumulation of proper conclusions subject to researcher bias (Galvin, 2015:2). The data collected during this study was consistent by making use of two audio recording devices; this process ensures that a backup system is available should one of the recording devices be dysfunctional during the procedure.

1.8.5 Authenticity

Authenticity is portrayed by an extensive variety of terms in qualitative studies (Smith, 2017:121). This concept is not a single, settled or widespread idea, yet instead an unforeseen construct, unpreventably grounded in the procedures and expectations of specific research methodologies and projects (Thorne, 2016:231). Furthermore, authenticity determines if the study genuinely measures what it was expected to quantify or how accurate the research results are (Galvin,

2015:2). Authenticity also focuses on how much researchers dependably and genuinely portray participants' encounters.

This study concluded that it is essential to explore the trustworthiness of every phase of the analysis process, including the preparation, organisation and reporting of the results.

1.9 ETHICAL CONSIDERATIONS

Research ethics include prerequisites on daily work, the assurance of the poise of the participants and the production of the data in the study (Mantzorou & Fouka, 2011:3). The major ethical issues in conducting research, according to Ponterotto (2010:581), are:

- a) informed consent;
- b) protection of participants;
- c) confidentiality;
- d) authorisation of the study;
- e) intellectual property; and
- f) respect for privacy.

It is essential to recognise that qualitative research methods demonstrate some remarkable ethical challenges, given the researcher's regularly extraordinary, individual, and delayed cooperation with participants in their community environments (Fusch & Ness, 2015:1408).

1.9.1 Informed consent

Informed consent is a procedure in which a person learns critical certainties about research, including potential risks and advantages, before deciding whether or not to participate in a study (Hackett, Oliveira, Jain & Kim, 2015:184). One of the critical ethical guidelines administering research is that participants must give their informed consent before partaking in a study (Cohen, 2013:3), which involves more than acquiring a signature on a form. Researchers must, therefore, guarantee potential research participants to be given adequate information about a study, in a format they comprehend, to empower them to exercise their entitlement to make an educated decision, regardless of whether they contribute in given research (Gordon, 2012:2273).

In this study, participants were informed about the background of the research and the reasons for choosing them as participants. Consent forms were signed by all participants who took part in the study, irrespective of the type of involvement. The processes were explained to the participants; and contact details were provided in case the participants should need added information from the electrical energy utility or the research department at VUT. Consents were acquired from the potential participants to make an electronic entry in the individual's electronic diary. The participants were further informed that there would be no compensation for taking part in the research.

1.9.2 Protection of participants

The researcher has to educate the participants of research on how far they will be afforded obscurity and confidentiality (Corbin, Strauss & Strauss, 2014:316). This assurance of confidentiality and anonymity given to participants must be honoured by all beneficiaries of the study unless there are clear and superseding motivations to do otherwise (Holloway & Galvin, 2016:61). Researchers should not rupture the duty of confidentiality and should not pass on identifiable information to third parties without a participant's consent (Hackett *et al.*, 2015:184). However, research data given in confidence by participants does not imply any legal benefit and may be at risk of a subpoena by a court of law (Corbin *et al.*, 2014:316); and participants to the study should be made aware of this reality as part of the consent process.

The protection of participants' rights was spelt out to them before the commencement of the data collection procedure. They were informed of their rights regarding taking part in the research and the type of protection available for this type of study. No group bookings were made, rather individuals were booked, which ensured that no prior discussions took place before the actual meetings. Participants only discovered each other's participation on the day of the interview. To allow the data collection process to flow, participants could make use of designations rather than refer to identifiable names. Before commencement, participants were informed that the recordings would become the property of the university and would be kept under the guidelines of the VUT for the prescribed period. The transcribed interviews would be edited and the names of the participants would be omitted as well as the names of the references made during the data collection process.

1.9.3 Confidentiality

The ethical obligation of confidentiality incorporates obligations to protect information from unlawful admittance, usage, revelation, alteration, forfeiture or theft (Yin, 2011:36). Initially, issues of confidentiality are discussed at the time of information collection. Discussing confidentiality at the outset is fundamental for procuring informed consent and building trust with potential participants (Holloway & Galvin, 2016:51). The next notable stage where confidentiality is addressed is the data cleaning stage, which includes the removing of identifiers to create a “clean” data-set (Ellingson, 2017:156). An uncontaminated data set does not contain information that recognises participants (Dewey & Zheng, 2013:23), such as a name or address (such identifying information might be stored elsewhere, in separate, protected files).

The purpose and framework of the study were discussed with every individual before each interview, guaranteeing a comprehension of the research involved. All the recordings and transcripts were archived according to the guidelines given by VUT. All data naming participants were removed during the transcribing phase. The consent forms signed by the participants highlighted the individuals who would have access to the data.

The list of participants in Table 5.1 comprises all the individuals who took part in the focus groups, and Table 5.2 shows individuals who took part in the in-depth interviews. All participants were assured that their comments would be non-inferable within the study. Participants completed consent forms before the interviews for both ethical reasons and as an audit trail. The explanation behind obscurity is that it gives the interviewee a chance to talk uninhibitedly and honestly about the researched topic. This provides an entire dialogue where the interviewees are less likely to restrict the profundity of information given so as not to repudiate the company position.

1.9.4 Authorisation of the study

Before commencement of the study, in line with the protocols, rules and procedures of the Vaal University of Technology, approval was obtained from the Higher Degree Committee. This study followed the ethical guidelines, which were explained to the participants prior to, during and after the interviews and discussions.

Further permission was obtained from the ethical office of the participating company, which is valid until 2020 and is attached to this study as Appendix A. The process of obtaining permission

allows the study to collect data in line with the guidelines of the participating company. The company has been chosen because it has a national footprint and has a large procurement budget for both goods and services and faces different risks daily.

1.9.5 Intellectual property

Intellectual Property (IP) alludes to manifestations of the mind; for example, inventions, abstract and creative works, designs and symbols, names, and images used in commerce. IP is ensured law by, for instance, licenses, copyright, and trademarks, which empower individuals to acquire acknowledgement or financial advantage from what they invent or make (Bently & Sherman, 2014:31). As “plagiarism” is a genuine issue with important legal and ethical ramifications, academic institutions should establish guidelines for maintaining a strategic distance from the theft of ideas or works under the umbrella of intellectual property in their respective environments (Foltýnek, Rybička & Demoliou, 2014:21). Plagiarism in academia can be described as the “unjust adoption” and “pilfering and publication” of another author's "language, contemplations, ideas, or expressions” and the portrayal thereof as one's “innovative work” (Elander, Pittam, Lusher, Fox & Payne, 2010:157). Whereas plagiarism in some contexts is considered theft or stealing, the notion does not exist in a legal sense, though the custom of using someone else's work to increase academic credit, may meet some legal meanings of extortion (Doró, 2016:15).

To ensure that plagiarism is avoided during the current study, the referencing, citing and sourcing was done in line with the prescribed methods and the latest approved guidelines from the Vaal University of Technology.

1.10 CHAPTER SUMMARY

The final thesis is sub-divided into the following chapters:

Chapter 1: Introduction and background of the study

This chapter outlines the research objectives and questions, research framework, research scope and the structure of this thesis. It briefly highlights the requirements for this research and outlines how the research will be conducted.

Chapter 2: Overview of the energy sector

This chapter presents an overview of the energy sector, which is the context of the research study. The chapter discusses the history and development of the energy sector, as well as the challenges and opportunities facing the industry now.

Chapter 3: Strategic sourcing

This chapter discusses strategic sourcing as an institutional procurement process that continuously improves and re-evaluates the purchasing activities of a company. The application of strategic sourcing in the various industries, especially in the energy sector is discussed. As part of the supply chain, strategic sourcing is highlighted, and the latest methodologies are discussed.

Chapter 4: Supply chain risk management

This chapter concentrates on the objectives driving supply chain risk management as well as outlines models, tools and techniques which have been developed to mitigate risks in supply chains. Moreover, it also discusses common barriers that organisations face when dealing with risks along the supply chain. Furthermore, it outlines how the traditional ways of running supply chains are not fit for purpose in today's volatile markets, while a detailed discussion about strategic sourcing and the application thereof is covered.

Chapter 5: Research methodology

This chapter is dedicated to the identification of suitable methods and methodologies for the research. Selecting the appropriate methodology is the key to undertaking and delivering valuable research. As a result, it discusses every detail considered when the research study was designed, from its ontological stance to the data collection and analysis stages.

Chapter 6: Findings and discussion

This chapter compares the findings from the different interviews by critically discussing them. The chapter draws out key insights into the relationship between organisational culture and risk management in the supply chain. It provides clues about the influence an organisation's culture has on supply chain risk management, how different supply chain environments influence

organisational cultures, and it generates understanding of how organisational cultures may be harnessed to support supply chain risk management.

Chapter 7: Conclusions and recommendations

This chapter concludes the study and further summarises the fundamental contributions of the thesis. More specifically, the chapter highlights general contributions made by the study, that is, contributions to theory as well as contributions to practice. A reflection on the research objectives as well as a discussion of the limitations of the research is provided. Furthermore, this chapter presents the directions for future research in this field.

1.11 CONCLUSION

This chapter proposes the overall research design of this thesis and explains in detail the methods applied to each research phase. Firstly, it discusses research philosophy, research approach, research strategy, and time horizon and research choice as an overarching idea of research methodology. Subsequently, it presents and justifies the data collection and data analysis methods of model development and model validation. The sampling process, administration and data analysis method of focus groups and the in-depth interviews and statistical analyses including ATLAS.ti 8 are discussed in detail to define the methodology. The results are discussed in detail in Chapter six.

CHAPTER 2

DEVELOPMENTS WITHIN THE WORLD OF THE ELECTRICAL ENERGY SECTOR

2.1 INTRODUCTION

This chapter discusses countries that have received media coverage with regard to specific several reasons throughout the most recent decade. Beginning with Europe and the investigation into the British electrical energy sector, Britain was in the news for several reasons over the last year. Notable was the referendum in June 2016 to decide on their withdrawal from the EU, which was labelled as BREXIT by the media. With the recent change of leadership, in one of the most developed and competitive countries in the world, this chapter further discusses the electrical energy sector of the United States of America (US). Not to be missed were the headlines; a fierce battle between Hillary Clinton and Donald Trump for the US presidential race finished on 8 November 2016 with Donald Trump becoming the new president of the United States.

Presently, the fastest developing economy in the world, with the most significant population, this chapter reviews the electrical energy sector of the People's Republic of China, ordinarily known as China. The nation is the pioneer in electrical energy use in the world. Africa is steady in the news, either for her magnificence, respected by the developed world or for her difficulties faulted in the colonial past. Whichever way, this chapter discusses distinctive parts of the mainland, the opportunities for renewable energy and the hardships with the developing of the different economies. Such hardships include the 2011 Arab spring challenge in which Morocco took part, the terrorist assaults in Kenya's Westgate shopping mall in June 2013. The mass abductions in Nigeria by extremist groups, including the kidnapping of 276 schoolgirls from Chibok in April 2014. With the now infamous *fees must fall*, a slogan utilised by South African students, dissenting with the expectation of free tertiary training, which began in 2015 and picked up energy amid September 2016.

The chapter concludes with a summary of the electrical energy sector in the countries that form part of the chapter.

2.2 DEFINING THE ELECTRICAL ENERGY SECTOR

Electrical energy is arguably a valuable resource of energy, essential in fulfilling the requirement for contemporary electrical energy services for the socio-economic well-being of households' efficiency and financial growth within a country. Electricity lights homes, workplaces and public areas, supports information and interaction technology, allows financial transactions and abilities and runs devices and mobile phones. Without electrical energy, financial development would not be possible, individual achievements would become the order of the day, and national security would become a nightmare. Cost-effective, efficient power is essential to modern life. It provides clean energy, safe light around the clock; it cools down buildings on hot summer days and warms many of them in winter, and it silently inhales lifestyle into the digital world (Institute for Energy Research, 2014:1). Electrical energy is, therefore, an inextricable part of a nation's security (Akinbami & Lawal, 2010:346). The electrical energy sector is segmented into what is known as generation, transmission and distribution.

2.3 THE ELECTRICAL ENERGY SECTOR IN EUROPE

The European single business sector programme launched in 1987 was aimed at member states to remove any physical, legal and financial hindrances with a specific end goal to acquire the free development of merchandise, administrations, capital and work in the European Union (EU) (Domanico, 2011:5064). Accessibility of electricity was identified as one of the key variables influencing the prosperity and smooth working of advanced social orders (Chalvatzis & Ioannidis, 2017:2196). The Single Europe Act needed, in addition to other things, the abolishing of state-owned monopolies. These progressions connected, likewise, to the electrical energy sector (Domanico, 2011:5064). It is conceivable to contend that the prerequisite of securing electrical energy sector resources has become predominant to the degree that it drives the foreign affairs agendas of nations at all phases of improvement. The year 2007 was a defining moment for the European Union's climate and energy strategy (Jäger-Waldau, Szabó & Scarlat, 2011:3703). During the European Council meeting in Brussels on 8–9 March 2007, the Council endorsed a binding target of a 20 percent share of renewable energies in the comprehensive EU energy utilisation by 2020. At least a focus on a 10 percent reduction to be accomplished by all member states for the share of bio-fuels in overall EU transport and diesel consumption (Domanico, 2011:5064). The prosperity of individuals, industry, and the economy relies on safe, secure,

sustainable, and moderate energy usage. Energy is an everyday need in a modern world and is most of the time underestimated in Europe (Morales Pedraza, 2015:64). There has been a critical increment in energy generation and distribution over the last 100 years, giving more relief and specific opportunity; however, in the meantime, it pollutes the environment and (at least moderately) and drainsexisting reserves (European Union, 2011:1). This research considers the electrical energy sector of countries and regions in the EU with variable performances.

2.3.1 The electrical energy sector in Britain

The United Kingdom (UK) is found north-west of the European region between the Atlantic Ocean and the North Sea. It has a total land area of 244,100 square kilometres, of which 99 percent are islands and the rest water. From north to south, it is about 1,000 kilometres long. The official name of the UK is the "United Kingdom of Great Britain and Northern Ireland." The United Kingdom is made up of England (capital is London), Scotland (capital is Edinburgh), Wales (capital is Cardiff) and Northern Ireland (capital is Belfast) (Sweidan & Alwaked, 2016:1363). Figure 2.1 further shows the various locations. When the electrical energy sector was developed over 100 years ago, offering electricity to consumers, it was viewed by policymakers globally as a service that was unsuitable for competitors (Anderson, 2011:70). Under the current UK regulating structure for electrical energy sector distribution systems and resources, improvements are planned with the goals of reducing both capital expenses (and thus customer fees) and common expenses such as those associated with pollutants and client disruptions (Martínez Ceseña, Turnham & Mancarella, 2016:63). Since the privatisation of the UK's electrical energy sector began in 1990, the regulating structure of distribution networks has gone through several modifications, based on the continually changing goals and conditions throughout the nation and the electrical energy sector (Pearson & Watson, 2012:10).

Figure 2.1 The United Kingdom



Source: Bishop, Amaratunga and Rodriguez (2010:633)

The UK was one of the first EU nations to liberalise gas and electricity markets through privatisation and open-access systems (Anderson, 2011:70).

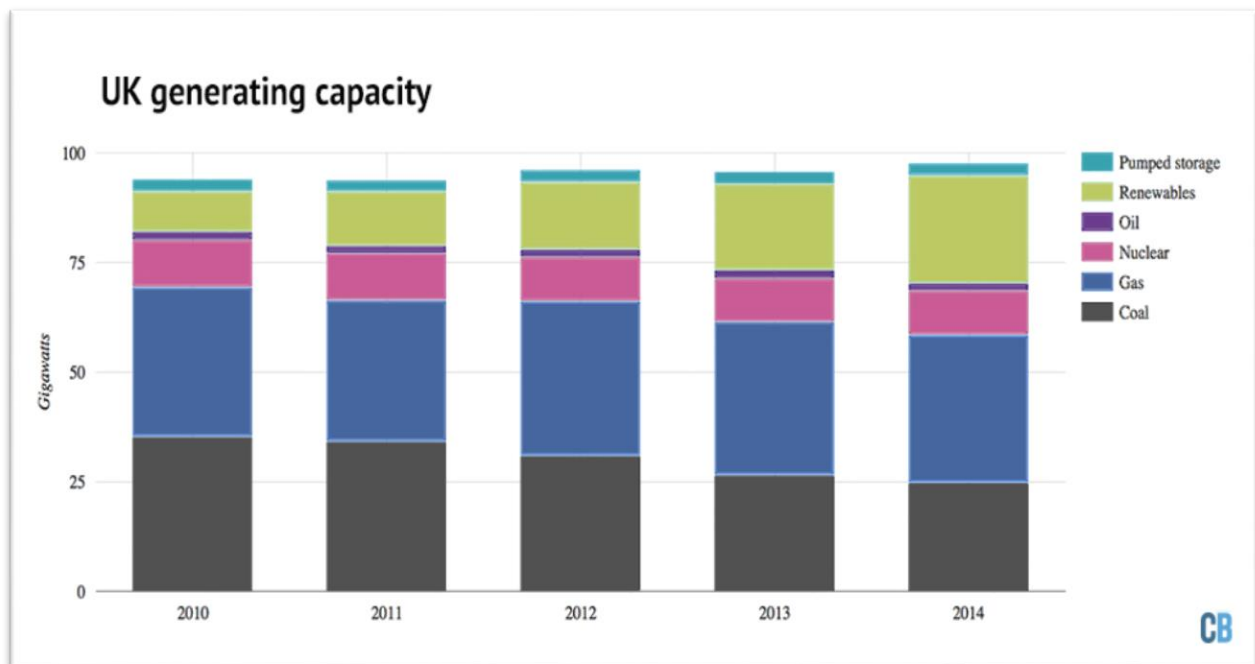
2.3.1.1 Electrical energy generation

Great Britain's centralised system of electrical generation includes vast power stations with independently significant ecological effects (Shaw, Attree & Jackson, 2010:5927). Recently, the UK has added thousands of renewable-energy techniques to its ageing and diminishing resources of coal, nuclear and gas plants (Pearce & Evans, 2015:1). However, these mature resources still contribute to most of the UK's electrical energy sector.

Different methods are used to produce electrical energy in the UK. Electrical power is produced in several ways. Recently, UK government authorities have outlined numerous responsibilities to reduce CO₂ emissions (Department of Energy & Climate Change, 2011:1). In the early 2000s, issues increased over the possibilities of an 'energy gap' in the UK's electrical energy generating

potential. This was predicted to occur because it was expected that some fossil fuel-fired power stations would close due to being incapable of fulfilling the clean-air specifications of the European Large Burning Place Directive (Shaw *et al.*, 2010:5928). There has been a stable flow of closures over the past few years as old and unclean coal plants have closed, rather than spending money on air contamination management. Figure 2.1 shows the generating capacity of coal and gas over the period 2010 and 2014. The days of using coal are numbered if the stated phase-out period of 2023 is achieved. The numbers in the figure show full potential, such as renewable sites, which will lower electrical energy results more than the potential would suggest (Pearce & Evans, 2015:1).

Figure 2.2 UK electricity generating capacity by fuel type



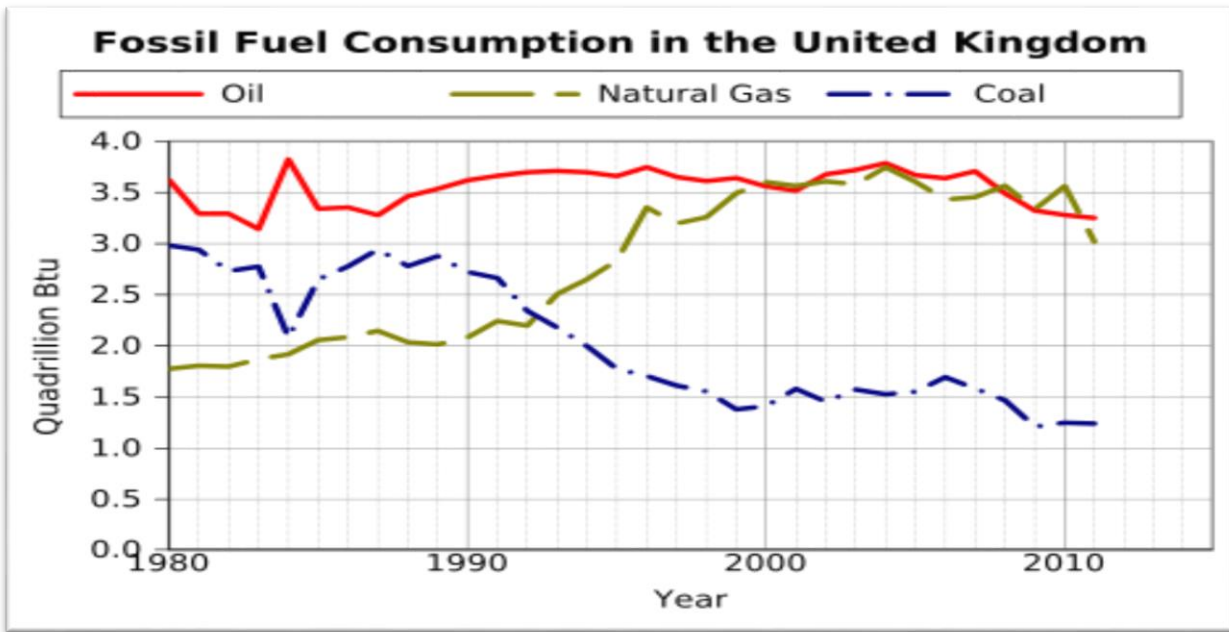
Source: Pearce and Evans (2015:1)

2.3.1.2 Fossil fuels

Issues over oil have been raised by high-profile comments in Britain such as by renowned chemist Sir Bob King (Adam, 2010:23) and the UK Industry Task-Force on Peak Oil and Energy Security (European Union, 2011:45). **Error! Reference source not found.** visibly illustrates that the consumption of fossil fuel (coal) in the UK has declined through the 90s, while natural-gas usage expanded (Adam, 2010:23). Conversely, the fastest developing resources of world energy are

renewable-energy sources and nuclear energy. Apart from this, Morales Pedraza's (2015:64) prognosis is that the renewable share of total energy use is expected to increase from 11 percent in 2010 to 15 percent in 2040. An increase of 4 percent and the nuclear portion is anticipated to grow in the same period from 5 to 7 percent, which is an increase of 2 percent.

Figure 2.3 Fossil fuel (coal) consumption in Britain



Source: Simpson and Min (2011:14)

The risks presented by global warming and local air pollution raise community and governmental issues regarding the feasibility of the continued use of non-renewable fuel and other strong fossil-fuel sources in electrical energy generation, although for most European nations, solid fuels are the most significant natural energy source (Chalvatzis & Ioannidis, 2017:2196).

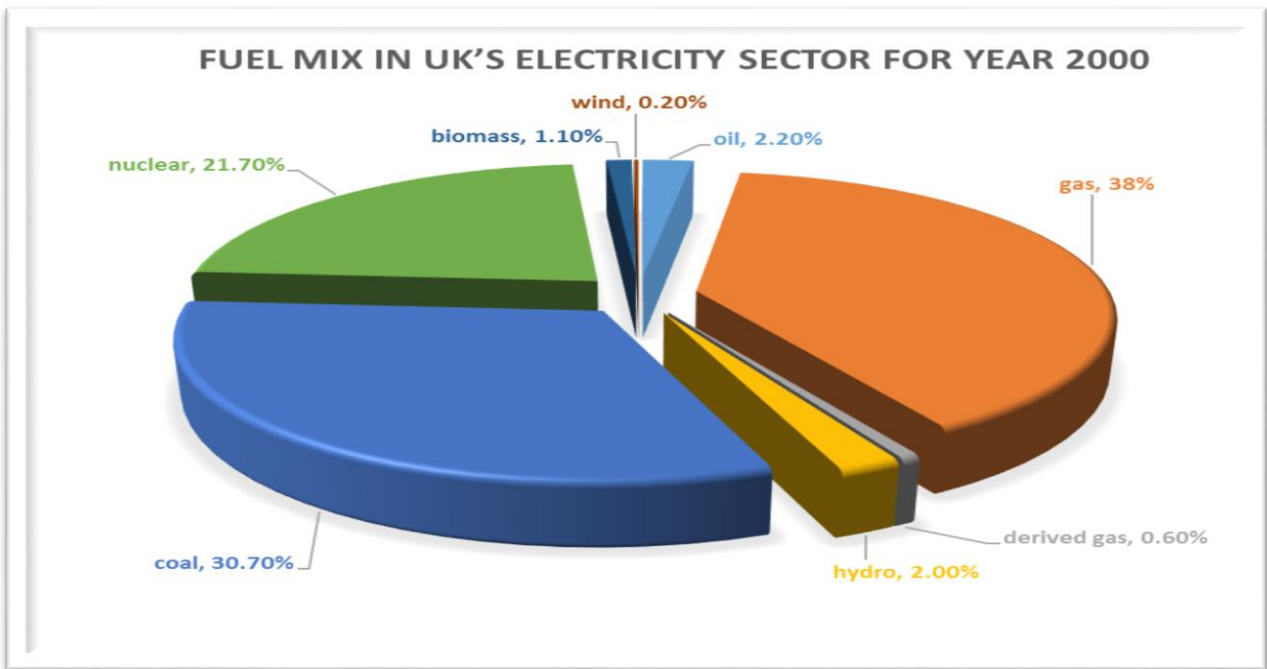
2.3.1.3 Electrical energy supply in the UK

The UK government's plan to close all coal-fired power stations by 2025, heterogeneous with the retirement of most of the UK's ageing nuclear fleet and the increasing electrical energy requirement, will have the UK experiencing a 40-55 percent electrical energy supply gap (Institution of Mechanical Engineers, 2016:1). Recent technological innovations, such as offshore wind as well as Carbon Capture and Storage (CCS), needs investment to keep costs down. The

market should be open to every technological innovation, such as a contribution of an onshore breeze (Evans, 2016:1). Chalvatzis and Ioannidis (2017:2196) further allude that accessibility to electrical energy is one of the critical aspects impacting the well-being and glossy performance of contemporary society in the UK. It is now feasible to claim that the need for secure energy resources has become prominent at the level that it drives the foreign affair's schedules of countries at all stages of development (Tekin & Williams, 2010:13). Many nations in Europe, including Britain, have been trying to enhance public-sector performance in the last decade (Vilko, 2013:27). This could strengthen competition as customers will not necessarily look for the cheapest source but also the most effective for their needs regarding electricity supply. As dependency on electricity develops, the electrical energy sector providers with higher flexibility and user-friendly features become more popular (Chalvatzis & Ioannidis, 2017:2196).

With the enhancing of the national grid and the change to using electricity, the UK's electrical energy sector usage improved by around 150 percent between the post-war nationalisation of the market in 1948 and the mid-1960s (Evans, 2016:27). The standard volume of electricity required annually to light and heat the UK home decreased from 720 kilowatt-hours in 1997 to 508 kilowatt-hours in 2013, a decrease of 29 percent (Marshall, 2013:1). The UK generation mix is covered by traditional thermal generation, which in 2005 accounted for 77 percent (308 GWh) of the generation of 400 GWh, with nuclear contributing 20 percent (82 GWh), hydro 2 percent and wind 0.8 percent (Chalvatzis & Ioannidis, 2017:2196). This is an indication that the UK is highly dedicated to supporting renewable energy as an aspect of their global warming strategy (Bishop *et al.*, 2010:633).

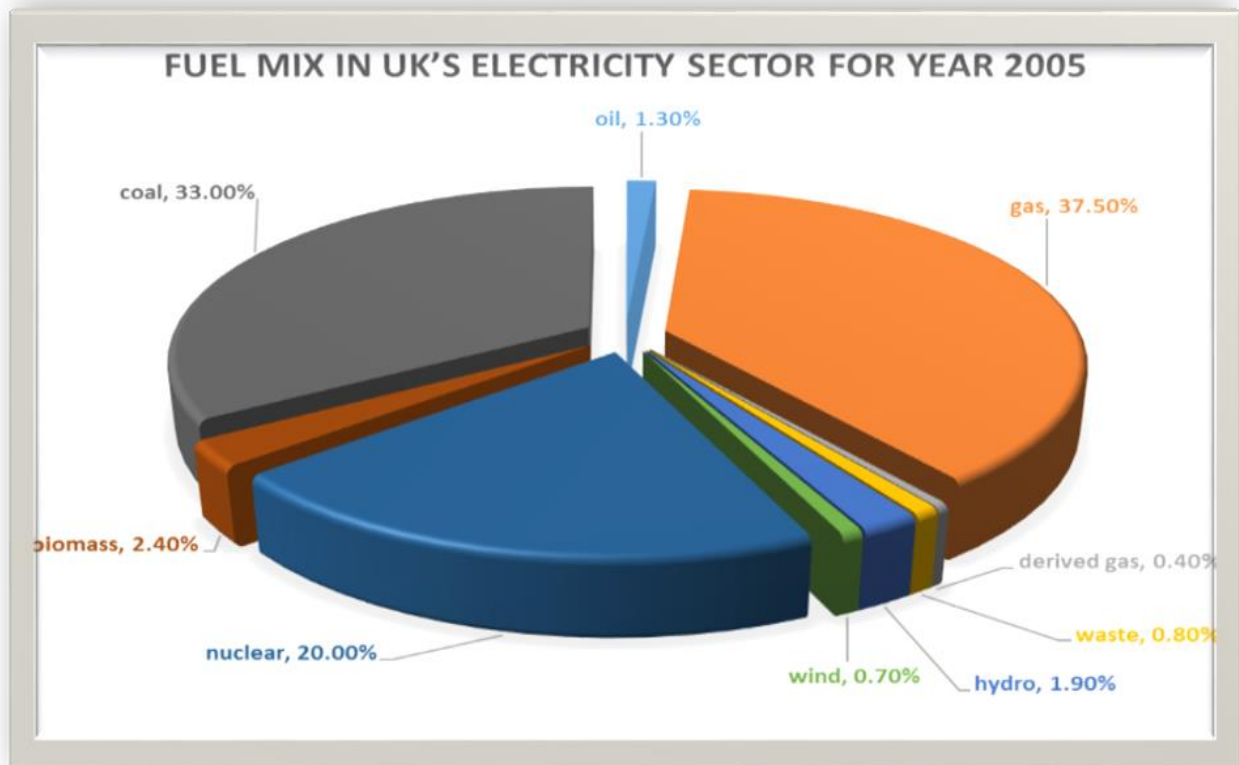
Figure 2.4 Fuel mix in UK's electricity sector for the year 2000



Source: Bishop *et al.* (2010:633)

Looking at electricity in the UK at the turn of the century and comparing it five years later we can see that in 2005 these representations of the UK energy mix in 2000, shown in the realisation was that natural gas, coal energy and nuclear, are the prominent fuel resources for the British electrical energy sector for both years. Hence, although the ratios of these fuels changed in the analysed reward period, there are some changes, only slightly from 90.2 to 90.5 percent. The share of coal energy improved by 2.3 percent between 2000 and 2005, while that of nuclear power dropped by 1.7 percent. The change in carbon energy source in the year 2000 was 25 percent, while hydro, wind, biomass and nuclear power all contributed (Bishop, Amaratunga & Rodriguez, 2011:971; Chalvatzis & Ioannidis, 2017:2916). In 2005, the relative usage found was 25.8 percent due to the decreased use of nuclear power offsetting the higher contribution of all renewable types except hydro, which dropped by 0.1 percent.

Figure 2.5 Fuel mix in UK's electricity sector for the year 2005



Source: Chalvatzis and Ioannidis (2017:2916)

At the same time, the use of oil for electrical energy generation dropped from 2.2 percent to only 1.3 percent. Lastly, in 2000 the UK was required to import 3.7 percent of its electrical energy requirement, while the respective figure for 2005 was 2 percent (Chalvatzis & Ioannidis, 2017:2916). The decrease shows that the UK used less oil energy.

Given that electrical energy generation units are typically public-owned and outsourcing is a relatively new trend, there is a need for new knowledge that will highlight the recognition of outsourcing opportunities and improved understanding of the potential competitive benefits to those working in the electrical energy sector (Vilko, 2013:40). Between 2007 and 2012, the UK's best energy requirement dropped from 61.5 to 57.5 gigawatts. The advantages of cost-effective

lights are good news for the UK, which will need to work steadily to keep up its electrical energy supply. Ageing electricity power stations have been redundant over the last few years. New ability from renewable energy is slowly ramping up, and organised nuclear reactors are ten years away. This indicates that the risk of energy shortages could increase within the next five decades (Marshall, 2013b: 2). Thirty gas-fired power stations (Combined-cycle Cycle Gas Turbines, CCGTs) are required to fill the supply gap it identifies with (Evans, 2016:1). The UK's energy sources are not distributed equally. Most remarkably, the UK's solar plants are focused in the southern parts, where insulation rates are higher than the northern regions. In the south of the UK, the obvious observation is the small-roof solar, which is more predominant (Pearce & Evans, 2015:2). Together with the government's low carbon conversion strategy and the evaluation of energy markets, the government understands that these indicate its identification of the need for a '*more interventionist*' strategy in the electrical energy sector (Shaw, Attree & Jackson, 2010:5930).

2.4 THE ELECTRICAL ENERGY SECTOR IN UNITED STATES OF AMERICA

The United States of America (USA), known as the United States (U.S.) or America, is a federal republic consisting of fifty states and a federal district (Sharkey, 2014:903), as shown in the map in Figure 2.5. The forty-eight states and Washington, D.C. are in central North America, between Canada and Mexico (Sicotte, 2014:1850). At 3.80 million square miles (9.85 million km²) and with over 320 million people, the United States is the fourth-largest nation by complete area and the third most populated (Elliott & Frickel, 2013:521). It is one of the world's most ethnically diverse and modern nations, the product of large-scale settlement from many countries (Sharkey, 2014:903). The location and environment of the United States is also incredibly diverse, and the country is home to numerous types of wildlife (Clement, 2010:291). The United States is a developed nation and has the world's leading national economic system, gaining from loads of natural resources and high employee efficiency (Alba & Foner, 2015:195). While the U.S. economy is considered post-industrial, the country remains one of the world's major producers (Elliott & Frickel, 2013:128).

Figure 2.6 Map of the United States of America (USA)



Source: Sharkey (2014:903)

The electrical energy sector of the United States has a broad range of stakeholders who provide services through electricity generation, transmission and distribution and marketing for industrial commercial, public and residential customers (Lueken, Klima & Griffin, 2016:1160). It also contains many community organisations that control the electrical energy sector in many states (Xu & Chen, 2006:2455). In 1996, there were 3,195 electrical energy utilities in the United States, of which less than 1,000 were involved in electrical energy generation (Kahrl, Williams, Jianhua & Junfeng, 2011:4032). This leaves merely many, mostly smaller resources involved only in electrical energy distribution. Out of all the utilities, 2,020 were publicly owned (including ten federal utilities), 932 were rural electric companies, and 243 were investor-owned utilities (Elliott & Frickel, 2013:521). The electricity transmitting network is managed by Independent System

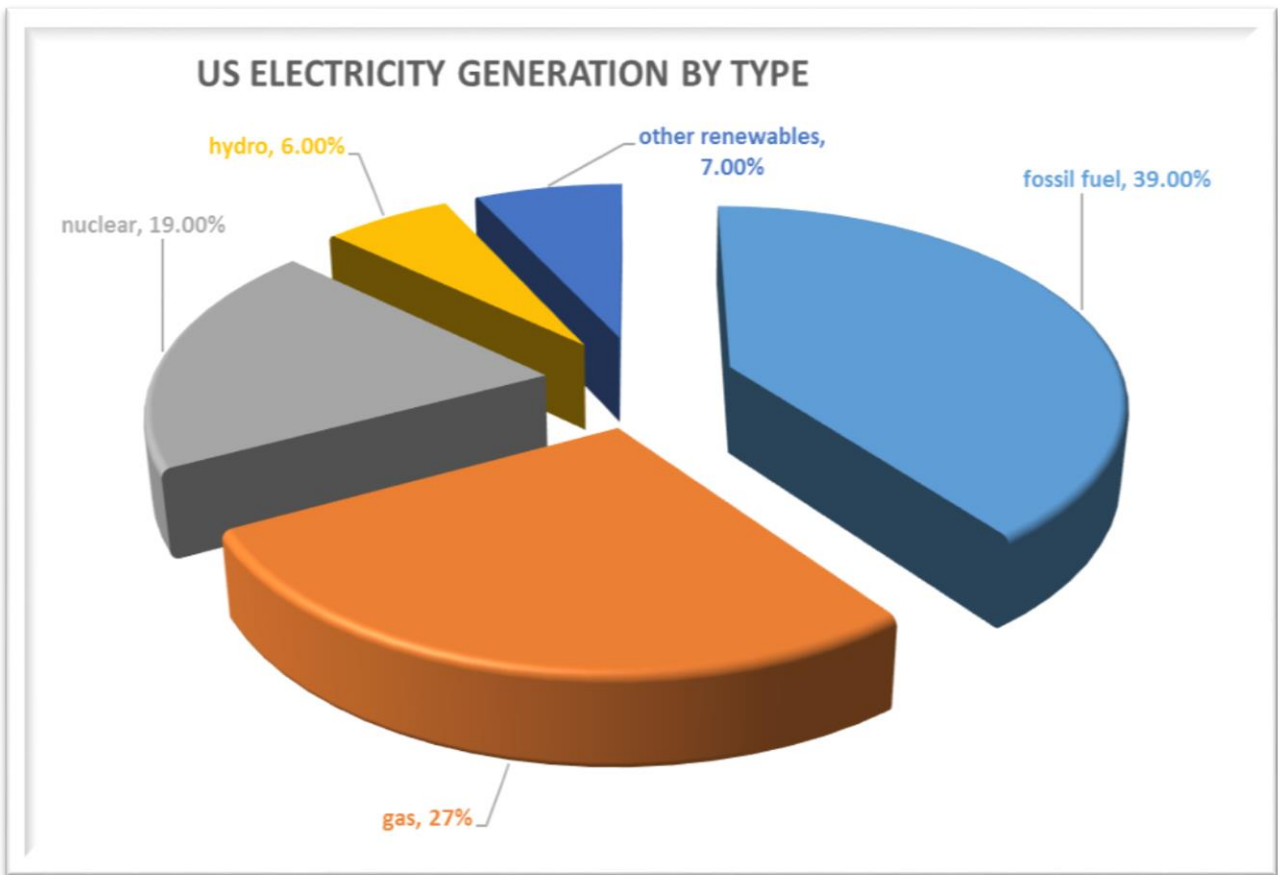
Operators or Local Transmission Companies, which are non-profit organisations that are required to provide infrequent access to various providers to promote competition (Venkatesh, Jaramillo & Griffin, 2012:9838).

While precise prediction of future sales or requirements is useful for any business, it is particularly so for the electrical energy sector. This is mainly because the demand for electrical energy must be met in real-time, as opposed to other businesses, where the suppliers of electrical power depend on a list of saved electricity as a shield against varying supply and demand (Jun & Tolga Ergün, 2011:810).

2.4.1 Electrical energy consumption in the USA

The primary sources of US electrical energy supply in 2014 were: fossil fuel (39%), gas (27%), nuclear (19%), Hydro (6%), and other renewables (7%) (Bishop *et al.*, 2010: 633). Figure 2.6 illustrates the generation of several types of electricity. Over the decade years 2004—2014, most increases in electrical energy generation came from gas (2014 generation was 412 billion kWh greater than 2004), wind (a rise of 168 billion kWh) and solar (an increase of 18 billion kWh). Over the same period, yearly generation from fossil fuel reduced by 393 billion kWh, and from oil, decreased by 90 billion kWh (Lueken *et al.*, 2016:1166). The system operators in a large area, such as the Independent System Operators (ISOs) in the USA, generate short-term forecasts of the electrical energy requirement, or the system load as the part used for system operation and the loss in transmission (Jun & Tolga Ergün, 2011:811). These forecasts are freely available to US citizens. In 2008, the standard electricity cost in the U.S. was 9.82 cents/kilowatt-hour (kWh) (Aad, Abajyan & Abbott, 2012:1).

Figure 2.7 US electricity generation by type - 2014



Source: Bishop *et al.* (2010:633)

In 2006-07, tariffs in the U.S. were higher than in Australia, Canada, France, Sweden and Finland, but less than in Germany, Italy, and the UK (DiTomaso, 2013:256). Residential charges differ between the various states from 6.7 cents/kWh in West Virginia to 24.1 cents/kWh in Hawaii (Pontikes, 2012:81). **Error! Reference source not found.** illustrates a detailed annual breakdown of the usage by fuel source. The regular residential bill in 2007 was US\$100/month (Aad *et al.*, 2012:1). Private companies fund most investment strategies in the U.S. electrical energy sector through debt and equity (Jochem, Doll & Fichtner, 2016:60). However, some investment strategies are ultimately funded by taxpayers through various financial assistance methods varying from tax rewards to financial assistance for research and growth and feed-in charges for renewable energy and assistance to low-income homeowners to pay their utility expenses (Pontikes, 2012:81).

Table 2.1 Yearly per-capita consumption (kWh) by fuel source 1999-2014

Yearly US Per capita Consumption (kWh) by Fuel Source 1999-2014														
Year	Population (M)	Fossil Fuel				Nuclear	Renewable							Misc
		Coal	Oil	Gas	Sub Total		Hydro	Geo Thermal	Solar	Wind	Wood	Bio other	Sub Total	
2014	318.857	4,961	95	3,571	8,626	2,500	813	50	55	570	133	68	1,689	190
2013	316.129	5,001	86	3,599	8,686	2,496	850	50	29	531	127	66	1,651	176
2012	313.874	4,824	74	3,944	8,841	2,451	880	50	14	449	120	63	1,576	179
2011	313.85	5,523	96	3,267	8,886	2,518	1,018	49	6	383	119	61	1,636	147
2010	309.33	5,972	120	3,230	9,321	2,609	841	49	3.9	306	120	61	1,382	108
2009	307.01	5,719	127	3,034	8,881	2,602	891	49	2.9	241	117	60	1,361	135
2008	304.38	6,524	152	2,939	9,616	2,649	837	49	2.8	182	123	58	1,252	126
2007	301.58	6,686	218	3,018	9,922	2,674	821	49	2	114	129	55	1,170	121
2006	298.59	6,666	215	2,782	9,663	2,636	969	49	1.7	89	130	54	1,292	83
2005	295.75	6,806	413	2,618	9,838	2,644	914	50	1.9	60	131	52	1,209	105
2004	293.05	6,751	413	2,475	9,639	2,691	916	51	2	48	130	53	1,199	58
2003	290.33	6,798	411	2,292	9,502	2,631	950	50	1.8	39	129	54	1,224	41
2002	287.8	6,717	329	2,441	9,486	2,710	918	50	1.9	36	134	52	1,193	90
2001	285.08	6,679	438	2,274	9,390	2,697	761	48	1.9	24	123	51	1,009	88
2000	282.17	6,968	394	2,179	9,542	2,672	977	50	1.7	20	133	82	1,263	117
1999	279.04	6,741	423	2,045	9,209	2,610	1,145	53	1.8	16	133	81	1,430	96

Source: Pontikes (2012:81)

Natural gas is seen by several as the future of United States energy; a source that can offer energy freedom and reduce greenhouse-gas pollutants in the process. However, there have also been misinterpretations regarding the weather effects of the improved use of gas for electrical energy and transport (Alvarez, Pacala & Winebrake, 2012:6435). Over the previous decade, shale gas development has increased USA household gas manufacturing by 40 percent (Lueken *et al.*, 2016:1160).

Non-renewable energy sources, mainly coal and natural gas remain the central source of electrical energy creation in the U.S., comprising 68 percent of installed generation volume in 2010 (International Renewable Energy Agency, 2016:1). In 2007, the Division of Energy approximated

the forecasting of additional potential for 2008-2012 at 92 GW, most of which is to be provided by organic gas (48 GW) and coal (US Energy Information Administration, 2016:4).

As of 2007 in the U.S., there are 104 commercial nuclear reactors, producing roughly 20 percent of the country's total electrical energy consumption (Lambert, Nelson & Jovanovic, 2015:107). For many years, no new nuclear plants have been constructed in the US (Lambert *et al.*, 2015:107). However, since 2005 there has been a changed awareness towards nuclear energy in the US. This has been assisted in part by the federal government with the Nuclear Power 2010 Program of 2002 (Bishop *et al.*, 2011:971).

Total revenue from the sale of electricity in 2008 was US\$344 billion, together with US\$148 billion from residential customers, US\$129 billion from business customers and US\$66 billion from industrial customers (US Energy Information Administration, 2016:4). Several massive industries are self-generating electrical energy, and their electricity consumption is not included in these figures. Non-public corporations support most investments within the U.S. electrical energy sector through debt and equity (Guerre & Kittler, 2012:16). However, some investments are indirectly supported by taxpayers through many subsidies.

2.5 THE ELECTRICAL ENERGY SECTOR IN ASIA

Lack of access to clean, affordable and adequate energy and large-scale use of solid fuels such as firewood and cow dung cakes are one of the reasons for a lower quality of life in developing countries (Behera, Rahut, Jeetendra & Ali, 2015:468). This has been a significant international problem in discussions about maintainable financial growth and atmosphere for the last several decades (UN-SG AGECC, 2010:4). There is a perception that the majority of households around the world that use solid fuels are situated in South Asian countries (Vidyarthi, 2014:188). Besides the reduction of non-renewable energy, the build-up of their pollutants has disastrous effects on the environment. Modern civilisations are more interested in environmental purity (Awan & Khan, 2014:236), hence the embracing of renewable energy. Electrical energy supply in remote areas and islands far from the utility grid has been a considerable undertaking. However, the electrical energy shortage is a paradox in some of these places with abundant renewable energy sources (Wang, Gilland & Tomlin, 2010:489).

Renewable energy could be an essential means of generating electricity in Asia (Mahmood, Javaid & Zafar, 2014:82). For solar energy, Asia has the ideal mixture of both much solar-energy installations and a pronounced solidity of potential customers (Hossain & Howard, 2014:94). Affordable solar energy would bring electrical energy to a significant slice of the subcontinent's people, who still live off-grid, bypassing the necessity of installing costly gridlines (Khalil & Zaidi, 2014:194). Additionally, since the prices of electrical energy captured for temperature management directly impacts on a region's energy intensity, and with cooling load requirements roughly in phase with the sun's strength, cooling from extreme solar radiation makes excellent energy-economic sense in the subcontinent (Awan & Khan, 2014:236). Research conducted by Rahman, Noman and Shahari (2016:82) reveals that both G8 countries and Southeast Asia are energy dependent, with the G8 countries being the most electrical energy-efficient economies and the least efficient in Asia.

Asia is the world's most populated region, located mainly in the southeast and north hemispheres (Zhang & Yeung, 2012:612). It includes 8.7 percent of the earth's total surface and comprises 30 percent of its land area (Vidyarthi, 2014:182). It was recorded during 2015 that Asia has a population of 4.3 billion people, which is equal to 60 percent of the earth's inhabitants (Hossain & Howard, 2014:94). According to the UN Department of Economics and Social Affairs (2015:5), China is the most populated nation in Asia, with over one billion people. Historically, Asia was known for its history of ancient civilisations, philosophies and religions, performing arts and exotic lifestyles, as well as spicy cooking specialities (Dutta, 2011:52). In many of the thriving financial systems in Asia, the need for electrical energy is growing at least as fast as the rate of development within the financial system (Bortolini, Gamberi & Graziani, 2014:81). For economic development to continue, the growing need for electrical energy must be met. Being the most celebrated region in the world, Asia contains fifty separate nations and consumes the eastern part of the single Eurasian zone, as indicated in Figure 2.8 (Zhang & Yeung, 2012:612). The most frequented by visitors is China, as it is an enormous cultural centre, followed by the less well-known locations like India, Thailand and Malaysia (Vidyarthi, 2014:183). Energy plays a crucial role in the economic development of a country. A reliable supply of power is needed to enhance the living standards of individuals.

Figure 2.8 Map of Asia



Source: Zhang and Yeung (2012:612)

Based on this literature the study will also examine the electrical energy sector in China.

2.5.1 Electrical energy sector in China

After two decades of rapid industrialisation and unmatched inhabitants' growth, the requirement for energy in Eastern Asia has been increasing (Hart, 2016:1). Besides seeking to import fossil fuels from the Middle East, Africa, the Caspian Region, Russia, Latin America, Australia, and so forth, it is imperative for the Asian countries to collaborate in considerably raising the efficiency with which electrical energy is consumed (Thomson, Chang & Lee, 2010:408). In particular, electrical energy requirements from customers have been motivated by the inhabitants and GDP development (Hart, 2016:1). In 2007, China's population was 1.31 billion and was anticipated to grow to 1.45 billion by 2020 (Herrerias & Liu, 2013:268). This growth will have a significant

impact on how electrical energy is produced in China and the region as a whole. Aside from China, the population in Southeast Asia has also grown quickly (Wang *et al.*, 2010b:490). It is increasing at a rate of 1.5 percent yearly over the last twenty-five years and is now amassing over 620 thousand people more than the whole population of the European Union (Rahman *et al.*, 2016:82).

Figure 2.9 Administrative divisions of China



Source: Herrerias and Liu (2013:270)

There are thirty-four authoritative divisions in China, regarded as twenty-three provinces (including the Taiwan Region, which is claimed but not managed by the People's Republic of China). There are four municipalities, five independent regions, and two Unique Administrative

Areas, as illustrated in **Error! Reference source not found.** (Herrerias & Liu, 2013:268). The growing economy in China has led to rising demand for electrical energy. China's electrical energy sector is the world's leading electrical energy consumer, surpassing the United States consumption in 2011, after rapid growth since the early 1990s (Li, Xu & Lu, 2016:981). China's swift economic growth has impaired its electrical energy sector, as demonstrated, for instance, by the huge electrical energy shortage during 2008 (Wang & Chen, 2012:143).

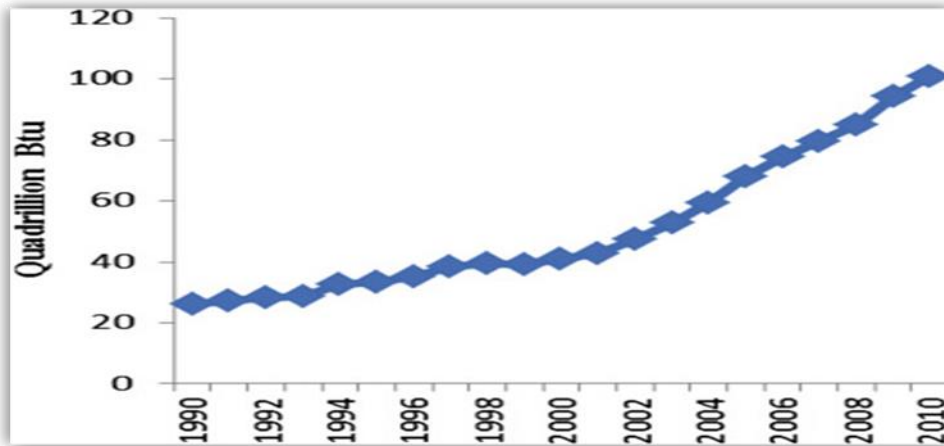
2.5.2 Electrical energy consumption in China

The electrical energy sector in China has experienced high peak loads, and the peak-valley difference has progressively increased, this has vast negative consequences for the grid, especially during excessive weather activity (Lyi *et al.*, 2016:990). Two approaches have been documented to reduce this threat, namely, increasing the peak regulation capacity from the supply side, or applying a Demand Response to alleviate the pressure associated with the peak loads (Zhang, Wang, Feng & Lui, 2010:97). Demand Response relates to some activities, which can be taken as the consumers' (end-users') side of the electrical energy measure in reaction to particular circumstances within the electrical energy system (such as peak period system overloading or high prices) (Sianaki, Hussain & Dillon, 2010:154). Demand Response has been designed and applied in the US and European nations. However, it has only lately garnered interest in China (Torriti, Hassan & Leach, 2010:1575). The primary challenges to Demand Response, are recognised to be the elasticity of demand and the low-level of contribution, due to asymmetry's statistics studies conducted that showed a significant interest in these two full issues (Torriti *et al.*, 2010:1577). Compared with Demand Response, Demand-Side Management (DSM), which has existed in China for approximately three decades (Wang & Li, 2011:1), is a relatively broader concept that incorporates many activities. Demand-Side Management activities include the replacement of energy-efficient equipment to decrease electrical energy consumption to the fluctuation of times when electrical energy is used in the implementation of multifaceted, dynamic pricing mechanisms (Zhou & Yang, 2015:954).

A good forecast of electrical energy consumption and production may be a requirement for the efficient development of electrical energy policies because it will reduce the likelihood of errors occurring throughout the electrical energy planning process (Xiong, Dang, Yao & Wang, 2014:623). In the last two decades, China's electrical energy intake has been increasing

considerably alongside its fast financial growth (Du & Lin, 2015:570). According to the Institute for Energy Research (2014:1), as illustrated in Figure 2.9, China's electrical energy usage increased, from 33.2 quadrillions Btu in 1990 to 42.6 quadrillion Btu in 2001, showing an annual growth of 4.6 percent.

Figure 2.10 Energy consumption in China from 1990 to 2010



Source: Institute for Energy Research (2014b:1)

Consequently, the speedily increasing power intake has raised issues about China's power security and ecological problems (Wang & Chen, 2012:145). How to control or slow down China's power consumption provides difficulties for policymakers (Du & Lin, 2015:572).

2.5.2.1 Coal usage in China

In November 2014, China and the United States pronounced a combined declaration regarding their post-2020 pollutants reduction objectives to reduce global warming as a highly effective dominant force (Wang, Zhu & Zhu, 2016:369). The countries will enhance collaboration in advanced fossil fuel technology, nuclear energy, shale gas and renewable energy, and thus enhance bilateral electrical energy structure optimisation and reduction to include what is generated by fossil fuel emissions (Fan, Wang & Sun, 2015:1160). Information released concerning the usage of electrical energy in China by the National Energy Administration approximated that China absorbed nearly 2.69 trillion kilowatt-hours (kWh) of electrical power in the first seven months of 2011 (National Energy Administration (NEA) of China, 2016:1). In July 2011 alone, electrical

power was up an astonishing 11.8 percent year-on-year, arriving at 434.9 billion kWh (Fan *et al.*, 2015:1162). According to the NEA of China (2016:1), the country uses 46 percent of the world's coal. This further highlights the fact that imported coal costs have been increasing, partly because China is purchasing more.

Figure 2.11 Coal usage in China – 2011



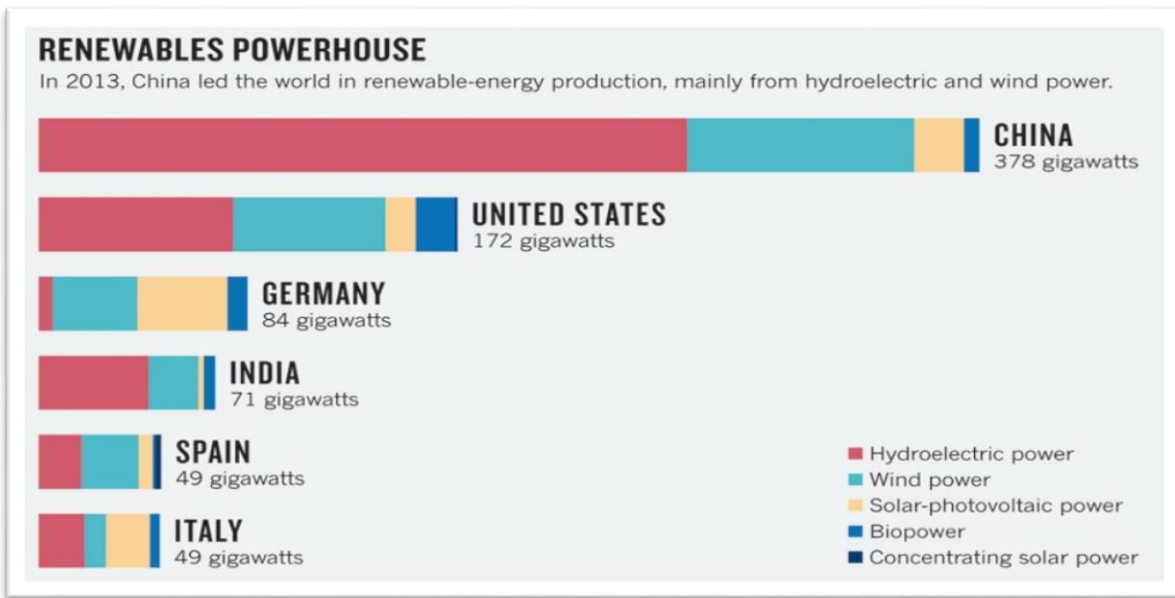
Source: NEA of China (2016:1)

Error! Reference source not found. demonstrates how much China is coal-reliant for electrical energy generation and demonstrates that shifting to electrical energy automobiles will not decrease CO₂ reductions, to the disappointment of environmentalists (Fan *et al.*, 2015:1160). Economic development is the prominent driver for the increasing power intake in all the provinces. Most provinces experienced the fast development of electrical energy intake (Du & Lin, 2015:576).

2.5.2.2 Renewable energy in China

Most of the energy, which is created and absorbed in China, comes from unclean non-renewable energy sources. According to figures from the International Energy Agency (IEA) (2016:1), about 78 percent of the total electrical energy produced in China between 2004 and 2010 came from coal.

Figure 2.12 Leading renewable energy producers in the world – 2013



Source: IEA (2016:1)

It is worth mentioning that China's per-capita emission numbers still lag behind those of other developed countries. This must have triggered large-scale side effects for the world-driven global climate, the local Chinese environment and the health of the Chinese nation as a whole (Fan *et al.*, 2015:1167).

2.6 THE ELECTRICAL ENERGY SECTOR IN AFRICA

More than a century since the invention of the light bulb, most of the African continent is still in the dark after sunset. Youngsters often cannot read after sunset, companies cannot grow, health facilities cannot refrigerate medicine or vaccines, and industries are idle, restricting economic growth, jobs, and livelihoods (The World Bank Group, 2013:1). Africa is the third-largest continent in the world and the second-most populated continental area with over 1,2 billion people (Mandelli, Barbieri & Mattarolo, 2014:657). Most of the continent's electrical energy companies are untrustworthy sources of supply, ineffective users of producing capacity, lacking in maintenance, irregular in the purchasing of spares, and are not able to staunch failures in transmitting and submission (Briceno-Garmendia & Foster, 2010:4). Electrical energy development has not kept up with the increasing demand in developing areas, putting pressure on the continent's current resources over the first decade of the new century (Briceno-Garmendia &

Foster, 2010:183). The vast inhabitants' development started in the second half of the 20th century with almost a quadruplicating of people from about 230 to about 810 thousand people (UN Department of Economics and Social Affairs, 2015:23).

Global warming, in particular, rainfall variability, affects rain-dependent farming in Africa. Sustainable and reasonable growth is one of the essential difficulties for rural and urban growth in developing countries (Chineke & Ezike, 2010:678). Sustainable development demands an efficient, reliable and decentralised electrical energy economy system based on local and clean types of electrical energy sources, in which the price paid by the customer will indicate the real cost of electrical energy products to the economy (Oyedepo, 2014:255). The African continent is faced with many difficulties on its path to sustained growth and development. There is no doubting the point that Africa needs to considerably enhance development efficiency if it is to obtain the Millennium Development Goals (MDGs) (Ahmed & Hanson, 2011:101).

2.6.1 Regional economic communities in Africa

The efficiency of any country, in looking to achieve its set objectives, largely relies on its leadership. Effective leadership results in sensible public policy formulation and implementation (Dartey-Baah, 2014:203). Some Asian economies (South Korea and Malaysia) who experienced the exact-same growth difficulties as Africa are currently hailed as “economic miracles”, while the situation in Africa is described as a “disaster” and a “tragedy” (Kuada, 2010:9). To discuss economic issues on the African continent, the African Union (AU) set up the African Economic Community (AEC) in 1991 under the Abuja Treaty. The 1980 Lagos Plan of Action for the Development of Africa and the Abuja Treaty suggested enhancing Regional Economic Communities (RECs), as the foundation for broader African incorporation, to regional and ultimately continental integration (Iwowo, 2015:408). The Regional Economic Communities is progressively engaged in managing AU member states' interests in broader areas such as serenity, security, growth and governance. The Regional Economic Communities are carefully incorporated into the AU's work and services its fundamentals (Iwowo, 2015:408). Member States are, either for traditional, governmental or financial reasons, generally, members of more than one local financial group (United Nations Economic Commission of Africa, 2016:1).

The AU recognises eight Regional Economic Communities as illustrated in figure 2.12, namely, the Arab Maghreb Union (AMU), the Common Market for Eastern and Southern Africa (COMESA), the Community of Sahel–Saharan States (CEN–SAD), the East African Community (EAC), the Economic Community of Central African States (ECCAS), the Economic Community of West African States (ECOWAS), the Intergovernmental Authority on Development (IGAD) and the Southern African Development Community (SADC) (Mandelli *et al.*, 2014:656). The Regional Economic Communities are expected to serve their member states with the execution of the regional incorporation agenda, where the concept of good trust and the resulting observance of treaty responsibilities are the basis on which member states must make regional integration choices, as well as guaranteeing their performance and implementation (United Nations Economic Commission of Africa, 2016:1). An observation by Chineke and Ezike (2010:678) points out that “the efficiency of blocs is mainly limited by problems of variation in preliminary conditions, settlement problems, real government commitment, the actual account, policy harmonisation, lack of diversification and inadequate private market participation”. This further brought them to the conclusion that regional groups had an insignificant impact on the circulation of bilateral trade. However, the protocol on relations between the Regional Economic Communities and the AU provides a coordination framework between the African Economic Community and the Regional Economic Communities (Koskimäki, 2012:189).

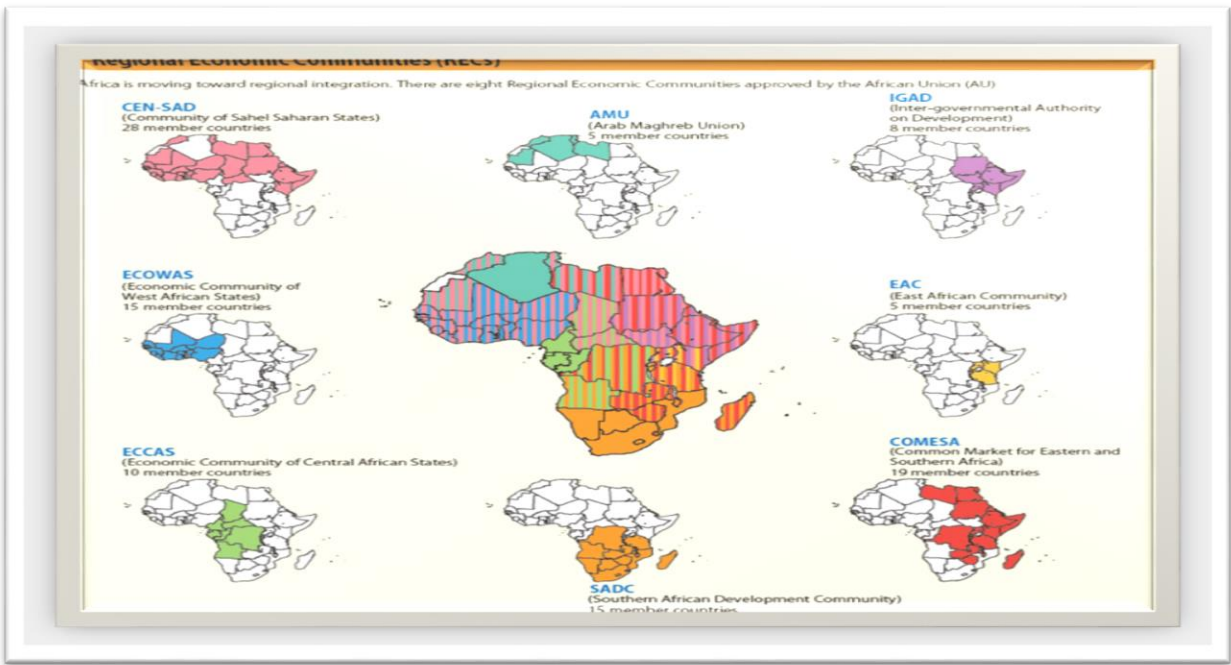
Ahmed and Hanson (2011:101) observe that there is a real optimistic outlook for the prospects of Africa reclaiming the 21st century, given its latest sterling growth efficiency and the number of valid changes undertaken.

Table 2.2, by the United Nations Economic Commission of Africa (2016:1) indicates the various performance levels including the GDP of the regions.

Macroeconomic efficiency increased considerably for the better over the last ten years since 2000, marking the most extended development episode since the 1960s. In 2000-2008, Africa’s annual

GDP increased at an average of 5 percent of buying power equality; twice as fast as in the 1980s and 1990s and above the regular international rate of 3.8 percent (Léautier, 2011:138).

Figure 2.13 Regional economic communities



Source: Adkins, Oppelstrup and Modi (2012:249)

Research conducted by Prahalad (2006:300) on the four billion Bottom of the Pyramid consumers who make under USD1 a day and who live in developing country markets, offered a spate of expanded global business research in this area (Chikweche & Fletcher, 2014:404). Just over the Bottom of the Pyramid lies the Middle of the Pyramid, which represents another 1.5 billion individuals who originate from what are portrayed as "developing markets" and comprises individuals who have been depicted as the "working class" (African Development Bank, 2011:4).

Table 2.2 Regional economic communities

Selected regional indicators for the AU Regional Economic Communities (REC)								
INDICATOR	AMU	CEN-SAD	COMESA	EAC	ECCAS	ECOWAS	IGAD	SADC
GDP	US\$426.7 billion	\$1,350.7 billion	\$657.4 billion	\$169.5 billion	US\$ 257.8 billion	US\$716.7 billion	\$218.2 billion	US\$678.8 billion
GDP per capita	US\$4518	US\$1363.8	US\$1335	US\$918	US\$ 1631.4	US\$2130.4	US\$874	US\$2265.2
Area (sq. km)	5.8 million sq. km	14.3 million sq. km	12 million sq. km	2.5 million sq. km	6.5 million sq. km	5.1 million sq. km	5.5 million sq. km	10 million sq. km
Total population	94.2 million	553 million	492.5 million	168.5 million	158.3 million	339.8 million	247.4 million	312.7 million
Total imports	US\$150.9 billion	\$312.1 billion	\$183 billion	\$40.2 billion	US\$ 63.7 billion	US\$113.2 billion	\$55.9 billion	US\$202.2 billion
Total exports	US\$126.8 billion	\$244.3 billion	\$95 billion	\$13.6 billion	US\$ 108.1 billion	US\$138.7 billion	\$18.2 billion	US\$204.3 billion

Source: United Nations Economic Commission of Africa (2016:1)

As much as the Regional Economic Communities are there to discuss the economic imbalances in the regions, some individual countries perform below the regional average. Table 2.2 shows how the regions are performing. Recent studies have demonstrated that provided there is a continued pledge towards sound economic administration which incorporates investment in infrastructure for improvement, economic broadening, and the establishment of natural resource funds and also limpidity and liability for natural resource windfalls, the scourge of natural resources can be averted (Léautier, 2011:141). It is noteworthy that there has been an enormous advancement in

respect of regional integration, with COMESA, SADC, and the East African Community moving to common market status (Chikweche & Fletcher, 2014:410).

2.6.2 Electrical energy in the Arab Maghreb Union (AMU)

The Arab Maghreb Union (AMU) was set up in February 1989 in Marrakech with the endorsement of the Treaty Instituting the Arab Maghreb Union. At the treaty endorsement, the member states consented to organise, orchestrate and excuse their approaches and procedures to accomplish reasonable advancement in all divisions of individual exercises (African Union, 2011:1). The member states of the Arab Maghreb Union are Algeria, Libya, Mauritania, Morocco, and Tunisia. This study will discuss the electrical energy in Morocco.

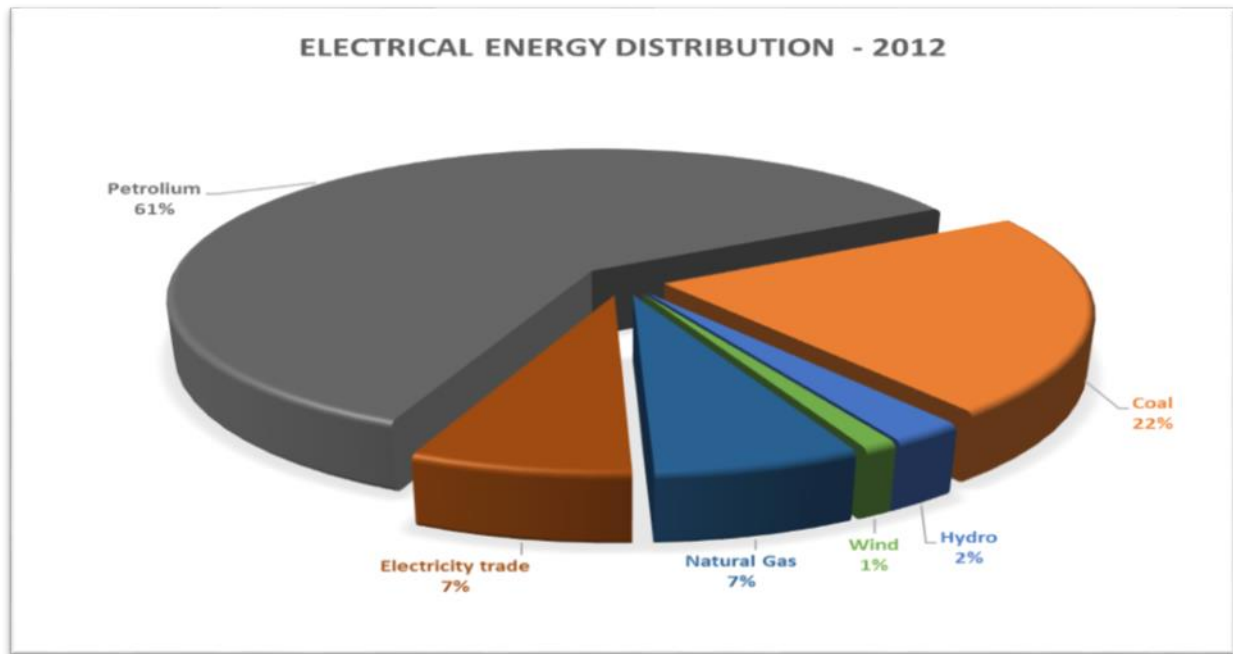
Despite the fact that the security of electrical energy sources is frequently found at the highest point of the global political agenda, real standard vitality sources are joined by dangers of the grave and irreversible harm to the earth, including world atmosphere adjustments (International Energy Agency, 2014:10). As of late, various global foundations have stressed the need for dispersion and the execution of renewable energies and the restructuring of the vitality division for a low-carbon economy. Given the issues connected with identifying promising projects, evaluating the magnitude of the decreases, and observing the conclusions, a few methods for lessening those boundaries were unmistakably called for (Kousksou, Allouhi & Belattar, 2015:98). Subsequently, the Climate Investment Fund (CIF) was established in 2008 by the World Bank to serve as an intermediary for empowering the Clean Development Mechanism (CDM) diminishments in greenhouse gases (Climate Investment Fund (CIF), 2015:1). The Clean Technology Fund (CTF) provides financing to larger emerging economies and to regional groups to promote renewable energy and energy-efficient technologies for electrical energy. Morocco qualifies for this funding. Since March 2013, sixteen investment plans for USD5.58 billion in direct funding (with an anticipated USD40 billion in leveraged financing or co-funding) were proposed in a few developing nations (Kousksou *et al.*, 2015:99).

2.6.2.1 Electrical energy usage in Morocco

Morocco, officially known as the Kingdom of Morocco, is a country in the Maghreb region located in North Africa, on the Atlantic and Mediterranean coasts (African Union, 2011:1). Morocco's population has dramatically multiplied in recent years, putting the nation's natural resources under

pressure. The population as recorded in August 2016 was 34 955 287 (United Nations Economic Commission of Africa, 2016:1). During 2014, Morocco imported around 96 percent of its supplies of electrical energy resources and Morocco's energy profile is dominated by imported fossil fuels (Kousksou *et al.*, 2015:100). This creates the opportunity for dependency by developed countries.

Figure 2.14 Electrical energy distribution Morocco – 2012



Source: Supersberger and Führer (2011:4458)

This reliance on energy imports makes Morocco exceedingly vulnerable to increments in universal fuel costs, putting a sizeable monetary weight on the national budget. In 2012, petroleum stood for 60.7 percent of the general national electrical energy utilisation (see

Figure 2.14 Electrical energy distribution Morocco – 2012

) (Supersberger & Führer, 2011:4458). Morocco provides a high potential for renewable energies, and some research has examined the accessibility to electrical energy due to wind (Sierra, Martín & Möso, 2016:20) and solar radiation in the country (Ouammi, Sacile & Zejlib, 2010:4226). These days, and regardless of its tremendous potential for wind and solar electrical energies, only 10 percent of the electrical energy in Morocco is from renewable sources, mainly gas and wind electrical energy (Sierra *et al.*, 2016:32).

2.6.3 Electrical energy sector in the Common Market for Eastern and Southern Africa

The Common Market for Eastern and Southern Africa (COMESA) was formed in December 1994 to supplant the earlier Preferential Trade Area (PTA) from the mid-1980s in Eastern and Southern Africa. The primary objective of COMESA has been on the development of a large economic and trading unit to remove business limitations experienced by individual states (United Nations Economic Commission of Africa, 2016:2). COMESA consists of the following participant states: Burundi, Comoros, the Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Sudan, Swaziland, Seychelles, Uganda, Zambia and Zimbabwe (African Union, 2011:1). Nature has invested in sub-Saharan Africa with a variety of natural energy resources: for example, wind, coal, water, oil, wood and solar. Countless resources have stayed unexploited for a considerable length of time, and consequently, numerous African nations face severe electrical energy deficits because of a reduced level of interest in energy infrastructure (Nondo, Kahsai & Schaeffer, 2010:1). Solar home-electrical energy systems are the most used in the COMESA region. The COMESA region installed explicitly around 52,000 megawatts of renewable electrical energy, of which roughly 69 percent is thermal and 30 percent hydro (Amakobe & Kirui, 2014:4). With the current political situation in the region being unstable, this research reviews the electrical energy situation in Kenya.

2.6.3.1 The electrical energy sector in Kenya

Kenya is an Eastern African country, according to the United Nations Economic Commission of Africa (2016:1). The country has over 47 million people living in rural and urban areas. The reliance on conventional biomass fuels; for example, firewood and charcoal and also agricultural waste for different tasks, such as cooking, lighting, or space warming is high in numerous developing nations (World Bank, 2011:11). There are distinctive associations between energy use and the environment, human prosperity, and inadequacy, which makes it conclusive to perceive how people in different parts of the world, mainly Africa get or reject a particular energy source (Treiber, Grimsby & Aune, 2015:54).

With regard to electrical energy, Kenya has a generous extent of unexploited renewable resources; for example, biomass, solar and wind (Kiplagat, Wang & Li, 2011:2960). Besides all the challenges faced by Kenya, it must be added that the country has low levels of electrification and necessary infrastructure. The electrification rate is only at 28 percent, and only 8 percent of people

in the rural areas have access to electrical energy (International Energy Agency, 2016:1). Also, while considering the grid extension alternative for Kenya, it can to a great extent be costly (Ghaem Sigarchian & Paleta, 2015:1830). This circumstance gives the Kenyan authorities the opportunity to investigate, using the accessible renewable resources, which will be less expensive and less demanding, to build and improve the electrical energy availability of the country.

2.6.4 Electrical energy sector in the Community of Sahel-Saharan States

The Community of Sahel-Saharan States (CEN-SAD) was established on 4th February 1998, resulting from the Conference of Leaders and Heads of States held in Tripoli, Libya (United Nations Economic Commission of Africa, 2016:2). The member States of CEN-SAD are: Benin, Burkina Faso, Central African Republic, Chad, the Comoros, Côte d'Ivoire, Djibouti, Egypt, Eritrea, the Gambia, Ghana, Guinea-Bissau, Libya, Mali, Mauritania, Morocco, Niger, Nigeria, Senegal, Sierra Leone, Somalia, the Sudan, Togo and Tunisia (African Union, 2011:1).

Climate-change alleviation policies currently being confronted will have little impact on adjusting the rate of global warming over the following twenty to thirty years, due to the forces present in the energy and climate systems in the region (Hertel & Lobell, 2014:562). Numerous researchers advocate that coping with climate variability is the first step towards dealing with losses caused by climate variability in a region (Cooper, Dimes, Rao, Shapiro, Shiferaw & Twomlow, 2012: 24). Climate risks, as intra-and inter-season variability, have presented a challenge to farmers (Hertel & Lovell, 2014:564).

This region has experienced many difficulties throughout recent years after the kidnapping of the 200 young women in Nigeria. Nigeria as a part of CEN-SAD has a significant population scattered throughout the world, with high population numbers in the various provinces and with the potential for further growth, the use of electrical energy will be researched.

2.6.4.1 The electrical energy sector in Nigeria

With an expected population of over 180 million people in October 2016, Nigeria is the most populated nation in Africa and belongs to the group of countries with the least power utilisation per capita on the continent (Ibitoye & Adenikinju, 2015:492). Access to clean and stable electrical energy is crucial to completing Nigeria's mission for joining the league of twenty most enterprising countries by the year 2020. The challenge confronted by Nigeria is that only 40 percent of the

population is connected to the national grid (Aliyu, Ramli & Saleh, 2013:354). Currently, between 60 and 70 percent of the Nigerian population do not have access to electrical energy. This situation will remain unless the government diversifies electrical energy into domestic, commercial and industrial sectors (Oyedepo, 2012:15). Accessibility and unreliable quality of power supplies have consistently been a vexing issue in Nigeria (Ibitoye & Adenikinju, 2015:492). This electrical energy shortage includes all forms of customers; the situation might be different if the Nigerian government made use of the resources at hand.

Many research studies describe how electrical energy can improve the lives of nations. What comes to mind is the number of resources available in Nigeria not producing electrical energy. There is no scarcity of renewable energy in Nigeria. The estimated renewable-energy resources there are presented in Table 2.3 (Ibitoye & Adenikinju, 2015:500). Nigeria has immense resources of electrical energy (crude oil, tar, sand, regular gas and coal) and also a considerable measure of renewable-energy resources (e.g. hydro, solar, wind and biomass) (Adaramola & Oyewola, 2011:2501). This was further detailed in the annual statistics released by OPEC, which showed that crude oil and natural-gas reserves in Nigeria are between 37.2 billion barrels and 5 292 trillion standard cubic meters, respectively (Organization of the Petroleum Exporting Countries, 2016:2). The expectation was that by the end of 2008, Nigeria would have generated 15 000 MW electrical energy (Ibitoye & Adenikinju, 2015:484).

Table 2.3 Renewable energy in Nigeria

Renewable Energy	Estimated Reserve
Hydropower (large/small scale)	14750 MW
Solar radiation	3.5–7.0 KW h m ² /day
Wind	2–4 m/s at 10 m height
Biomass	144 million tons per year
Wave and tidal energy	150000 TJ per year

Source: Ibitoye and Adenikinju (2015:500)

Although electrical energy has been produced for over a century, Nigeria started generating electricity for public consumption in 1896 (Mohammed, Mustafa & Bashir, 2013:354). The demand in Nigeria is at present significantly more than the supply (Obadote, 2011:1), which, in this manner hampers the nation's socio-economic and technological advancements. The Nigerian economy depends heavily on its petroleum sector, which represented more than 95 percent of export earnings and more than 75 percent of government revenue in the 2014 fiscal period (Aliyu *et al.*, 2013:360).

2.6.5 Electrical energy sector in the Southern African Development Community

The conference held by Southern African Development Coordination (SADC) during April 1980 saw the official formation of SADC. One of the main reasons was to propel the motive for national political and economic freedom in Southern Africa (United Nations Economic Commission of Africa, 2016:2). The Heads of State and Government, at the annual meeting in 1992, chose to develop the integration and collaboration processes in SADCC in a type of community (African Union, 2011:1). This concluded the signing of the Southern African Development Community (SADC) Treaty that successfully transmuted SADCC into SADC. The current member states of SADC are Angola, Botswana, the Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe (African Union, 2011:1).

The UN 2030 Agenda for Sustainable Development agreed upon in September 2015 incorporates the objective to end worldwide electrical energy destitution by giving access to consistent, dependable, supportable and advanced energy for all (Trotter, 2016:111). Africa's electrical energy circumstance is novel. The continent is rich in energy resources, oil, gas and renewable energy, and it is an essential energy exporter. Africa's electrical energy generation is near 10 percent of the worldwide aggregate output (Koskimäki, 2012:189). Extensive volumes of biomass residues are created annually in the SADC region as by-products of commercial forestry, agricultural and industrial sectors (Njenga, Karanja & Prain, 2009:2). Biomass can contribute to the shortage of electrical energy in the region. In parallel, numerous African and remarkably SADC affiliated countries experience the ill effects of exceptionally serious electrical energy destitution (Koskimäki, 2012:191). Biomass, easily obtainable, does have effects when used for household electrical energy relief. The accumulation of firewood puts significant time-work stress on

families, particularly women, and can put an extra burden on nearby forest resources, especially in places where firewood is rare (Adkins, Oppelstrup & Modi, 2012:249). Biomass is the only form of electrical energy in the SADC region that is manufactured for export purposes. A state in the SADC region with several types of energy resources is South Africa. However, the country has experienced indifferent results since 2008 regarding its electrical energy infrastructure, also affected by political changes in the local election of 2016.

2.6.5.1 The electrical energy sector in South Africa

South Africa, authoritatively the Republic of South Africa (RSA), is the southernmost sovereign state in Africa. South Africa is the 25th-largest country in the world, by land area, and with nearly 53 million people, which makes it the world's 24th-most crowded nation (Ibrahim, 2016:45). South Africa has a multi-ethnic culture, including a variety of dialects and religions. Its pluralistic makeup is reflected in the Constitution's acknowledgement of eleven official dialects, which is among the most astounding number of official languages of any nation in the world (Comaroff, 2013:10). The nation is one of only a handful in Africa never having had a rebellion, and regular elections have been held for just about a century (Van der Berg, 2011:120). Nevertheless, the majority of black South Africans were not liberated until 1994. The country fluctuates in size, from the Northern Cape, which covers almost 33 percent of the country's land area, to Gauteng, which takes up a inconsequential 1.5 percent (Statistics South Africa, 2011:3). The full capacity of 1 220 813 km² of the other provinces is shown in Table 2.4.

Table 2.4 Provinces in South Africa

Rank	Province	Area (km²)[1]	Percentage
1	Northern Cape	372,889	30.5
2	Eastern Cape	168,966	13.8
3	Free State	129,825	10.6
4	Western Cape	129,462	10.6
5	Limpopo	125,755	10.2
6	North West	104,882	8.6
7	KwaZulu-Natal	94,361	7.7
8	Mpumalanga	76,495	6.3
9	Gauteng	18,178	1.5
South Africa		1,220,813	100

Source: Statistics South Africa (2011:3)

After a long battle with the African National Congress, racial segregation, and activists both inside and outside the country, South Africa's unjust laws began to be revoked or nullified from 1990 onwards. Since the first democratic elections of 27 April 1994, the country has been divided into nine provinces. Before 1994, the more significant part of households in South Africa had little access to electrical energy and other essential services because of the policies that existed (Louw, Conradie, Howells & Dekenah, 2012:2812).

Electrical energy in South Africa is used for many purposes that incorporate household, commercial and industrial usage. South Africa met an extreme electrical energy supply predicament amid 2007/2008 with extensive electricity outages or load shedding. The harm this did to the economy was unending. The National Energy Regulator of South Africa (NERSA) assessed that roughly ZAR50 billion (approximately USD3, 936) was lost during this crisis (Blignaut, Inglesi-Lotz & Weideman, 2015:1). South Africa is thought to be the most noteworthy electrical energy producer and consumer in Africa. It is projected that more than half of the electricity produced in Africa originates from South Africa (Odhiambo, 2013:635). Coal contributes around 70 percent of the primary energy supply. Coal-fired power stations provide over 90 percent of electrical energy production (World Bank, 2011:3). In the same way as other coal-bounteous nations, South Africa is confronting a significant policy situation, identifying with the utilisation of coal against the advancement of different energy sources (Büscher, 2011:3951). It is further argued that a lack of research on electrical energy usage resulted in the blackouts during 2007/2008. Be that as it may, Eskom Holdings Limited (Eskom), the national electrical energy supplier, argues that the lack of capacity can only be solved by building new power plants (Inglesi, 2010b:199). Eskom Holdings Limited (Eskom) is a South African public electricity utility, established in 1923 as the Electricity Supply Commission (ESCOM) by the government of South Africa with regards to the Electricity Act of 1922 (South Africa Info, 2012:1).

2.6.6 Electrical energy resources in South Africa

Electrical energy permits households to meet their most fundamental subsistence needs. It is a focal element of all the Millennium Development Goals (MDGs) and while the absence of access to electricity may not be a reason for poverty, addressing the energy needs of the impoverished gives them a chance to access services which in turn, addresses the reasons for poverty (Louw *et al.*, 2012:2814).

Internationally, coal is now the most widely used primary fuel, accounting for 36 percent of the world's electricity production. South Africa, which has been heavily reliant on coal, is looking at ways to diversify its power-generating capacity (South Africa Info, 2012:8). The Development Bank, the Treasury, and Eskom are working on a renewable-energy programme that involves independent power producers (South Africa Info, 2012:6). The Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement Programme (REIPPP) has seen companies investing over R168 billion in the renewable-energy industry. Eskom envisions a more prominent role for itself in the emerging renewable-energy industry in South Africa (Njobeni, 2016:1). Renewable energy has an extensive way to go to surpass South Africa's reliance on coal (Barbee, 2015:10).

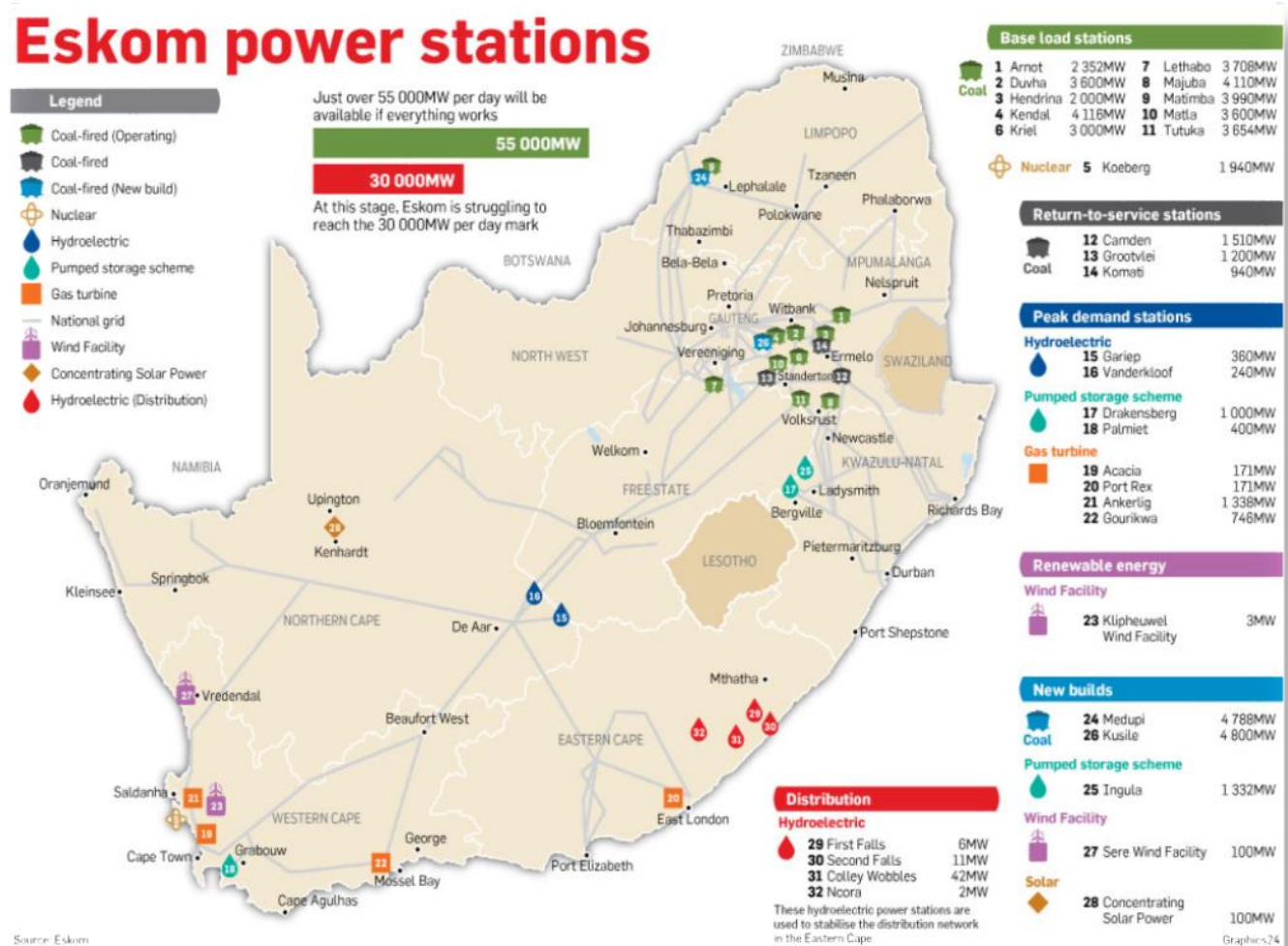
Having the capacity to get to the current electrical energy resources is recognised as a condition for carrying out sustainability and a reason for personal satisfaction. In both creating and developing nations, urbanisation has turned into an essential part of socio-economic growth; although the level of urbanisation contrasts countries and continents, it is recognised that the population growth in urban areas is quicker than in the provincial regions (Musango, 2014:305). It is worth noting that South Africa has one of the most reduced electrical energy costs in the world. Renewable energy has been a "hotly debated issue" since the expanded consciousness of the results of the environmental change. Africa is powerless against such climate changes and, thus, ought to be more mindful of the effect of fossil-fuel generation on the environment, although it has wealth in coal (Nakumuryango & Inglesi-Lotz, 2016:999).

2.6.6.1 Electrical energy infrastructure in South Africa

Government's responsibility for restraining infrastructure was frequently advocated because the state was the overseer of public interest and along these lines it would be most drastically averse to acting opportunistically, as monopolists are inclined to do (Gratwick & Eberhard, 2012:3948). This initiative helped the likes of Eskom as the only or the biggest supplier of electrical energy in South Africa. South Africa supplies two-thirds of Africa's electrical energy and is one of the four least expensive electricity producers in the world (Davidson, Kenny, Prasad, Nkomo, Sparks, *et al.*, 2006:5). Ninety percent of South Africa's electrical energy is generated in coal-fired power stations. Koeberg, a sizeable nuclear station near Cape Town, produces around 5 percent capacity

as shown in Figure 2.14. A further 5 percent is provided by hydroelectric and pumped storage schemes as shown in Figure 2.14 (Department of Energy, 2016:1).

Figure 2.15 Eskom Power Stations



Source: Eskom Holdings Ltd (2015:1)

South Africa, which was always extremely reliant on coal, is looking at ways to diversify its power-generating capacity (South Africa Info, 2012:1). In figure 2.14, it is visible that coal power stations are in the majority. The electrical energy sector in South Africa comprises generation, transmission, distribution and sales, as well as the importing and exporting of electricity (Eskom Holdings Ltd, 2015:1).

South Africa mines an average of 224 million tons of coal every year, making it the fifth largest coal-generating country in the world (Bureau for Food and Agricultural Policy, 2015:10). The country is a noteworthy contributor to the continent's CO₂ discharges. In the previous forty years, South Africa has gained some ground in using nuclear and hydroelectric generation as alternative sources of energy (Hipkin, 2013:4). This situation is likely to remain until at least 2020 (Eskom Holdings Ltd, 2016:1).

2.6.6.2 South Africa's electrical energy crisis

Alongside India, Sub-Saharan Africa is the region in the world with the least per-capita utilisation of electrical energy and with the most minimal rate of electricity access (Rosnes & Vennemo, 2012:1318). Since the mid-1990s, Sub-Saharan Africa has, without precedent for three decades, begun developing at an indistinguishable rate equated to the rest of the world (Andersen & Dalgaard, 2013:19). South Africa is rich in renewable-energy resources, which can alleviate the burden of coal mining, which is much more expensive to turn into electrical energy than such alternative resources.

In 2008, South Africa faced a significant electrical energy crisis. This signalled the start of the blackouts (load shedding) in the country. Household and industrial electricity users experienced the ill-effects of the energy outages across the nation (Inglesi, 2010:200). These blackouts commonly lasted two to four hours and were executed at various times, according to the pressure on the network and the region in which they occurred (Nel, Booysen & Van der Merwe, 2016:62). Typically, the distinction between the electrical energy assimilated and the electricity delivered is low, frequently under one percent (Faranda, Pievatolo & Tironi, 2011:2086). Electrical energy supply is running under expanded burdens because of economic factors, and the rapidly growing load usage is exposed to the risk of stability issues, and Eskom and South Africa are not exempted from such threats. These blackouts can be costly, especially when implemented during business hours, with a predicted cost of R89 billion (US\$ 7.2 billion) per month to the private sector because of lost production, loss of income and wastage (Nel *et al.*, 2016:63). Accordingly, if all participated in the load shedding programme, the difficulties would be insignificant, considering the brief length of time of a blackout (Faranda *et al.*, 2011:2087). In some instances, load shedding was necessary for the prevention of a total blackout.

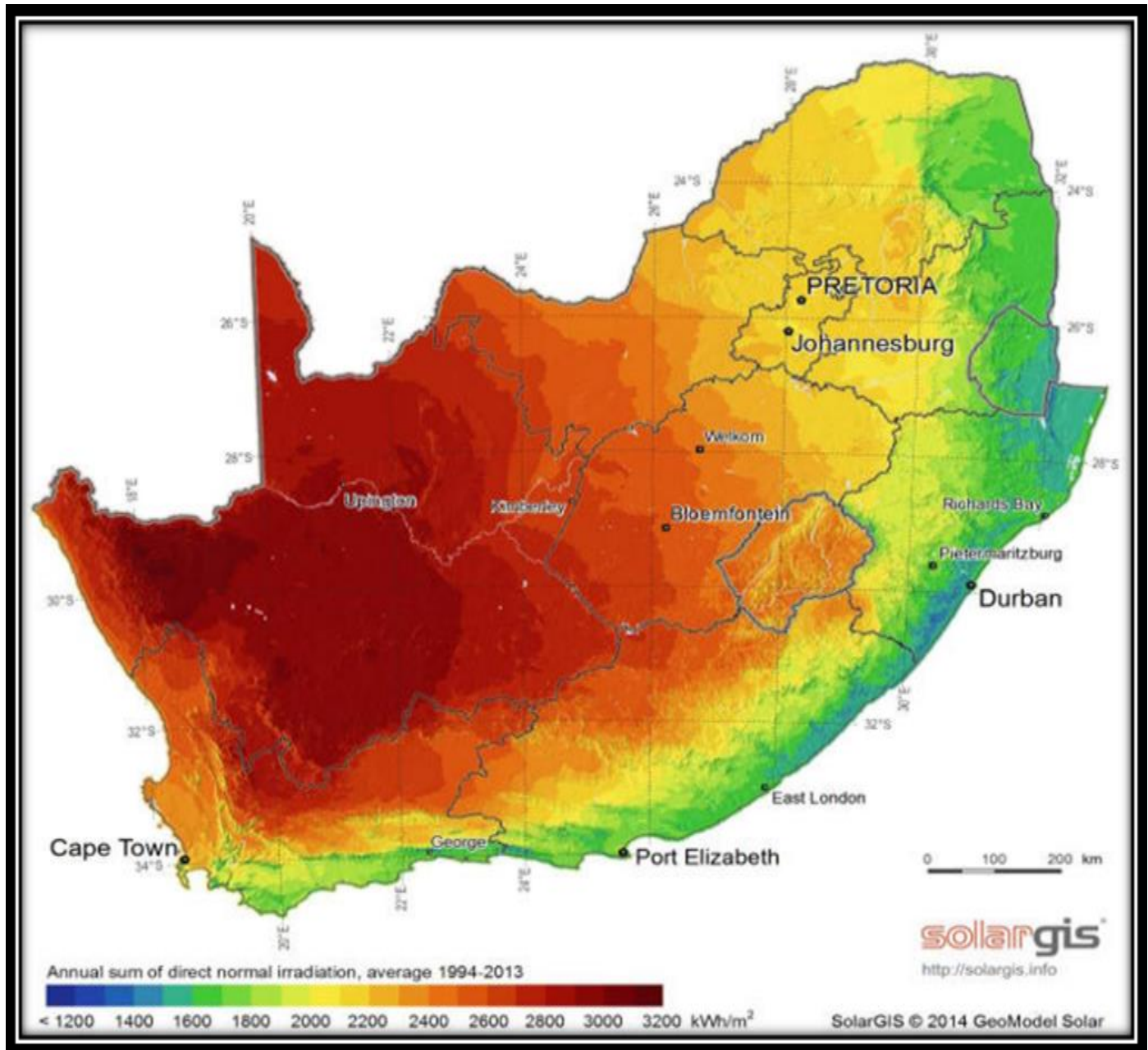
2.6.6.3 Renewable energy in South Africa

The trial of changing entire economies is tremendous; substantially more so if a country is as fossil fuel based and emission intensive as South Africa (Pegels, 2010:4945). Africa does not have a lack of any electrical energy resources – particularly fossil fuels. Although numerous countries in Sub-Saharan Africa keep being plagued by electricity deficiencies (Adams, 2010:243), South Africa is not excluded from this shortage. The electrical energy challenges in developed and developing countries are similar, with the governments at the helm. The notable shared supports for electrical energy productivity are substantial in Africa as well (Koskimäki, 2012:190). Pegels (2010:4945) found that almost all past emissions have originated from the electrical energy sector in financially sound countries.

The UN regards Africa as one of the continent's most at risk for the impact of global climate change as a consequence of its high dependency on agriculture, the water stress that it already suffers and its weak adaptive capability (UN Department of Economics and Social Affairs, 2015:1). In 2005, South Africa was answerable for about 1.1 percent of worldwide greenhouse gas emissions and around 40 percent of greenhouse-gas emissions in Sub-Saharan Africa (World Resources Institute, 2012:2). The current electrical energy provided in South Africa is primarily coal-based, and despite the fact that these resources can keep going for over a century if used at current rates, large power plants ought to be supplanted over the next thirty years (Banks & Schäffler, 2013:8). Coal is used for purposes of electrical energy. Making use of other resources for electricity would ensure the use of coal for centuries to come. The usage of the available renewable-energy resources would encourage this behaviour.

The renewable resource with the most effective potential in South Africa is solar energy. The country can benefit from two elementary innovations for generating electrical energy, namely: concentrating sun solar power (CSP), otherwise called solar thermal energy, and solar photovoltaic energy (Pegels, 2010:4949). South Africa has an average of over 2,500 hours of daylight for each year and average direct solar radiation levels between 4.5 and 6.5kWh/m² daily, placing it in the top three solar-energy-rich countries in the world (Department of Energy, 2016:2).

Figure 2.16 Solar radiation in South Africa – 2015

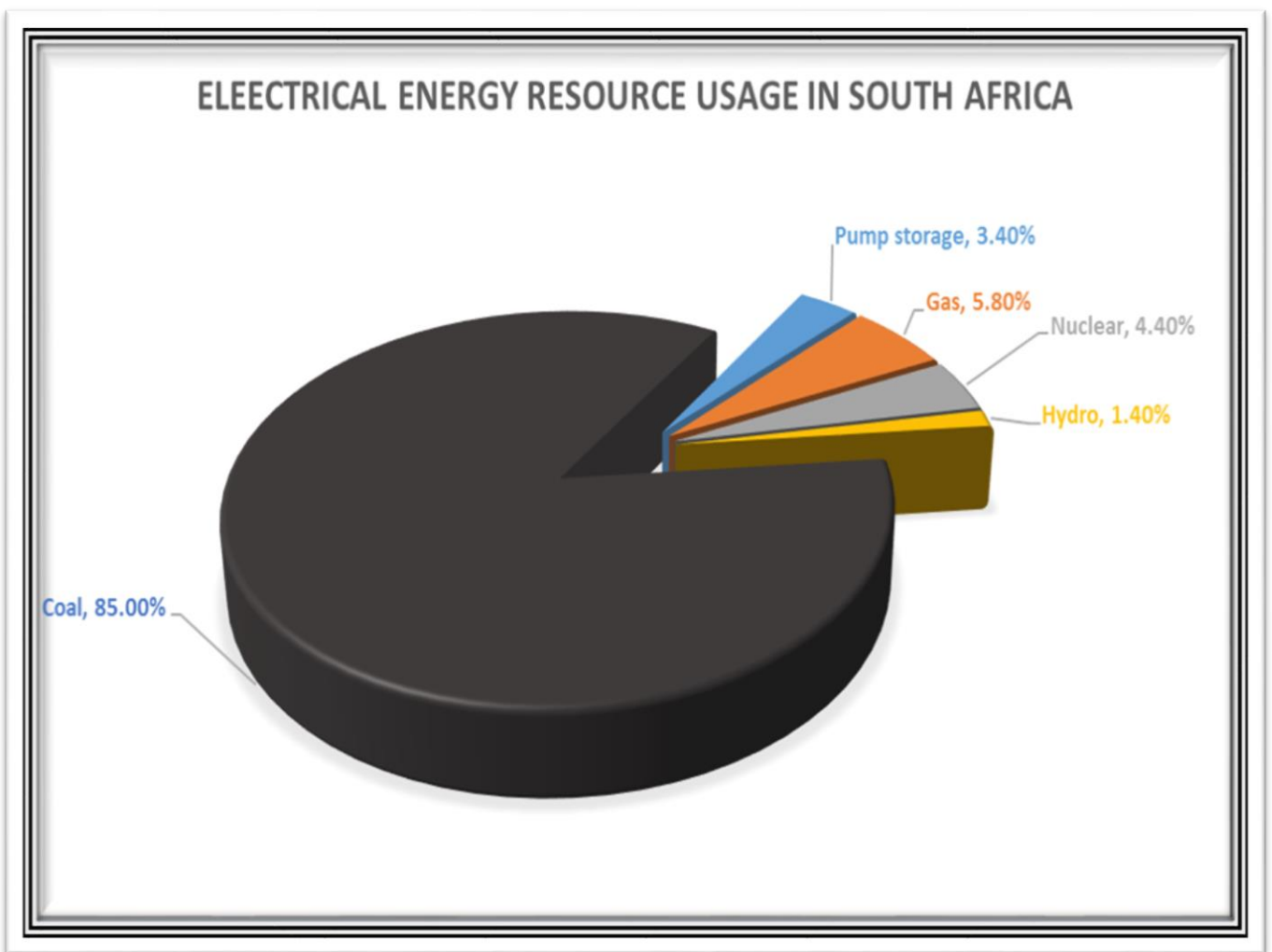


Source: Department of Energy (RSA) (2016:2)

Photovoltaic boards regularly use silicon to change the sun's radiation into power. Figure 2.15 demonstrates South Africa's solar energy potential, as the direct and diffuse solar radiation received on a level surface (Pegels, 2010:4949).

In the most recent decade, the South African government has subsequently executed an assortment of mid-and-long term projects to secure new capacities rapidly and to guarantee onward sustainable development (Giglmayr, Brent, Gauché & Fechner, 2015:779). There is currently a substantial backlog of electrical energy supply since the electricity demand has expanded past the generation capability of Eskom. Figure 2.16 illustrates the usage of fossil fuels compared to renewable energy (Eskom Holdings Ltd, 2016:2).

Figure 2.17 The electrical energy resource usage in South Africa



Source: Eskom Holdings Ltd (2016:1)

The South African government has pursued a policy throughout the most recent decade that offers a legitimate system to regulate an accumulative implementation of large-scale; more than 5MW electricity generation capability (>5MW), grid-connected renewable-energy sources (Giglmayr *et al.*, 2015:780). Adams (2010:251) further concludes in published research that as far as energy investment itself is concerned, the demand-supply gap within the next twenty years cannot presumably be narrowed to any necessary extent by sustainable energy investment. Renewable electrical energy innovations also involve financially bound elements that set boundaries to their cause. South Africa is well endowed with renewable electrical energy resources, including solar energy. Taking advantage of these resources would meet both the emissions and the power- supply challenges. The deployment of renewable energy would decrease air contamination, thus adding to upgrades (Pegels, 2010: 4952). Renewable-energy technologies may also expand electricity access in remote regions since they are suitable for small-scale, off-grid solutions (Musango, 2014:314). More people would have access to electrical energy if more attention is given to the development of renewable energy.

2.7 CONCLUSION

There is an overall necessity to decrease the ejection and the creating of fossil fuels. On paper, all nations are in concurrence with the goals and timelines set by world bodies, for example, the United Nations. The challenge is to enforce and keep alive these rules and regulations. The developed countries, for example, England and the US are continually trying to execute more secure and cleaner electrical energy agreements. This varies from the utilisation of solar energy to the utilisation of hydro-generated power. The fact is that both countries do not have the sufficient solar power to make up the deficit of coal usage. It will take significantly more research and budgetary muscle for both countries to meet the set thresholds. Because of the population in China, it has become a challenge to enforce the eradication of coal-powered stations. China is ranked as one of the major purchasers of fossil fuel from various parts of the world, and experiences high peak loads, which have negative results on the grid. The government has introduced a demand response strategy, which incorporates complete blackouts in some regions. This initiative is to increase the lifespan of the infrastructure. With all the difficulties confronted in Africa, the continent is rich in renewable energy sources. Historically, coal was utilised to generate electrical energy in the more significant part of Africa, with South Africa as the pioneer in both usage and

export. There is adequate research, which serves as confirmation that renewable energy is accessible in Africa. One of the most significant challenges on the continent is that most of its occupants are poor. Renewable energy is expensive during the infant stages and needs government support.

CHAPTER 3

STRATEGIC SOURCING

3.1 INTRODUCTION

This chapter is a literature review, which discusses the various steps in strategic sourcing as well as general processes and procedures followed to establish strategic partnerships. The research emphasises strategic sourcing in the electrical energy sector, which is sometimes portrayed as a seamless supply chain process. It discusses the challenges in the electrical energy sector. Supply chain policies and procedures guide the buying company on how to obtain specific products and where to buy.

Various forms of data will influence a procurement approach. Both conventional and modern methods may affect the sourcing strategy, e.g. Porter's five forces. Strategic sourcing can elevate the competitive position of the buying firm. If the segments and effects are taken into consideration, buyers will also make use of globally acquired data. This chapter discusses the development of a sourcing strategy from data collected in the market. The strategy development includes the evaluation stages, pre-contracting stages, and post-contracting stages. A further discussion of the methodologies is applied by Eskom Holdings Ltd when evaluating tenders above one million ZAR. As negotiations with suppliers are sometimes neglected, this chapter discusses the importance of preparations for successful negotiations.

Not all suppliers can compete against each other for the same tender. There are several reasons for this, however, and the buying company can increase competition on multiple scales by assessing the suppliers on their own merits. This process will ensure enough competition in the next round and will reduce predictability on the part of the tenderers. Lastly, the chapter looks at the importance of contract management as part of strategic sourcing, when various stages are illustrated. The effectiveness of contract management is of great significance as it will aid companies in managing lead times and other supplier performance aspects.

3.2 DEFINING STRATEGIC SOURCING

A supply chain incorporates every one of the activities connected to moving merchandise through an arrangement of facilities and appropriation channels, from providers to manufacturers to

wholesalers to retailers to decisive clients (Kotula, Ho, Kumar & Dey, 2015:238). Strategic sourcing, as a part of the entire supply chain function, has as a noteworthy task, the analysis and objectively-situated creation of individually impacting and sourcing of suitable elements (Bensch & Schrödl, 2011:100). Sourcing choices, for example, what to purchase and from whom to purchase, were seen as administrative (Ketchen, Crook & Craighead, 2014:165). It is not that business has changed; it is that the world has ended up being more engaged due to the interminable presentation of new developments in completing the full supply chain.

Literature comprehensively portrays Strategic Sourcing (SS) as a procedure that coordinates all sourcing activities towards opportunities that empower the firm to accomplish its long-term operational and organisational execution objectives (Eltantawy, Giunipero & Handfield, 2014:768). Today, notwithstanding, numerous executives see sourcing choices as strategic, and these decisions are being produced using more prominent positions inside firms (Ketchen *et al.*, 2014:166). While the statistics differ, most specialists in the supply-chain field concur that usual organisations spend somewhere around 40 and 80 percent of revenue with suppliers who help them create, manufacture, sell and service their goods and services (Chick & Handfield, 2014:20). This can change the perspective of the providers, who are yet contesting for business from the obtaining firm. The view may be that opposition has been prohibited. This reasoning can constrain rivalry on strategic products and services and creates monopolies.

According to the characterisation scheme, as shown in Table 3.1 developed by Holweg, Reichhart and Hong (2011:333), overall strategic sourcing costs may be classified under three categories: static, dynamic, and concealed costs.

Table 3.1 Characterisation scheme

Cost	Classification	Group
<i>Static Cost</i>	Incurred on a regular basis in a global sourcing agreement.	Encompasses the purchase price, transportation costs, order-processing costs, custom-clearance and brokerage expenses, insurance costs, packaging and handling charges, costs of loss and damages, disposal expenses, and costs of quality control and compliance with safety and environmental standards.
<i>Dynamic Cost</i>	Relates to the effects of demand fluctuation on the SC.	Comprises inventory-holding costs, cost of lost sales and stock-outs due to inflexibility and failure to respond to demand shifts, and costs of urgent shipments to avoid supply interruptions.
<i>Hidden Cost</i>	Not directly connected to SC operations, but they influence the profitability of global sourcing policies and are quite difficult to predict.	Has currency fluctuations, labour cost inflation, changing energy costs, costs associated with the risk of political and economic instability, potential costs of losing intellectual property rights, social costs associated with low morale such as high absenteeism and low productivity of personnel, and costs of managing the international supply base.

Source: Holweg, Reichhart and Hong (2011:333)

Warehousing and other element costs are essential in Just in Time (JIT) global sourcing, as a result of the need for meeting customer convenience and estimated product needs (Cagliano, Marco & Rafele, 2012:102). Concealed expenses (hidden-costs) regularly start from economic and financially-related occasions that put high-cost weight on offshore suppliers, which is then transferred to their clients (Holweg *et al.*, 2011:335). Researchers have demonstrated that extra sourcing expenses are on average 50 percent of the combined cost of purchasing the products, although they are frequently seen to be only 25 percent (Platts & Song, 2010:320). Therefore, from one perspective, it is vital to go past the estimation of the purchase price and other direct expenses. To ascertain the aggregate cost of possession out of global sourcing methodologies, Cagliano et

al. (Cagliano *et al.*, 2012:108) consider whether the planned approach was to be economically feasible in actually achieving expected savings.

3.2.1 Strategic sourcing in the electrical energy sector

In an aggressive electrical energy sector, purchasers look at strategies to secure their energy needs from several resources. They pool respective contracts and their generation facilities at minimum cost while controlling the risk (Zare, Moghaddam & Sheikh-El-Eslami, 2011:1826). In the last decade, companies have begun to expand their supplier base by sourcing globally. This has brought about suppliers additionally taking a gander at developing nations. This initiative was driven by several benefits, which included the increasing of competition (Cagliano, Marco, Rafele *et al.*, 2012:101). There is a combination of risks confronted during the procurement process. There are, moreover, worldwide risks and risks at every stage of the process, with risks of more conspicuous importance during each phase.

Electrical energy is provided through a progression of procedures, given the diverse parts of the sector and understanding the key players can support the sourcing department settle on more practical choices about overseeing and securing electrical energy as a strategic commodity for the procuring company. As business has ended-up being dynamically aggressive, the significance of controlling costs wherever conceivable has been extended additionally. One such control includes the procurement of electrical energy costs, and while this opportunity exists capitalising on it requires attentive analysis and planning (Rios, 2013:1). Verifiably, organisations have set electrical energy management within the environmental function. Today, those accomplishing the best results have made energy management a cross-functional process that traverses finance, operations, environment and business improvement (Department of Industry and Science AUS, 2011:1). To keep their systems trustworthy, both private and public utility and energy companies must run as competitive businesses by minimising costs and keeping quality high. Numerous utility suppliers have found that strategic sourcing has helped them to enhance relations with their suppliers, can stabilise their supply chains and decrease costs without losing quality (Yavas, Leong & Vardiabasis, 2011:10).

Strategic sourcing is the essential driver of cost decreases in most procurement organisations. Every project will commonly contribute 10-15 percent of added profits (Rios, 2013:1). Global

sourcing is characterised as a unified procurement methodology for multinational business, wherein a focal purchasing organisation looks for economies of scale through widespread institutionalisation and benchmarking (Jiang & Tian, 2010:4). Building a new infrastructure has the same difficulties, while keeping the maintenance of the present infrastructure. The challenges can include re-evaluating free market activity, stock adjusting, and energy sourcing standards with a view towards local production utilising next-generation technologies (Marsden, 2011:1).

The assurance of strategic sourcing by strategic purchasing, supplier development, internal integration, and data sharing affects a firm's supply chain agility and adaptability (Kotula *et al.*, 2015:238). The change of emphasis by concentrating on essential capabilities has resulted in the appreciation of the significance of purchasing. However, this developing strategic significance has not primarily changed the understanding of sourcing, which still mostly concentrates on activities at the purchasing/supplier interface. For example, supply base leveraging, supplier relationship development, and supplier performance evaluation (Schneider & Wallenburg, 2012:244). Kotula *et al.* (2015:240) point out that multi-stakeholder perspectives must be appropriately considered in a strategic sourcing supplier selection process. Ho, Dey and Lockström (2011:446) propose further that internal participants and their necessities must be considered in the strategic supplier evaluation process to such an extent that the supplier selection is accustomed to the business strategies. Strategic sourcing maturity varies across organisations and industries, which impacts directly on strategic sourcing within an organisation. This maturity affects the level of professionalism of the sourcing function (Kotula *et al.*, 2015:241).

A solid strategic sourcing strategy should be a separate part of a business and can contribute towards carrying out the organisation's corporate goals. The change from a procurement function to an inactive, clerical and responsive procedure to a proactive, strategic, boundary-spanning role, mirrors another integrated way to deal with procurement that grasps the other supply-chain management elements of materials management, logistics and physical distribution (Apte, Rendon & Salmeron, 2011:223). Pioneers in strategic sourcing, for example, Honda, accentuate persistent change, supplier improvement, and have committed teams working with supplier bases to reduce costs, by focusing on similar steps as in Table 3.2.

Table 3.2 Typical strategic sourcing steps

Step 1 Initiate project	Step 2 Research and analysis	Step 3 Develop strategy	Step 4 Implementation	Step 5 Implement contract
Governance	Spend profile, market requirement, supplier analysis	Sourcing strategy	Planning, supplier choice and negotiations	Operational transaction

Source: Eltantawy and Giunipero, (2013:215)

The strategic sourcing focus compels companies to embrace a strategic alignment to their procurement function and to look more at the total supply-chain management process and its impact on the organisation's competitive strategy (Burt, Petcavage & Pinkerton, 2010:201). There are different steps to carry out the advantages, which at times may take quite a while to complete.

3.3 STRATEGIC SOURCING DISCUSSING THE RENEWABLE-ENERGY PROCUREMENT CHALLENGES

Due to prevalent electrical energy insufficiencies and continuously intensifying energy costs, there is currently a prolonged constraint for cooling systems operating working cycles driven by renewable energy; for example, solar, wind, geothermal or biogas, while at the equal time having the least effect on the environment (Bvumbe & Inambao, 2011:66). As electrical energy costs rise and vulnerability around carbon estimating continues, it is more vital now than at any supplementary time in modern memory to get value for money through a strategic approach to deal with electricity procurement. The expanding entrance of irregular, unpredictable renewable electrical sources, for example, wind energy, posture significant challenges for utility organisations attempting to consolidate renewable energy into their portfolio (Nair, Adlakha & Wierman, 2014:85).

South Africa has encountered a noteworthy development in middle-to-high income families in the most recent decade. With these higher salaries come expanded requests for indoor air quality, thermal comfort and therefore expanded peak cooling loads amid summer months (Bvumbe & Inambao, 2011:67). The demand for electrical energy is expected to rise above the world average

in the Middle East, from 2010 to 2030, and energy utilisation has soared on average by 5.2 percent a year since 2000. The annual population growth of 2 percent is further expanding electricity requests (Jerath, Millerjothi, Karthiyayini & Sharma, 2015:341). The earlier chapter discussed the prerequisites, different frameworks and the utilisation of electrical energy in various parts around the world. While considering the decarbonisation of electricity, all aspects of the policy and innovation debates have their proponents and opponents. There is a significant contradiction concerning what a country's abatement targets should be. Some argue that for high-income countries, at least zero emissions and utterly renewable electricity is essential (Brear, Jeppesen & Chattopadhyay, 2016:621). In 2014, the Australian federal government became the first government throughout the world to expel a legislated cost on carbon (Jacobson & Delucchi, 2011:1156).

3.3.1 Policy impact on the use of renewable energy

A policy is a voluntary system of standards to guide decisions and accomplish discernible results. A policy is further known to be a statement of intent and is implemented as a procedure or protocol (Platts & Song, 2010:320). For a few organisations, developing supply chain policies and setting them into practice can be a staggering undertaking; often policies end up being inadequate documents lacking substance. To be understood, policies give required limits for successful operation. Since 1996, China's residential energy move to "cleanliness" is exceptionally self-evident. To be specific, the extent of electric power and thermal energy in auxiliary energy altogether increases. However, the progression of suburban electrical energy blends is not conducive to decreases in carbon emissions and outflow force (Jiang, 2016:870).

In September 2013, the state council issued The Action Plan for the Control of Air Pollution. The plan apparently raised the point that China's extent of non-fossil energy utilisation ought to increment, reaching 13 percent by 2017, and the advancement of green buildings, especially with dispersed rooftop photovoltaics installations (Guo & Guo, 2015:589). The present "clean energy" is different from "low carbon" energy, which is the concentration of future electrical energy blend adjustment; that is, the extent of "low-carbon" energy ought to be enhanced. For example, if you increase renewable energy (including solar, wind, geothermal, etc.), nuclear energy and other "zero carbon" energy, then the extent of thermal power generation in power systems will be reduced (Wang *et al.*, 2016:377). Solar photovoltaics power is now used in China. After hydro and wind

energy, it is the third most essential renewable energy source regarding globally installed capacity (Zhang, 2016:93). Astonishingly, the direct capital cost has been the first deliberation that has kept up a swift market expansion of renewable electrical energy platform augmentation in both developed economies and developing economies. Development of distributed solar photovoltaics has mostly benefited from the incentive policies in China (Zhao, Zeng & Zhao, 2015:572).

There are diverse sorts of instabilities of which policy is apparently one. Policy change is concerned with the future termination of the existing support scheme. Individually, governments may eventually decide to terminate their contemporary plans as renewable-energy technologies become increasingly matured (Boomsma & Linnerud, 2015:435).

Numerous companies erroneously expect if they “buy”, they ought to utilise aggressive "market" strengths to guarantee that they are getting the best deal (Vitasek, 2016:130). In doing so, the default approach is to utilise an exchange-based model (Cagliano *et al.*, 2012:102). Several sourcing managers hole-up behind energising statements on vision and mission, do not put much heart into making the journey and do not show enough integrity for realising the necessary arrangement for aggregate performance.

Currently, economists, social scientists, policymakers and other observers demonstrate great enthusiasm for the connection between institutional quality and the environment. This cooperation has attracted extraordinary intrigue in the Sub-Saharan Africa (SSA) economies (Abid, 2016:85). As grid-connected renewable electrical energy, Independent Power Projects (IPPs) turn out to be more pervasive around the world. Debates have heightened on the best policy instruments to accelerate and support investment by the private sector into this electricity-producing innovation (Eberhard, Kolker & Leigland, 2014:10). An expanding number of companies, as a part of a strategic planning approach to continuous improvement, are beginning to utilise policy deployment.

3.3.2 Market intelligence in strategic sourcing

Commodity markets have regularly been subjected to a concern of high concentration on the supply side, with a few bright illustrations being the market for energy resources; for example, oil, natural gas or metallurgical coal (Lorenczik & Panke, 2016:179). It is essential to understand any price dependencies between fossil fuels and renewable energy to assess better energy investment

decisions (Jerath *et al.*, 2015:344). An organisation's procedures for achievement depend on different parts of the association's conduct, explicitly the execution of business against its opponents. Lately, Supply-Chain Management (SCM) strategies have transformed into a contemporary part of the organisation's progression strategy.

3.3.2.1 Porter's five forces

Progressively, efficient firms utilise a higher level of strategic alliance-based worldwide sourcing for primary components by coordinating with their suppliers, notwithstanding when exceedingly particular resources are included (Jüttner, Peck & Christopher, 2010:197). In 1980, Michael Porter published *Competitive Strategy*, a work that moulded the reasoning of a generation of researchers and managers (Magretta, 2011:10). Incorporated into that foundational content was Porter's portrayal of "five forces" that shape the structure of all enterprises, and in large part, established the guidelines for rivalry and the underlying drivers of profitability within an industry (Federico, 2010:47). According to Dobbs (2014:32), the perception is that "any individuals comprehend the five forces framework and its utilisation in an excessively shallow way." Porter's five forces framework is one valuable strategic tool to assess potential opportunities and risks or threats for the electrical energy sector.

As seen in **Error! Reference source not found.**, these five forces covered in the analysis are competitive rivalry, supplier power, buyer power, the threat of substitution, and the risk of prospective new entrants. Barutçu and Tunca (2012:1047) further explain the five forces as illustrated in **Error! Reference source not found.** as follows: Supplier power alludes to the force of suppliers to drive up the costs of the crude materials, supplies, instruments or data sources. The threat of new entry alludes to the simplicity with which new organisations or competitors can enter the market. The number of substitute products and the cost of replacing them influences the threat of substitution. Buyer power alludes to the capacity of the customers to drive down your costs. Competitive rivalry alludes to the quality of competition within an industry. Throughout recent decades, both through a significant decrease in tariff barriers and through expanded global exchange activities, a *de jure* and a *de-facto* deepening of globalisation, individually, has been occurring (Doganay, Sayek & Taskin, 2014:340).

Figure 3.1 Porter's five forces



Source: Barutçu and Tunca (2012:1047)

Energy and environmental efficiency are firmly identified with sustainability and are also indicators of the performance of energy utilisation, economic advancement and ecological security under the thought of sustainable development (Zhang & Wang, 2016:190). Suppliers who can deliver significant measures of electrical energy to the sector at a lower cost have more control over the opposition in the industry through their bargaining power.

3.3.2.2 SWOT analysis

The motivation behind a SWOT analysis is to aid in the advancement of a vigorous business methodology by guaranteeing that careful thought has been given to the organisation's strengths and weaknesses, and to the opportunities and threats it comes up against in the market, S.W.O.T. is an abbreviation which means Strengths, Weaknesses, Opportunities and Threats. In the electrical energy sector, SWOT has typically been utilised to dissect the energy circumstances of a single area or system (Jacobson & Delucchi, 2011:1157), as illustrated in Table 3.3.

Table 3.3 SWOT analysis

Internal	Strengths	Weaknesses
	<ul style="list-style-type: none">• Development of rural areas.• Creation of direct and indirect jobs.• Diversity of energy supply.• Reduction of soil erosion during the replacement of energy fields by farmland.• Independence from fossil fuel markets.• Storage potential and possibility of generation prediction.	<ul style="list-style-type: none">• Possibility of affecting the quality of soil, air, water and biodiversity.• Possibility of using land that could be needed for food production.• Dependence on external conditions of climate and past attacks, during the production of a primary source.• Reduced experience with dedicated energy crops.• Dependence on land availability.• Economic viability dependent on regulated tariffs.• Cost of primary source.• High investment costs.
External	Opportunities	Threats
	<ul style="list-style-type: none">• Biomass is a heterogeneous energy and can be interesting for specific markets.• Market growth perspectives.• Energy and climate change priority on policy agenda.• Revenues still protected by feed-in tariffs and by ensured access to the grid.• Growth of RES plants of variable outputs needing backup technologies.	<ul style="list-style-type: none">• Competition with fossil fuels and other renewable sources.• Instability of the energy market and the liberalisation trend of the market and of the tariffs.• Social opposition.

Source: Jacobson and Delucchi (2011:1158)

There have been a few circumstances of the practical application of the SWOT analysis in the fields of bio-energy sustainable improvement and industry planning strategy. However, bio-energy production on marginal land has its particularity when confronting diverse internal circumstances and the external environment (Liu, McConkey & Ma, 2011:2378).

The SWOT analysis is composed of internal and external appraisals. The internal evaluation is led to illustrate the strengths and weaknesses of an organisation, while the exterior appraisal is applied to discover opportunities and threats (Chen, Kim & Yamaguchi, 2014:319). Bio-fuels are renewable, which originate from agricultural products; for example, sugarcane, oleaginous plants, forest biomass and different wellsprings of natural matter (Piterou, Shackley & Upham, 2010:2044).

Bio-energy projects, including energy products, can make a noteworthy contribution to employment opportunities; and job creation in the bio-energy industry is by all accounts enhanced by the fact that it requires little investment (Paschalidou, Tsatiris & Kitikidou, 2016:636). Energy crops prompt changes in agricultural labour patterns and add to rural financial enhancement. Qualities recognised for the utilisation of biomass are the advancement of countrified areas, the fortification of local industry, and the possibility of creating employment in fewer supported regions, which is important (Carneiro & Ferreira, 2012:46). One of the apparatuses that researchers and policymakers have utilised to encourage decision-making processes being developed in general and the electrical energy sector, precisely, is the SWOT model, which was initially created for use in business strategies and product assessment (Njoh, 2017:320).

3.3.3 Segments and effects on procedure progression in strategic sourcing

As interest in repeat interactions arises, exchanging desires progress and advanced transactions-based business models are understood, which lay the foundation of shared business connections and shape the foundation of current procurement procedures. While these insights shift, most specialists within the procurement field concur that regular organisations spend somewhere around 40 and 80 percent of revenue with suppliers who help them develop, manufacture, sell and service their goods and services (Chick & Handfield, 2014:20). For instance, the vehicle industry spends 70 percent of its revenue with suppliers (Henke, Stallkamp & Yeniyurt, 2014:21). This implies for some organisations, around one-half of procurement spent is on services that require a more advanced approach to deal with sourcing (Vitasek, 2016:132), keeping in mind the end goal to develop a sourcing strategy which will strengthen the competitive advantage. Notwithstanding Porter's five forces and the SWOT analysis, one must take a glimpse at other predominant collections, which add to an overall conclusion.

3.3.3.1 Global sourcing

Global sourcing is the acquirement of products and services from suppliers or subsidiaries found abroad for utilisation in the country of origin or a third country. It is a procedure which includes a legally binding relationship between the purchaser (the central firm) and an overseas supplier. As organisations have become more extensive and more universal in opportunities, they have become better situated to exploit brief uneven characters in wealth and political establishments to make invaluable worldwide economic models (Bregman, Peng & Chin, 2015:229). Climate change is one of the difficulties confronting humankind in this century. Dependable proof demonstrates that environmental changes are brought on by anthropogenic Greenhouse Gas (GHG) emissions, mainly from fossil energy combustion (McClintock, 2015:4).

To moderate climate change, the deployment of innovations that are more electrical energy efficient as well as being able to provide electrical power with lower carbon discharges is significant (Dai, Silva & Herran, 2016:20). The electrical energy technology advancement framework can be applied to both national and global levels of analysis, while accepting that they are, to a great extent, controlled by organisations and institutions portrayed naturally by specific regional effective influence and collaboration (Zhang & Gallagher, 2016:194). Renewable energy, a standout among the most critical low-carbon alternatives, embraces an extensive variety of electrical energy sources and advances, including solar power, wind power, bio-energy and hydroelectric power. Existing studies that utilise and incorporate evaluation models demonstrate that wind electrical energy for power generation is the most critical choice to allay climate change (McCollum, Krey & Kolp, 2014:651).

The results of rising electrical energy costs and climate change are more evident (effect on performance and strategic position) and rapid and supply more network disturbances for the individual organisation than at any other time (Halldórsson & Kovács, 2010:5). At the point when organisations embark on growing their businesses globally, it would then be prudent to take a gander at nations with favourable conditions that would elevate the business model. Expanding a business can be a costly exercise, let alone going global, despite its rich resource potential and significance in moderating climate change. Nonetheless, future distribution of renewable energy might be influenced by different variables; for example, rivalry with alternative sources of electrical energy and innovation, high direct financial costs, regional heterogeneity of resources

and system incorporation limitations (Luderer, Krey & Calvin, 2014:427). This further includes home-country policy issues, which govern the potential risks of climate change, for example, a carbon tax.

Progressively, organisations are taking research and development related ventures abroad - taking advantage of research and development sources outside their countries of origin, or accessing knowledge and innovation resources in a foreign land (Nepelski & De Prato, 2015:12). One of the most critical endeavours on the topic of how the globalisation of technology sourcing influences, both household and host countries, is associated between the internationalisation of research and development activities and careful execution. Bases of the Pyramid (BOP) or subsistence markets are exceptionally alluring to Multinational Corporations (MNCs) since development prospects are constrained in developed markets and social responsibility has become dominant (Parmigiani & Rivera-Santos, 2015:60). These business sectors incorporate an anticipated 2.74 billion individuals with a typical daily salary of USD2 or less and a total purchasing power of nearly USD5 trillion (Weidner, Rosa & Viswanathan, 2010:559).

However, growth in these business sectors has been considerably more robust than initially expected, mainly attributable to challenges within the supply chain (Simanis & Milstein, 2012:80). Subsistence markets are portrayed by destitution and seclusion from standard markets, which has essential significance for the business environment in these markets, both as far as institutions that govern business exchanges and of crevices in business ecosystems are concerned (Webb, Kistruck & Ireland, 2010:555). MNCs must adapt to an absence of mediators and popular institutional support for the product, labour, and capital markets, and also uncertainties in guidelines and a lack of formal contracting frameworks (Parmigiani & Rivera-Santos, 2015:63). These factors, termed institutional voids, are gaps within the business infrastructure; market failures that impact every stage of the supply chain (Mair, Martí & Ventresca, 2012:819) and are mapped in Table 3.4, indicating the different gaps.

Table 3.4 Mapping of voids in the supply chain

Significant effects of institutional voids on the stages of the value chain in subsistence markets				
Void type	Raw material procurement	Manufacturing and operations	Distribution and planning	Marketing and sales
Product market	Difficulty in finding a reliable source and verifying quality, as there are no certification or industry standards			Difficulty in communicating with customers, understanding their needs, promoting a value proposition and setting up a brand
Labour market		Scarcity of skilled employees, due to low education levels and poor training	Difficulty in finding, training and motivating qualified individuals to act as distributors	
Capital market		Difficulty in financing plant construction and equipment due to poor debt and equity markets		
Contracting	Difficulty in guaranteeing long-term material flows		Difficulty in setting up, enforcing and ending agreements	Difficulty in working with retailers to ensure pricing, promotion, and prompt payments
Regulatory		Difficulty in discussing corruption, ambiguous regulations and changing government policies		

Source: Parmigiani and Rivera-Santos (2015:63)

Typical kinds of vacuums influence several phases of the supply chain, and emptiness can traverse over various store network stages. Furthermore, voids emerging at both the dyadic and network levels will likewise affect this chain-level examination (Parmigiani & Rivera-Santos, 2015:63). Because of the many voids, it is exhorted that the MNCs liaise with native individuals, for example, NGOs to aid them with displaying the products while additionally tending to their social afflictions. Conversely, an MNC entering that same market may experience issues by building up a wellspring of supply since it cannot depend on social binds to bolster the trade and give execution motivations (Rivera-Santos, Rufin & Kolk, 2012:1721). A subsistence market entrepreneur with adequate social ties to the group, for example, might have the capacity to make contact with a merchant, sometimes by installing, without formal laws, an economic exchange in its social network (Viswanathan, Sridharan & Ritchie, 2010:570; Webb *et al.*, 2010:557). Universal sourcing often intends to exploit global efficiencies in the delivery of a product or service.

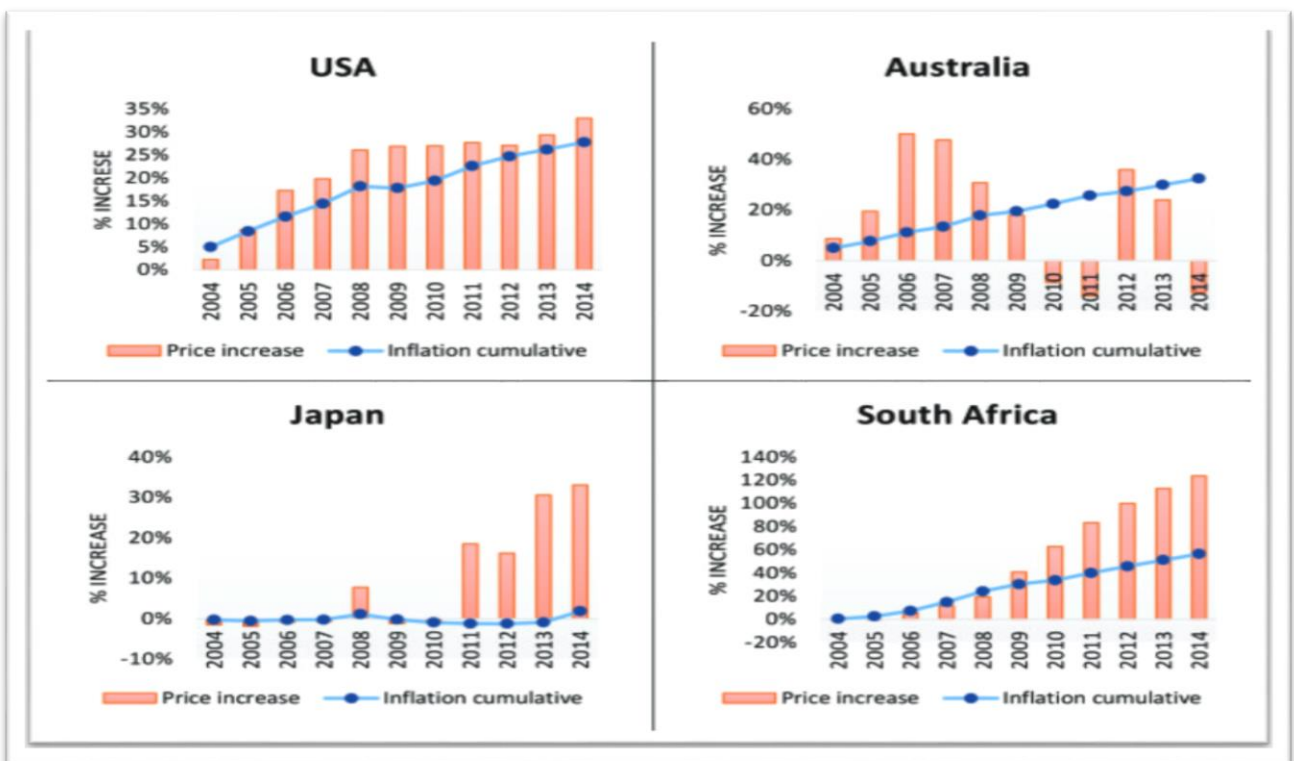
3.3.3.2 Make-or-buy (in - or outsourcing) decisions

The make-or-buy issue is the demonstration of settling on a choice between sourcing an item, processing or servicing it internally (in-house) or buying it externally (from an outside supplier) (Bajec & Jakomin, 2010:285). It is a standout among the most critical choices for some manufacturing companies as they justify their supply chain to accomplish enhanced profitability and benefits (Moschuris, 2015:2). Bartel, Lach and Sicherman, (2014:165) argue that organisations manufacturing items for which rapid technological change is distinctive will profit by outsourcing to circumvent the risk of not recovering their sunken cost investments when new production happens, and new technologies appear. Other than cost and benefit, make-or-buy decisions include criteria, for example, quality, and lead-time and delivery performance. At the point when these components are taken together, a sourcing decision can be so profoundly sophisticated that it affects the profitability of the firm (Kamble & Ghosh, 2010:12).

Global warming is an after-effect of products from burning fossil fuels for human utilisation. For example, electrical energy as a prerequisite for coal power stations and petroleum use for vehicles is presently obviously influencing the present temperature changes and has ensued in Earth's climate change. (Tam, Le & Zeng, 2016:1). The advancement of renewable clean electrical energy sources is one of the key accomplishments that influences overcoming issues regarding global warming. The accentuation has changed as people put more effort into innovation for the

improvement of energy systems that can utilise solar energy, specifically (Lynn, 2010:23). The make or buy decision is better executed when suppliers take a glimpse at manufacturing of products or the use of services. In the electrical energy sector, the viewpoint will be to concentrate on how much energy to allow on the grid from private energy producers. The introduction of the solar bonus / Feed in a Tariff (FIT) scheme, was to manage the incentives for the use of photovoltaic solar system owners (Tam *et al.*, 2016:3). These kinds of initiatives will diminish the 40 percent worldwide energy-related greenhouse-gas emissions contributed by the centralised electrical supply systems in various countries (The International Energy Agency (IEA), 2014:2). The rapid development of residential rooftop solar photovoltaic systems has demonstrated the collective and disruptive power of the consumer (Agnew & Dargusch, 2016:11). In the generation of electrical energy, the usage of renewable energy influenced the utilisation of the grid and the return to the network by the consumers. The electrical energy expenses and patterns in the USA, Australia and Japan were contrasted with the South African situation (Theunissen, 2016:1) as illustrated in Figure 3.2.

Figure 3.2 Comparing electrical tariff increases



Source: Theunissen (2016:1)

Each of these countries works in entirely unexpected ways concerning electrical energy generation, distribution and sales. Centralised energy organisations will likewise have the chance to contribute towards the improvement of the utilisation of electrical energy.

3.3.3.3 Decision-making

Suppliers are under extraordinary pressure to develop new products in the briefest conceivable time and also in a financially savvy way, considering the competitiveness for market share from other suppliers (Kwon, Lippman & Tang, 2011:138). A standout among the most critical choices to be made by the sourcing division has been distinguished to be the determination of a supplier. The procedure can discount the acquiring cost altogether and thereby enhance corporate competitiveness (Meena, Sarmah & Sarkar, 2011:1058). Albeit single sourcing improves communication because of a closer purchaser-vender relationship and could bring about lower costs as an outcome of the economy of scale (Maltz, Carter & Maltz, 2011:796). The instability of a particular buying-selling circumstance makes double/numerous sourcing a reasonable methodology (Costantino & Pellegrino, 2010:27). This decision is ceaselessly considering what the organisation needs and what the competition within the industry can offer companies, so they then have the right to continue providing the product to the market with terms which satisfy the users/customers.

The comprehension of how firms select their innovation sourcing strategy is increasingly developing enthusiasm for the current debate because of the necessary effect of these choices on an organisation's performance and competitiveness (Reuter, Foerstl, Hartmann & Blome, 2010:45). Additionally, there is a move away from value R&D organisations to more adaptable, legally constituted contractual agreements for joint R&D ventures (Bigliardi & Galati, 2016:869). This new strategy in product development becomes all the more difficult the more geographically remote the suppliers are (Prajogo & Olhager, 2012:514). Encouraging such improvement requires both propelled supplier integration devices and a proficient procurement department (Kauppi, Brandon-Jones & Ronchi, 2013:828). The decision-making power for both internal and external suppliers has achieved new status in different organisations, whereby a significant part of these

choices is taken by the management teams of organisations, mainly when it largely affects the aggressive position within the organisation.

3.3.3.4 Sustainable and ethical sourcing

There are a plethora of codes of practice emerging to assist businesses to oversee and impart social and environmental execution, especially the associations with suppliers in developing nations (Goebel, Reuter & Pibernik, 2012:7). These codes lie at the core of good dealings or ethical sourcing and often handle issues fundamental to sustainable business.

According to Brandenburg and Rebs (2015:215), the integration of sustainability into Supply-Chain Management (SCM) is a crucial issue for guaranteeing corporate aggressiveness in the face of vigorous natural and social situations. One reason for the decaying nature of communally funded Renewable Energy projects in Sub-Saharan Africa (SSA) is the non-appearance of a sustainable management method, and more particularly, the failure to fittingly follow the assignment of obligations (Ikejemba, Mpuan & Schuur, 2017:234). Publicly subsidised projects possess qualities; for example, delayed spans, generous spending budgets and numerous participants and concerns, which are inflexible to model, execute and oversee successfully (Chih & Zwikael, 2015:352).

Despite the conceivably enormous costs, strategic challenges and ecological effects, decommissioning has been given little regard to date (Topham & McMillan, 2017:417). Decommissioning is the last stage of a project's lifecycle and can be considered as the inverse of the establishment stage (Kaiser & Snyder, 2012:113). The first offshore wind electrical energy venture to be decommissioned, which occurred in 2016, was that of Yttre Stengrund in Sweden, a 10 MW project with five 2 MW turbines, which operated for more than a decade. This was significantly less than the expected lifetime of 20-25 years (Smyth, Christie & Burdon, 2015:247). Decommissioning is alluded to like all the measures performed to return a site as close to its original state as is sensibly practicable after the project's life cycle reaches its end (Kerkvliet & Polatidis, 2016:69). For the Yttre Stengrund, refurbishment was considered, yet rejected because of the difficulty of getting hold of spare parts and the tremendous costs involved in redesigning the turbines and gearboxes. It got to be distinctly budget-wise and unviable, and the choice to decommission became clear (Topham & McMillan, 2017:420). A significant decision at the time,

especially while considering sustainable sourcing, was that the decommissioned segments would be reused for other or tantamount limits or yield.

Ethics can offer a product a significant unique selling point in a competitive marketplace. However, dealing with the alterable and numerous inspirations for stakeholder participation throughout the commodity chain, keeping in mind the end goal to use the opportunity, is a complex negotiation (Herman, 2012:1121). The ethical integrity of organisations is essential to assess as business confronts challenges that emerge from various social and environmental responsibility issues (Smith, Cazier & Fox, 2012:147). The significance of adjusting corporate activities and pronouncements to satisfy the ethical desires of the organisations' internal and external stakeholders to maintain authenticity and guarantee economic manageability has been recognised by different researchers (Cronin, Smith & Gleim, 2011:158).

In this unique circumstance, the Purchasing and Supply Management (PSM) function has developed as a dynamic consideration to safeguard companies from being answerable for unethical conduct and subsequent reputational impairment (Ehrgott, Reimann, Kaufmann & Carter & Easton, 2011:99). Supplier selection is a crucial action of PSM and a standout among the most critical to constructing a solid supply base (Ashby, Leat & Hudson-Smith, 2012:497). While purchasing managers can choose from the scope of customary supplier evaluation and selection criteria, there is little accord concerning those characteristics that are basic for guaranteeing environmental and particularly social sustainability (Yusuf, Gunasekaran & Musa, 2013:501). Purchasing companies are not always ready to assess whether things obtained from remote sources were produced under conditions that are following their social and environmental policies. Hence, they may need proof from third parties in the form of auditors or by the laws of the home countries, who will give an impartial report.

3.4 DEVELOPING A SOURCING STRATEGY

The procurement profession received a boost starting in the middle 1980s when pioneers, for example, Kraljic (1983) and Porter (1980), pushed procurement professionals to think more strategically about the skill, science and routine of procurement (Vitasek, 2016:128). Companies of late tend to contract-out more manufacturing and service functions than they did a decade ago, which pattern has been driven by changes within the business settings and therefore the quest for

gradient operations followed (Kurdia, Abdul-Tharim & Jaffar., 2011:445). While applying strategic sourcing procedures, the sourcing organisation would settle on choices because of the different known strategic sourcing tools to choose the right supplier for the product or service.

Fariñas, López and Martín-Marcos (2016:90) identified decisions confronted by a firm, which needs an intermediate input. Two diverse sourcing strategy choices can signify these. Initially, the firm can choose to keep the procedure within its limits or to contract it remotely to a non-related party. Secondly, the firm can determine the process, either in the domestic market or abroad, and in doing so, the firm builds a strategic alliance. Although critical partnerships are turning out to be progressively crucial in today's strengthened competitive international business setting, they can, conversely, display a paradox because by definition, strategic alliances involve participation between at least two firms (Oumlil, 2015:479). A company's efficiency level is a vital determinant of sourcing choices by firms.

3.4.1 Competitive bidding

Competitive bidding is a transparent procurement method in which offers from contending contractors, suppliers, or vendors are invited by transparently advertising the scope, determinations and terms and conditions of the proposed contract; and additionally, the criteria by which the offers will be assessed (Ballesteros-Pérez, González-Cruz & Cañavate-Grimal, 2013:434). Regardless of the extensive literature on the hypothesis of competitive bidding for contract tendering, most models depend on hypothetical presumptions that are hard to apply to genuine cases (Ballesteros-Pérez, Skitmore & Pellicer, 2016:158). A standout among the most vital elements that affect bidding decisions is the probable number of bidders included.

According to Skitmore (2014:97), experience of the bidders' inclusion in a progression of past tenders for a similar sort of work and a related contracting, authority gives qualitative knowledge about which firms consistently participate in those agreements, and also the level of competitiveness every standard bidder has exhibited verifiably. This data can be utilised to decide which estimation of the bid will go to the developed business segments and which part will be set aside for the emerging markets. This method is used extensively in South Africa and must be conveyed forthrightly to the potential bidders.

Rivalry, both national and world-wide, has increased hugely in the most recent decade. Worldwide, competitors are challenging not only the vast global markets but also the restricted, specific and regional markets; markets that small firms once believed were protected from such rivalry (Feng, Sun & Zhang, 2010:1384). Additionally, the nature of the competitiveness in various fields has changed in a few instances to the benefit of the business or the market, and in different cases with adverse consequences for the bidding organisations.

The National Treasury regulates the bidding processes in State-Owned Companies (SOCs) in South Africa under the Ministry of Finance. Eskom as a SOC, subscribes to those regulations. National Treasury issued amended bidding guidelines, which will guide the buying entities in the evaluation of bids, to ensure equal participation (Department of Finance (RSA), 2010:1). The National Treasury is one of the departments of the South African government. The Treasury oversees state financial approaches, prepares the South African government's annual budget and deals with the administration's accounts (Republic of South Africa, 2012). National Treasury issued an instruction note on 3 December 2010 to amend the awarding of tenders; the Instructions Note (Department of Finance (RSA), 2010:2), makes provision for the allocation of points to tenderers who bid for values above one million ZAR.

In line with the guidelines, Eskom publishes both pricing and ownership criteria (Eskom Holdings Ltd, 2011:50), as illustrated in Table 3.5.

Table 3.5 Pricing and ownership criteria

Pricing and B-BBEE 90/10 criteria		
Evaluation criteria		Score
1.	Pricing	90
2.	B-BBEE	10
		100

Source: Eskom Holdings Ltd (2011:50)

The preceding table outlines a supplier's bid, as the lowest 90 percent of the assessment will be apportioned to the suppliers. The ownership will contribute 10 percent of the total. This is to ensure that suppliers with majority black ownership have an equal chance to win the tender.

The calculation below indicates the allocation of points (Eskom Holdings Ltd, 2011:37). As a SOC, and like other SOCs, Eskom adopted the policy according to the Instruction Note (Department of Finance (RSA), 2010:2), and furthermore, applies the accompanying information as a component of the procedure to evaluate bids:

90/10 Preference Point system

A maximum of 90 points is given to the price on the following basis:

$$P_s = 90 \left(1 - \frac{P_t - P_{\min}}{P_{\min}} \right)$$

Ps =

Ps = Points scored for the comparative price of tender under consideration

Pt. = Comparative price of tender under consideration

Pmin = Comparative price of the lowest acceptable tender

The above process forms part of the bidding pack available to potential bidders. The methodology is applied to every bid during evaluation.

In the competitive electrical energy market, a generating company is seen as being accountable for augmenting its rewards, generating companies that establish economic goals in the long and short-term, which include conformity of their scholarly output or self-scheduling (Mahvi & Ardehali, 2011:6367). Bidding strategies are composed of price–production sets intended to achieve these objectives in the short-term (Li, Shi & Qu, 2011:4686). Generating companies within the electrical energy industry are searching for policy direction on the most proficient method to decide on fitting electricity estimating frameworks. There are a few methodologies for generating companies to develop their bidding methodologies; for example, the companies can first calculate the market-clearing costs, and after that apply a benefit expansion technique (Vahidinasab & Jadid, 2010:1111).

This method requires much information about future electrical energy, which is confusing to conjecture (Al-Agtash, 2010:2886). Since most electrical energy markets are not flawlessly competitive, the price-taker presumption is additionally, as a rule, shy of practical support (Wang,

Zhou & Botterud, 2011:3459). Bid evaluation is an essential procedure for selecting the most suitable bidder, who possibly increments the likelihood of the different projects' achievement, and guarantees that the bidders will convey the venture, in a similar manner (Muner *et al.*, 2014:326). In this way it is critical for the generating company to guarantee that a free and fair bidding framework is applied from the start of the bidding procedure until the awarding of an agreement to the winning bidder.

3.4.2 Supplier selection

The most judgmental purchasing decisions include determination of a suitable source of supply, which is the segment of purchasing (Patra & Mandal, 2016:85). The quality of the supplier base influences the competitiveness of firms and the associated supply chain. The supplier choice is critical to effective supply-chain management, which in some instances determines the focused position (Rao, Xiao & Goh, 2017:63). Recent accentuation on sustainability has made this determination more comprehensive (Bai & Sarkis, 2010:252). Conventional supplier choice and assessment strategies concentrate on the necessity of single ventures, and neglect to consider the comprehensive supply chain.

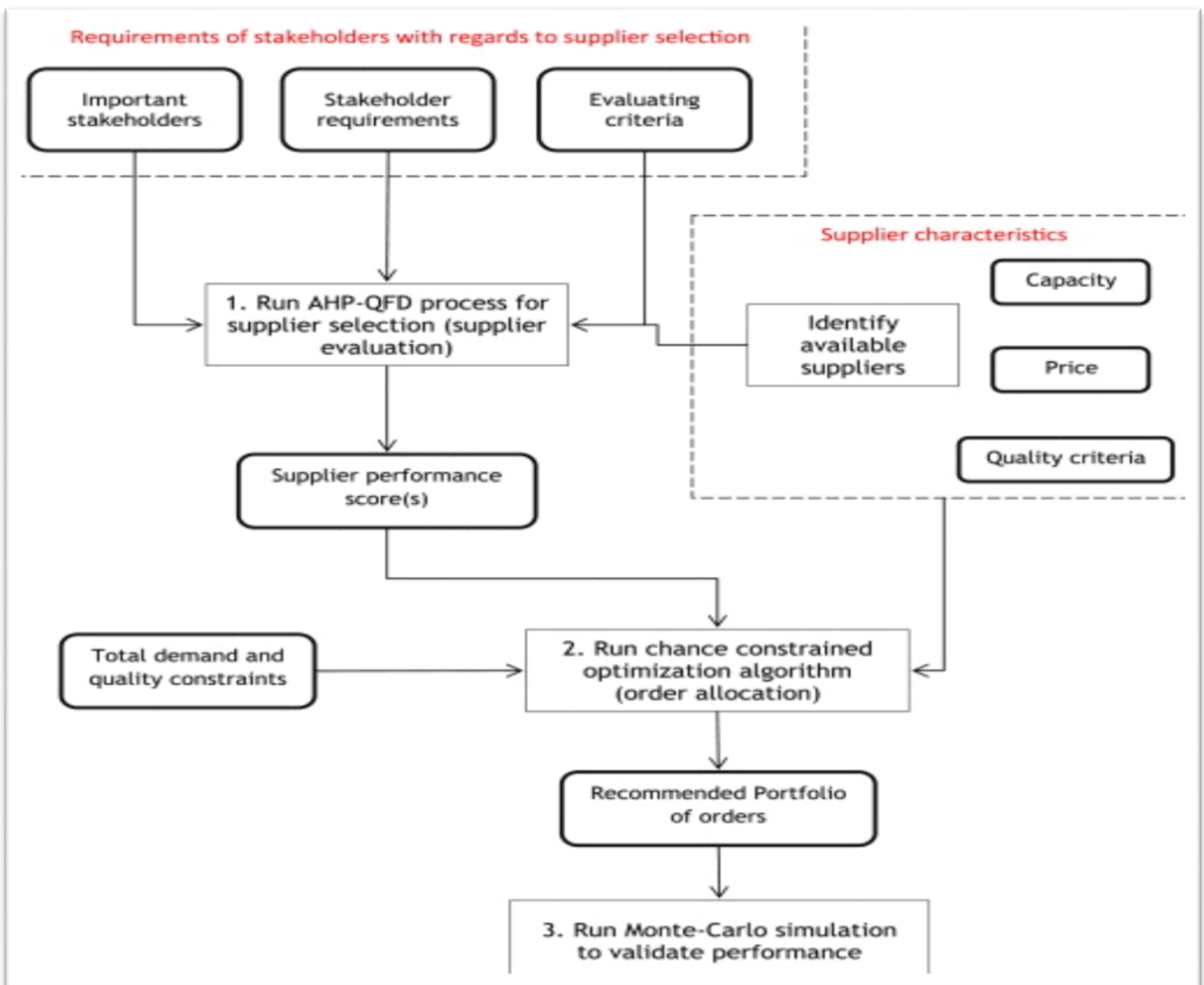
While most literature on sustainable supply-chain management considers associates in a few respects, there are controlled studies on numerous stakeholder prerequisites for supplier selection (Scott, Ho & Dey, 2015:226) which consider how corporate social responsibility has evolved from prominence of the firm to an emphasis on the supply chain presenting more stakeholders and perplexing the supplier selection process (Gopalakrishnan *et al.*, 2012:193). Wolf (2011:221) demonstrated how external and internal stakeholder needs, alongside supplier qualities, can be consolidated into supply chain methodology to decrease the risk in the supply chain. Reuter *et al.* (2010:45) explore how purchasing managers react to several stakeholder clusters and seamlessly arrive at an interpretation that different stakeholder and shareholder opinions are frequently in conflict, predominantly in the design of ethical or sustainable supply chains. The supplier applies both quantitative and scientific strategies, which demonstrate subjugate choice processes.

According to Ho, Xu and Dey (2010:16), strategies, including the integrated Analytic Hierarchy Process (AHP), the Quality Function Deployment (QFD), information envelopment analysis, forthright multi-attribute rating technique and case-based thinking have all been utilised to survey

the performance of suppliers against different criteria during evaluation. The challenge of incorporating stakeholder requirements in the supplier selection decision is typically taken care of in a few phases; stakeholder identification, subsequent prioritisation or positioning, and then the utilisation of a few methods for consideration of stakeholders into the decision procedure (Scott *et al.*, 2015:230).

Scott *et al.* (2015:232) further illustrate a calculated model for the decision support system, exhibited in **Error! Reference source not found.** Stage one of the proposed decision support system utilises the AHP–QFD methods. This interprets the significance of many stakeholder groups and the prerequisites of those stakeholders into a weighted list of evaluating criteria against which any potential supplier can be judged. The academic literature on supply-chain management and supplier choice has been developed by developing experts, and clients concentrate on sustainable supply chains. The full AHP–QFD strategy for supplier choice was produced by Ho and applied by Ho *et al.* (2012), Scott *et al.* (2013) and Dey *et al.* (2015). Stage two aims to distribute requests to suppliers to maximise stakeholder’s satisfaction and therefore optimise these lines to amplify the accomplishment of the supply chain. The streamlining calculation must assess the different choice criteria, the requirements of the final product or quality of goods ordered, the stochastic quality measures of the provided material, the perimeter limit of every supplier for supplying merchandise and the provider score from stage one. Along these lines, stage two could be performed by utilising a few distinctive methodologies. The strategy chosen would rely on the application. Stage three is the approval of the results stage. One of the reactions of choice support systems, in general, is the propensity for the human decision-maker to distrust the result if it seems untaught or imperfect. The Monte-Carlo simulation stage of the model defeats this by utilising a vigorous strategy to show consistency with the technical criteria approaches in the rationalisation stage.

Figure 3.3 Conceptual model of requirements for supplier selection



Source: Scott *et al.* (2015:232)

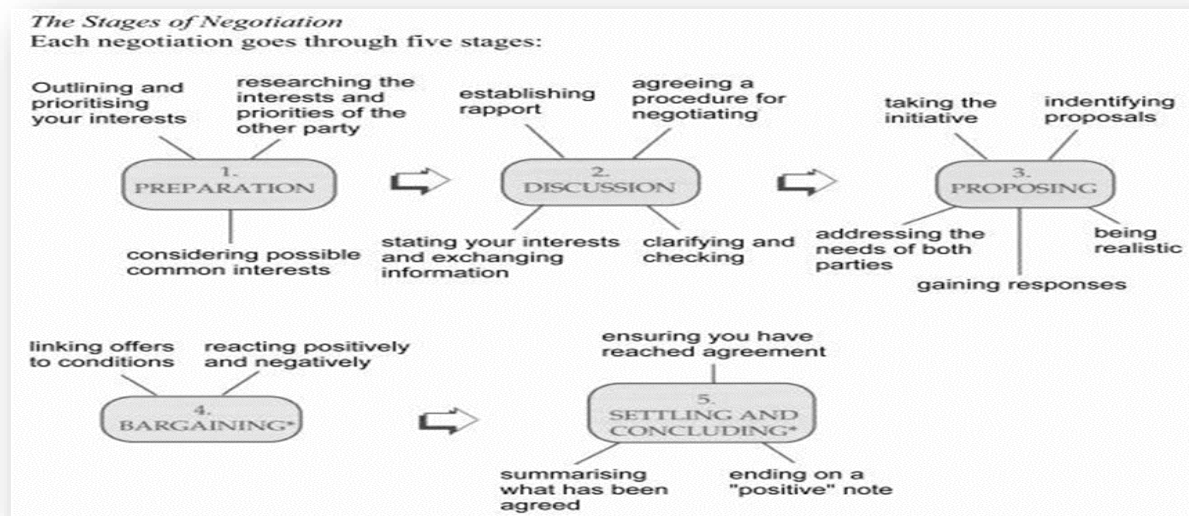
There are different techniques accessible for stochastic multi-target streamlining, including Goal Programming (Moghaddam, 2013:204) and distinct pursuit calculations; for example, pattern search, hereditary and evolutionary algorithms and heuristic strategies (Ho *et al.*, 2010:17). Goal Programming or genetic algorithms have been applied to help make decisions on supplier choice and order allocation.

While the existing literature incorporates techniques to handle different mixes of various suppliers, multiple stakeholders and transparent criteria provider determination, no available choice bolstered systems can thoroughly discuss these issues together; interpreting stakeholder requirements into a stochastic multi-criteria, multi-suppliers decision is a necessary process.

3.4.3 Negotiations

Negotiations are a crucial part of buyer-supplier relationships that shape the establishment of cutting-edge supply chains; i.e. the way buyers prepare for negotiations to have a significant effect upon the result. A typical preparation is illustrated in Figure 3.4. Research has recognised two common kinds of negotiation strategies that are utilised as a part of buyer-supplier negotiations (Thomas, Thomas & Manrodt, 2013:96). A win-win negotiation strategy endeavours to expand shared achievement while a win-lose strategy distillates into obtaining a skewed share of advantages (Terpend, Krause & Dooley, 2011:73). To cultivate the advancement of a longer-term reliant buyer-supplier relationship, win-win negotiation strategies are frequently encouraged (Baarslag, Hindriks & Jonker, 2011:143).

Figure 3.4 Stages of negotiations



Source: Thomas *et al.* (2013:95)

Illumination is achieved when the usage of different negotiation frameworks can be viewed as practical in several social settings, collaborating with a distributive negotiation methodology, with a safe separation relationship while cohesive negotiation approaches will still be a more inconsistent exercise between the parties.

Negotiation is often seen as a solitary collaboration between two parties where trade conditions are committed. In modern supply chains, negotiations resolve the subtle elements of product and service exchanges among purchasers and suppliers (Fang & Faure, 2011:320). Although the practice has dependably been an essential part of the business, the current economic environment has put expanded accentuation onto active negotiations, as performance pressure keeps on increasing (Herbst, Voeth & Meister, 2011:967). The essential dependent variable considered in negotiations is the economic result of profit which is understood as an objective result of buyer-supplier cooperation (Miao & Evans, 2013:73).

The more choice of offers negotiators can secure, the more influence they have, and the more they can request from their opposition. This conviction is grounded in an assortment of research spheres, including economics and psychology (Schaerer, Loschelder & Swaab, 2016:156). Discrete occurrences like exclusive negotiations are the foundation of the critical buyer-supplier

relationships that frame current supply chains (Daugherty, 2011:16). Profitable knowledge of the effect of several negotiation strategies in the negotiation setting is propelled forward, which, in turn, prompts a scrutinising of past research conclusions concerning the use of distributive negotiation strategies in strategic partnerships (Moosmayer, Schuppar & Siems, 2012:92).

3.4.4 Supplier relationship management

Supplier relationship management (SRM) has turned into a critical business process and accordingly causes competitive pressure which embodies the need to consider sustainability and risk, as well as the need to accomplish cost-effectiveness (Lambert & Schwieterman, 2012:337). Communicating data can elevate integration with suppliers, and necessary measurements can be utilised to drive performance and adjust observations (So & Sun, 2010:474). Given the colossal misfortunes from coal price fluctuations and the absence of guaranteed coal supply, power utilities are slanted to control coal supplies by setting up intimate connections, for example, through vertical coordination or long haul contracts with coal suppliers (Zhao, Lyon & Wang., 2012:520). Regardless, the suitable level of supplier compromise will depend on the relationship, and an effort ought to be made to distinguish a methodology customised to every relationship (Cao & Zhang, 2011:163).

Currently, Europe is importing approximately 80 percent of its oil and will most likely remain dependant on imports for its oil needs for the next couple of decades (Taft & Duero, 2011:6583). This highlights the importance of having reliable electrical energy suppliers arranged and prepared to supply customers with the required amounts of oil to the degree that their potential permits (Lacher & Kumetat, 2011:4466). Supplier integration can also include business process coordination through utilising IT applications, including data sharing, in accomplishing resolution synchronisation collaborated contractually with designated suppliers for risk allotment.

3.4.4.1 Supplier development

Since manufacturing firms progressively concentrate on their essential capabilities, proficient supplier systems assume a central part in generating competitive advantage (Vieira & Bonifácio-da-Silva, 2016:386). Notwithstanding, suppliers on numerous occasions, are not able to perform appropriately (Proch, Worthmann & Schlüchtermann, 2017:412). Accordingly, manufacturers over an extensive range of enterprises grow closer associations with their suppliers and initiate

supplier development programmes (Wagner, 2010:536). Substantial implanted ties are increasingly portrayed by the impact on a set-up social structure, the trading of insider data and the authority to decide issues other than by the vicinity and recurrence of performers' communication.

Supplier development is comprehensively characterised as "any effort by a purchasing firm to enhance a supplier's performance and capacities to meet the manufacturing company's short-and long-term supply needs" (Proch *et al.*, 2017:413). In the most recent three decades, critical universal changes have occurred in the electrical energy market with the most observable difference being the unbundling of the industry into different sectors. The primary tendency is to introduce competition into the electrical energy generation and retail markets and enhance the effectiveness of typical monopoly infrastructure transmission and distribution phases (Amador, González & Ramos-Real, 2013:953). The development of potential new entrants through the various spheres of the enterprise development matrix was necessary.

Under conditions of expanding environmental pressure from markets and regulators, central organisations in supply chains have perceived the significance of greening their supply chain through supplier development programmes (Dou, Zhu & Sarkis, 2014:420). One of the fundamental difficulties confronting Local Economic Development (LED) positioning in South Africa, is the need to change organising in connection with the dynamic progression of both global and national system conditions (Rogerson, 2014:203). The challenge of changing entire economies is enormous. Significantly more so if a country is as fossil fuel based and emission intensive as South Africa (Pegels, 2010: 4945).

According to the recent literature on industry stages, this demonstrates how it identifies with overseeing advancement inside and outside the firm, and also deals with technological and market disturbances and change after some time (Gawer & Cusumano, 2014:417). These suppliers will be new to the industry and cannot cover all aspects of the existing market.

3.4.4.2 Contracts management

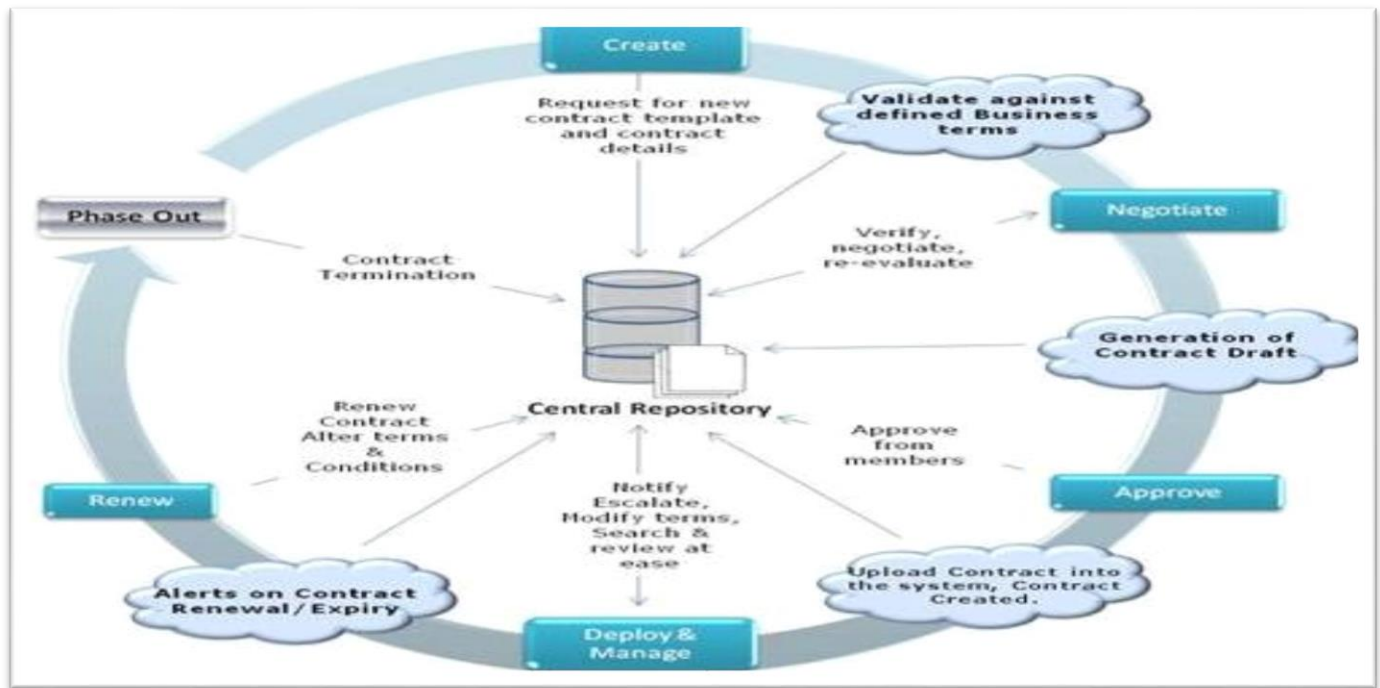
Customarily, the utilisation of supply chain contracts has been proven useful in progressing towards the execution of collaboration structures. Execution-based contracts have developed into a new service strategy in after-market operations that intend to make up for execution results.

(Mirzahosseini & Piplani, 2013:639). The service supply-chain management literature that services execution, additionally relies on customers' and sub-contractors' contributions to service creation and conveyance (Sampson & Spring, 2012:3). Contracting and impetus frameworks might be valuable in indicating and dealing with these inputs (Lillrank & Särkkä, 2011:274). Regardless of accentuating customer obligation for successful service delivery, Performance-Based Contracting (PBC) additionally involves expanded budgetary hazards for the service provider, including lack of payment or losses on performance improvement-related investments (Roels, Karmarkar & Carr, 2010:849). The application of performance-based incentive frameworks presupposes expansion procedures and systems for quantifying and reporting service execution indicators (Datta & Roy, 2011:579). In order to carry out the desired performance result, a proper impetus ought to be set up to motivate the supplier.

Contract lifecycle management is a procedure of overseeing contracts through a much-recorded strategy and process that permits the company to viably oversee different sorts of agreements, their terms, negotiation factors and establishments (Mirzahosseini & Piplani, 2013:640). The essential objective of contract management within any organisation is to guarantee that duties and obligations to customers and suppliers are unmistakably noticeable to the significant individuals in the association and that they are executed. (Kleemann & Essig, 2013:185). An effective contract management programme helps associations to monitor their contracts, customers and service suppliers compellingly (Sampson & Spring, 2012:3). This not only saves the company a ton of time and labour but at the same time is used as far as business systems and strategies are concerned (Roels *et al.*, 2010:851). The life cycle of a contract, as demonstrated in **Error! Reference source not found.**, starts from the creation of the contract and incorporates negotiations, approvals and actual deployment of agreements.

The management of contract-related exercises is amid the run, the renewal phase as well as the phase-out (Van der Valk & Van Iwaarden, 2011:198). At each of these stages, as further elaborated on by Van der Valk and Van Iwaarden (2011:198), different assets and meetings are included in creation, evaluation and approvals.

Figure 3.5 Contract lifecycle management



Source: Van der Valk and Van Iwaarden (2011:198)

As such, it is authoritative that rules are set to manage these undertakings. An issue lies along the way, that most of these exercises are manual, which take after non-standard approaches, impede simple access to records and do not allow an efficient approach to managing contracts and related reports. Numerous organisations invest a substantial amount of energy and assets executing contracts into their pre-planning and after that, once implemented, neglect to appropriately screen and manage these agreements (Lillrank & Särkkä, 2011:275). Successful contract management guarantees better supplier and vendor relationships as well as viable ones, authorises consistency and mitigates the potential risks (Wakolbinger & Cruz, 2011:4063). Any error in contractual commitment or skipping of a due date might bring about extreme punitive measures as it affects the execution and capacity of the association to screen its resources in minute detail.

3.5 CONCLUSION

To be a leader in market-buying companies such as Eskom requires taking the lead in finding strategic partnerships worldwide. It is essential to know the position or ranking strength of the strategic partners in the industry. Strategic alliances should not hinder the growth of emerging

companies and should also not be used to strengthen the monopolistic position of one party. This chapter, with limited research material, explores opportunities for minority or small suppliers as part of the value chain. While it focuses on five pillars of strategic sourcing, it should be mentioned that the supply-chain department could decide, based on importance, what to include and what to exclude. These decisions can be industry-driven, depending on the ownership of the company. The application of evaluation criteria further depends on the ownership of the enterprise if the evaluation criteria are known to the suppliers at the tendering stage.

The tendering process forms part of the strategy development stage. This becomes statutory and can be used in the context of an audit process, should there be a need to do so. All the information gathered during the information gathering stages must be included in the strategy document. This will aid the approval authority in deciding on a result.

The information obtained from the markets, using either analysis or bidding, can be used to prepare for negotiations. The company should be aware of the players in the market and will be able to negotiate better terms and conditions and in some cases, price. An active negotiation strategy goes with proper preparation. All members of the negotiation team must take part in the preparations. The tenderer also has information which could have been obtained from earlier tendering events or, in the Eskom case, from the public domain. In closing this chapter, the research also looked at the development of suppliers by the buying company. The enterprises that do not win the bid are not always weak in all aspects of the evaluation. Those businesses can be guided and developed to enhance future competition.

CHAPTER 4

SUPPLY CHAIN RISK MANAGEMENT

4.1 INTRODUCTION

This chapter is the last chapter of the literature review chapters. It discusses and explains the term Supply Chain Risk Management (SCRM), as well as the application of SCRM in different business sectors and the entire value chain. As part of SCRM, it further discusses the supply chain risk factors, with a focus on the supply risk, the demand risk and the operational risk in the electrical energy sector.

Furthermore, the chapter discusses the supply chain risks from a global perspective, looking at countries in the European Union (EU), and their stance on the type of products used to supply electrical energy. The EU has set a target of expanding the use of renewable energy to 27 percent by 2030. The EU is reliant on China for most of the products to achieve this goal.

A large number of Western manufacturers have migrated to the Asian emerging economies (AEE). This has resulted in the exploitation of the labour force and market expenses. This has encouraged the AEE to enhance all parts of their supply chains.

In America, natural gas has become a critical electrical energy source because shale gas has recently become obtainable. Columbia has discovered a progression of substantial electrical energy and has introduced natural gas rationing because of the unpredictability of natural gas. Different events are tabled to illustrate facts.

A discussion on the supply chain risks in Africa details the situation in the Nigerian economy, discussing how the electrical energy situation has crippled the country. The following chapter discusses the supply chain risks in South Africa's power utility and looks in depth at the building of two power stations, namely, Medupi and Kusile.

4.2 SUPPLY CHAIN RISK MANAGEMENT

Supply Chain Risk Management (SCRM) is an emerging area, growing out of a developing appreciation for supply chain risk by practitioners and researchers (Sodhi, Son & Tang, 2012: 1). The expanding globalisation of production and marketing endeavours permits firms to cultivate a

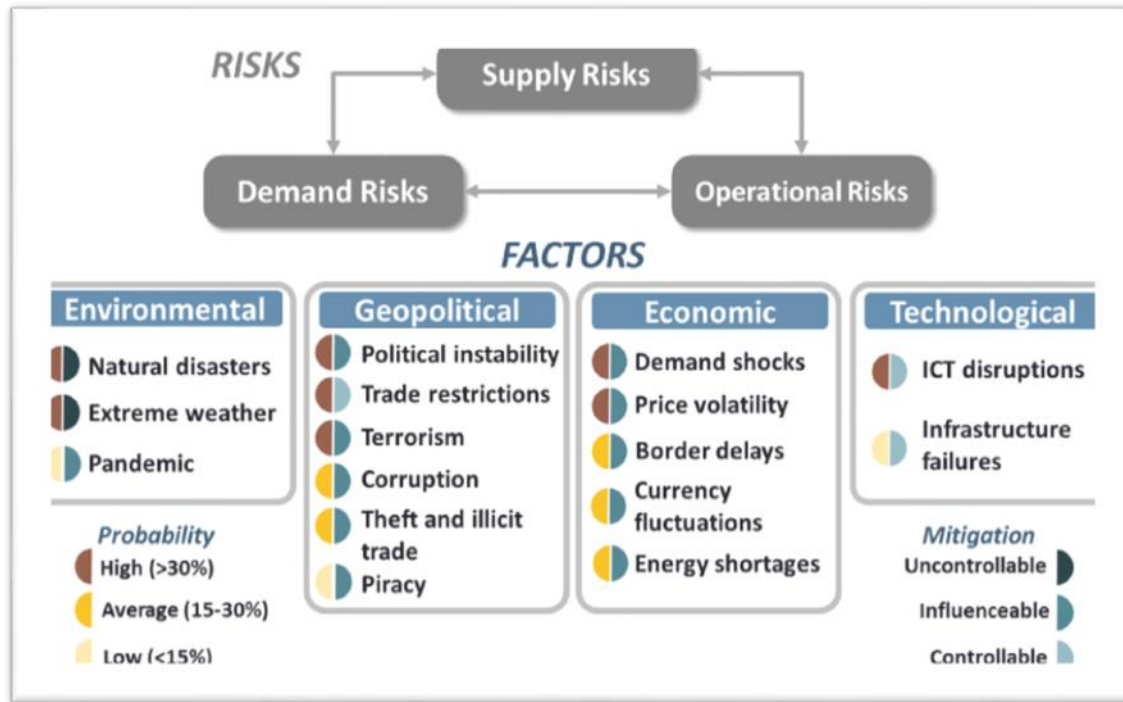
product in one country, deliver it in an alternative one and offer it in another (Sofyalıoğlu & Kartal, 2012:1448). Organisations operating in a globally competitive environment have some preferences; for example, a less-expensive workforce and crude materials, better financial opportunities, arbitrage prospects and more extensive product markets and incentives offered by host nations (Ghadge, Dani & Kalawsky, 2012:313). The hypothesis is that SCRM supports supply chains adapting to vulnerabilities, both proactively by supporting vigorously, and responsively by supporting agility (Wieland & Wallenburg, 2012:887). Key suppliers and customers are presently assuming a noteworthy role in the survival and intensity of organisations in global markets. Supply chains have now turned out to be more complicated and time has shown that the electrical energy industry is an excellent example of this change.

There is extensive agreement in the literature that managing risk in the supply chain is a fundamental necessity to compete in the current, logically exceptional and erratic business environment (Colicchia & Strozzi, 2012:403). Companies refer to a desire for concentration on core abilities and a need to exploit weak production costs outside of their manufacturing borders (Kleemann & Essig, 2013:185). Conversely, depending on a single supplier only may open the purchasing organisation to significant supply risks. Worldwide, oil exchange has become a need. This is shown by two noteworthy examples. One is the global oil markets, in which members are exposed to risk from oil price fluctuations (Jawad, 2013:62). The other risk is the worldwide Oil Supply Chain (OSC) network, within which physical disturbance is the most important risk confronted by the participants (Zhang, Ji & Fan, 2013:87).

4.2.1 Supply chain risk

SCRM has to perceive potential supply chain vulnerabilities and curtail these instabilities using suitable activity (Yaakub & Mustafa, 2015:151). There are still many organisations that have not established a structured Supply Chain Risk Management and extenuation system (Batista, 2012:124). Also, such organisations are uninformed about supply-chain disruption risk management (Taghizadeh & Hafezi, 2012:22). The intricacy of supply chains requires an appraisal of the sort of risks included and the related factors that may cause them. The risks are interrelated (Qazi, Quigley, Dickson & Ekici, 2017:198), as illustrated in **Error! Reference source not found..**

Figure 4.1 Supply chain risk and factors



Source: Qazi *et al* (2017:198)

4.2.1.1 Supply risk

The issue of risk and instability related to supplier execution using various measures, and additionally, that of supply risk in general has become a significant consideration in purchasing literature (Thun & Hoenig, 2011:242). Supply risks are the instabilities associated with suppliers, which incorporate physical conveyance (or non-conveyance) as well as in the relationship between the supplier and the operator, and also any risks identified with inbound logistics and product (or crude material) supply (Nakandala, Lau & Zhao, 2016:1). Effects including elements of inbound supply suggest that a supply chain is sometimes unable to meet the demands concerning quantity and quality of parts and completed products.

Given that oil production and consumption occurs in several regions around the world, an imbalance between oil supply and demand is developing (Sun, Liu & Chen, 2017:449). As an important strategic resource, oil is the lifesaver of a nation's economy and the essential determinant

of a country's electrical energy security and economic safety (Oyedepo, 2014:255). China's oil imports confront more unpredictable and variable risk factors and protecting the oil supply has turned into a significant issue (Sun *et al.*, 2017:449). In particular, expanding supply sources can diminish interruption vulnerability from a specific source, in principle and practice, which alludes to supplier diversification (Yang *et al.*, 2014:930).

4.2.1.2 Demand risk

Demand risk factors emerge from the vulnerabilities associated with user demand of products and the variation of markets, according to consumer demand; that is, any risk associated with outbound logistics streams and product demand (Scholten & Fynes, 2017:413). Potential interruptions can be brought about by fluctuations in customer demand and financial factors. For example, these may include exchange rates, market pressures, and environmental and geopolitical factors; specifically, climate, natural disasters, political instability and industrial action (Qazi *et al.*, 2017:189). Distribution system planning and the economic and robust planning of distribution networks are essential strategies for electrical distribution companies.

Electrical energy demand is categorised into baseload, intermediate load, and peak load. In the medium term, baseload requirements do not change fundamentally for some time. These are characterised as the base measure of electrical energy that an electricity supplying utility or Energy Distribution Company should consistently make accessible to its customers (Nicholson, Biegler & Brook, 2011:305). Intermediate load varies, however, as it is projected and influenced by the time of day, for example, weekday mornings and night times (Andersen & Dalgaard, 2013:19). Peak load is considerably less predictable and is frequently affected by climatic conditions that change the demand for building, warming and cooling (Zagoras, Balasubramaniam & Karagiannidis, 2015:1).

As item lifecycles shrivel and new generations of technology enter the market more rapidly, accomplishing solid top- and bottom-line results depend on estimating overall demand and product blend as precisely as may be expected under the circumstances (Matzler, Grabher & Huber, 2013:420). In high-volume industries, such as electrical energy, where demand is frequently hard to anticipate, before the introduction of a product, instability can be a tremendous issue (Yaakub & Mustafa, 2015:152). Extrapolative supply chain modelling can help address demand instability

concerns (Nakandala *et al.*, 2016:2). A typical obstacle is over-estimating the goods and services needed by companies. Buyers become distinctly captivated with immeasurable optional components, innovative capacities and logistical conveniences that suppliers progressively make accessible

4.2.1.3 Operational risks

Operational risks vary from different sorts of risks as they deal with set conventional procedures as opposed to dealing with complex conditions (Oehmen, Olechowski & Kenley, 2014:441). They can be characterised as the risks associated with calamities that may result from inadequacies or non-conformances inside operational procedures within an organisation, including quality, environmental, and occupational health and safety risks, to name a few (Aven, 2011:719). One of the fundamental issues with operational risk is that it can be inflexible in disengaging the operational adversity element from losses in other risk classifications with which they are interlaced (Sofyalıoğlu & Kartal, 2012:1448).

Distinguishing and moderating risks emerging from operations and supply chains are being highlighted more and more (Sodhi *et al.*, 2012:1), as having significant ramifications for consumer security and operational competitiveness (Fawcett & Waller, 2014:157). Albeit the fact that operational risk has consistently existed as one of the core risks in the financial industry, it is developing into a prominent element of risk management in the light of new threats to monetary dependability because of higher geopolitical risk (Bryce, Webb & Cheevers, 2016:131). If this is inadequately dealt with, the interruptions and ecological damage resulting from operational losses cause enormous recuperation costs, diminish customer goodwill and brand value, and cause costly litigation.

4.3 CRITICAL FACTORS AFFECTING SUPPLY CHAIN RISKS – A GLOBAL PERSPECTIVE

Concentrating on developed nations, extensive research on supply chains disregards instabilities in the political climate because of their secondary significance to their operations (Davarzani, Zanjirani & Farahani, 2015:1567). Fundamentally, instabilities, for instance potential constraints, sometimes change the situation and financial transactions fundamentally increase the difficulties

experienced by numerous SC managers in developing countries (Ghadge, Dani, Ojha & Caldwell, 2017:262). Over the last few decades a large number of firms in nations across various continents; for example, Burma, Cuba, Iran, Iraq, Libya, Nicaragua, North Korea and Sudan, have been exposed to critical limitations because of universal and unilateral sanctions (Matzler *et al.*, 2013:420). It is impractical for these organisations to remove all the risks they confront entirely, although they can limit their exposure to these risks.

In SCRM literature, disruption is characterised as a group of risks set up in some external element. For example, these may include catastrophic events, labour disputes, supplier liquidation, demonstrations of war and terrorism (Davarzani, Zegordi & Norrman, 2011:1517). The detailed consequential results of risky events shed light on the significance of proactively managing supply chain risk (Cinar, Isin & Hushmat, 2016:7). The fundamental entity in risk management is to recognise and portray the specific risks confronted by a particular firm or industry (Ghadge *et al.*, 2017:262).

In recent years, the topic of supply chain risk has been pushed to the forefront; at first by fears identified with conceivable disturbances resulting from the hugely publicised "millennium bug" (Oehmen *et al.*, 2014:441) also known as Y2K (year 2000 problem). Y2K passed without any momentous events. However, the boundless interruptions brought on by fuel challenges in South Africa after that, including Foot and Mouth Disease in the UK, and terrorist assaults on the USA have underlined the defencelessness of cutting-edge supply chains (Davarzani *et al.*, 2015:1567). Different firms in countries exposed to public agitation, drug cartel wars and uprisings, likewise, need to adapt to their vulnerabilities and take steps to reduce such vulnerability

4.3.1 Supply chain risks in Europe

With the objective of decarbonising its electrical energy sector, the European Union (EU) has set a target of expanding the amount of energy obtained from renewable sources to 27 percent by 2030 (Lunt, Ball & Levers, 2014:380). While European renewable electrical energy producing firms have the necessary innovative aptitude to meet this objective, they are substantially dependent on imports of specific crude materials that empower them to achieve this (Rabe, Kostka & Smith Stegen, 2017:692). Given their reliance on a single country, China, for the sourcing thereof, both governments and industry analysts have raised uncertainties over future pricing and availabilities

of sustainable energy (Chaudhuri, Mohanty & Singh, 2013:2790). China is the premier producer and exporter of tellurium, gallium and indium (utilised as a part of making photovoltaics), and two rare piles of earth, neodymium and dysprosium (used as a part of assembling wind turbines) (Moss, Tzimas, Kara, Willis & Kooroshy, 2013:556). Table 4.1 demonstrates that the EU's interest in these materials is anticipated to peak in around 2020 and after that to start fading (Rabe *et al.*, 2017:692). Demand is increasing, as specialists trust that the utilisation of thin film cells will spread in the future (Moss *et al.*, 2013:556).

The EU further projects that demand in the EU for neodymium and dysprosium will grow by 2020 and 2030, discretely (Smith Stegen, 2015:1).

Table 4.1 Projected demand over mentioned period for critical raw materials in EU

Material	Annual EU demand (<i>in tons</i>)	
	2020	2030
<i>Solar</i>		
Tellurium	150	126
Indium	145	121
Gallium	4	3
<i>Wind</i>		
Neodymium-Praseodymium	845	1222
Dysprosium	58	84

Source: Rabe *et al.* (2017:692)

There are a couple of alternatives, which European solar firms can investigate, which include the reduction of their dependence on China for tellurium, indium and gallium. Prices are currently low, and there are alternative supply sources (Glöser, Tercero Espinoza & Gandenberger, 2015:35). Where the EU sources these materials, they rely on supply accessibility and preparing limits. China tops the list of suppliers of many crude materials and owns the main co-ordinated mine-to-magnet value chain globally.

The renewable electrical energy creation focus on the EU has started a bio-energy boost in Europe, particularly for wood-based, biomass energy production systems. In Austria, regulations to advance bio-energy efficiently, animated the setup of consolidated warming plants, bringing about a significant increase in forest fuel demand (Rauch, 2017:561), which ended up being a more costly and challenging assignment than was initially anticipated by investors. In Finland, the expanding utilisation of domestic fuels is promoting the developing significance of measures to enhance supply security (Klaminder, Lucas & Futter, 2011:1). Similarly, throughout Europe, aggressive EU and national bio-energy targets have brought on an abundance of demand issues in national biomass markets, between competing industries (Mansikkasalo, 2012:150).

According to an analysis by Rauch (2017:561), environmental changes incite impacts. For example, the occurrence of more continuous storms and expanded risk of bark beetle infestations. These harm forests and result in an overflow of surplus wood. These occurrences will ease forest fuel supply in the short-term only. Safety stocks are a standard measure intended to support supply and demand instabilities and can always be introduced to reduce risks. Safety stockholders for forest fuel supply, more often than not, store unchipped wood assortments as these combinations have superior storability potential (Shahi & Pulkki, 2015:1313). Another methodology, according to Kou and Zhao (2011:608), ordinarily found to defeat feedstock supply disturbances in the bioenergy sector, is the utilisation of various sources of lignocellulose biomass as feedstock for heating plants.

4.3.2 Supply chain risks in Asia

In recent decades, the hasty economic development in Asian emerging economies (AEE) has brought about significant environmental problems. Lai and Wong (2012:267) emphasise that this phenomenon is a worldwide issue, as the dominant portion of products disbursed in developed nations receives their raw materials, and a part of the manufacturing processes, from different operations situated in developing countries. One of the first apprehensions of Western investors is the non-existence of stable legal and regulatory systems that could be utilised to monitor and facilitate business operations in the AEE (Geng, Mansouri & Aktas, 2017:1). Of late, a large number of Western manufacturers have migrated from their business bases and production facilities to AEE, exploiting lower labour and material expenses (Tang & Zhou, 2012:585). These migrations have placed an increasing burden on the AEE, especially China, Taiwan, India,

Malaysia, Indonesia, Thailand and South Korea, to enhance all parts of their supply chains (Lai & Wong, 2012:267).

Since the Fukushima Daiichi Nuclear Power Plant accident, the estimation of the external cost of a nuclear power plant misfortune within the social cost of nuclear energy has acquired significant consideration (Lee & Kang, 2016:111). The Fukushima Daiichi nuclear disaster was an energy accident at the Fukushima 1 Nuclear Power Plant in Fukushima, caused by the tsunami after the Tōhoku earthquake on 11 March 2011. An economic analysis of severe disasters in energy sectors frequently includes allocating monetary values to human lives (Wang, Hong & Chen, 2012:3323). There is concern regarding the effects of the nuclear energy disaster since individuals might be affected by exposure to radioactive scission. Products might be discharged into the environment and may present a radiation threat to the local population (Van de Poel, 2011:285).

Although the risk of a fatality arising out of a nuclear power plant accident can be assessed in physical terms, it is challenging to convert the chances of casualty forthrightly into the health bearing cost of the accident since there are no immediate, measurable market costings for the value of a life (Laes, Meskens & Van der Sluijs, 2011:5664). There have been several studies which investigated the relationship between risk avoidance and the probable cost of an NPP accident and some proposed methods to assess risk aversion in the external cost estimation (Hong, Bradshaw & Brook, 2014:569). The conservative approach to calculating the cost risk comprises presuming an expected estimate of different misfortune situations. Assessing the entirety of the accident situation, the probabilities were shown to have increased relative to their fiscal outcomes (Kharecha & Hansen, 2013:4889).

Among the consequences of the March 2011 accident at Japan's Fukushima Daiichi Nuclear Power Plant, was the plant's future commitment to nuclear power. The worldwide electrical energy supply has turned out to be dubious to some degree (Wang *et al.*, 2012:3323). Also, in March 2012, Greenpeace distributed a South Korean rendition of their Energy Revolution format report (done now in many countries), which proposed to eliminate nuclear power by 2030 and decrease the fossil fuel electrical energy supply significantly (Hong *et al.*, 2014:569). Categorising and finding the risks involved makes nuclear power a genuine threat to the environment and human

life. There is a disparity between the social acceptability of the risk and the evaluated expected estimation of nuclear power plant accidents.

4.3.3 Supply chain risks in the Americas

Disasters and accidents happen because of the effect of a natural or human-made risk. Various internal and external forces are emerging which increase the risk stakes for international supply chains (Rauch, 2017:561). Some are full-scale patterns; for example, the risk posed by globalisation and worldwide connectivity, which can make supply chains more complicated and may increase the impact of issues that may arise (Moss *et al.*, 2013:556). Other patterns arise out of the push to enhance effectiveness and reduce operating costs. One of the regions which encountered an assortment of disasters is the Americas.

Natural gas has turned into a critical global electrical energy source because of the reserves of shale gas that has recently become obtainable using new hydraulic fracking technologies (Saldarriaga-C & Salazar, 2016:349). Due to the unlimited global reserves and the minimal effort put into production and transportation, different nations in South America like Brazil, Chile, and, of late, Colombia have built up their production, transportation and distribution infrastructures so much that natural gas is today a vital part of their electrical energy network (Curran, Wagner, Graves, Keller & Green Jr., 2014:194). In Colombia, for example, natural gas is at present the second most crucial essential energy resource for the electrical energy sector, with hydro-resources being the most critical (Knudsen, Whitson & Foss, 2014:165). In any case, relentless quality is a vital point as these rapidly developing economies require stable supply, transportation, and distribution systems that will support their economically related changes in the years ahead. Colombia has encountered an increasing supply of substantial electrical energy and the consequential necessity for natural gas rationing because of the unpredictability of natural gas supply and transportation (Ríos-Mercado & Borraz-Sánchez, 2015:536). One resolution for enhancing the dependability of the natural-gas system is to build LNG-RTs (liquefied natural-gas regasification terminals) that make it conceivable to import natural gas and consequently, increase the security (dependability) of supply (Saldarriaga-C & Salazar, 2016:349).

Due to the natural risks involved, the Ministry of Mines and Energy (MME) of Colombia in Spain has restricted the service because of the absence of adequate infrastructure, amid various climatological phenomena (El Niño and La Niña), as illustrated in Table 4.2.

Table 4.2 Most recent events that caused rationing of natural-gas supply in Colombia.

Year	Cause	Consequences	Actions taken by the Minister of Mining and Energy (MME)
2006	Expansion of Chuchupa-Ballenas production field	Reduction of the natural gas production during the expansion process.	Resolution 18-0257 of 2006 by the MME that declared the beginning of a natural gas rationing and defined the priority of supply for natural gas users.
2008	Maintenance of the Cusuaian-Cupiaga production field	Reduction of the natural gas production that affects the supply of the important industrial customers and natural gas vehicles.	Resolution 18-2278 of 2008 by the MME that declared the beginning of a natural gas rationing and defined the priority of supply for natural gas users.
20092010	The occurrence of El Niñoa	A reduction of the water-storage capacity of various dams that obligated the dispatch of the most of the natural gas based power generation. The use of natural gas for power generation caused a shortage of supply for other type of users.	Resolution 18-1654 of 2009 by the MME that declared the beginning of a natural gas rationing and defined the priority of supply for natural gas users.
2012	The occurrence of La Niñab	Natural gas pipeline ruptures due to landfalls caused by the rainfall. The rupture caused a supply shortage in the southwest of the country.	No actions
2012	The occurrence of La Niñab	An overflowing of the Magdalena river in the north threatened to rupture a natural gas pipeline. For security reasons<comma> the operation of that pipeline was suspended so that there was a supply shortage for most of the natural-gas based power generation. It led to electric power rationing in the country.	Resolution 18-0056 of 2012 by the MME that declared the beginning of a natural gas rationing and defined the priority of supply for natural gas users.
2014	The possible occurrence of El Niñoa	Interruption of natural gas exports to Venezuela.	Resolution 9-0456 of 2014 by the MME that declared the beginning of a natural gas rationing and defined the priority of supply for natural gas users.

Source: Saldarriaga-C and Salazar (2016:349)

Additionally, Table 4.2 demonstrates that the electrical energy sector has been adversely affected by the absence of natural gas for the thermal generators (Saldarriaga-C & Salazar, 2016:349). Reliable communication and coordination between electrical energy systems and natural-gas system operators is a method used to counteract, distinguish and take corrective actions in case of an adverse contingency.

In February 2011, exceptionally icy weather in the Southwest U.S. brought about the coincidental failure of critical parts of the region's infrastructure for natural-gas supply, handling and transportation, and electrical energy generation (Hibbard & Schatzki, 2012:6). The loss of natural-gas production and electricity generation during the incident accelerated widespread service disruptions to electrical energy and natural-gas clients in Texas, New Mexico and Arizona. A total of 1.3 million electrical energy usage clients were without service (Wei, Chen & Sun, 2016:305). The interdependence of the nation's electrical energy generation and natural-gas infrastructure, and the coordination difficulties in the way of the competent and dependable operation of both have come to the attention of state controllers, and the system operators of a few districts (Touretzky, McGuffin & Ziesmer, 2016:500).

According to Wei *et al.* (2016:305), the risks of supply interruption attached to the interdependence include:

- (a) the decreased accessibility of natural-gas-fired electrical energy generation, at times when winter electricity demand concurs with local distribution centres' natural-gas demand for residential and commercial heating;
- (b) the potential loss of natural-gas-fired electric generating capacity, after the unforeseen loss of a significant interstate pipeline serving different generators;
- (c) decreased pressure in interstate pipelines and local distribution centres' gas distribution systems triggered by electrical energy generation facilities drawing gas at rates beyond planned amounts; and
- (d) declines in accessible service or interstate pipeline pressure because of the loss of electrical energy to natural-gas pipeline compressor stations. These risks are not necessarily widespread throughout the country because all regions are subject to similar levels of natural gas for electrical energy generation (Curran *et al.*, 2014:194).

These risks are related and are not distinct from each other. For instance, the potential for unfavourable natural-gas system conditions or interruptions prompting consistent quality of a power framework is attached to both the accessibility and attributes of the gas framework foundation (Hibbard & Schatzki, 2012:6). Discontinuities in the operation of electrical energy and

natural-gas markets in both the long and short-term, contribute to interdependence risks. Thus the risks related to interdependence are tied to both infrastructure conditions and financial variables.

4.3.4 Supply chain risks in Africa

The conciliation of communism, the overview of market drivers in China and Russia, the break-up of colonialism in Africa, the development of economic communities in Europe, South-East Asia, Africa, the Americas, which includes the acceleration of technology applications, have all contributed to the openness in this era of peace (Kilubi, 2016:662).

Access to electrical energy services is fundamental to both social and economic development and critical in accomplishing the majority of the Millennium Development Goals (MDGs) of diminishing hunger and poverty by 2015. This is adding to the focus on developing countries and the African continent, individually.

The most effective method to guarantee the versatility of a worldwide supply chain is an issue which has possessed the World Economic Forum since 2009 (Bogataj, Aver & Bogataj, 2016:68), and it has remained a point of discussion among market leaders. The Industry Agendas in Davos communicated the need to build up a risk evaluation structure for the end-to-end supply chain, which has not been developed yet (Bogataj *et al.*, 2016:68). Although it is impossible to eliminate the risks from a supply chain, they can be diluted. Supply chain partners can prepare themselves to counteract the risks and develop effective mitigation strategies.

Given the rapid urbanisation and expanding requirements of state spending, governments throughout Sub-Saharan Africa have mostly been compelled to concentrate on the difficulties of maintaining and expanding the urban grid-based service, instead of spending money on the electrification of rural areas (Bhattacharyya, 2013:462). Broadening the grid-electrification into rural regions has demonstrated that it is an 'under-cover issue' in most of the countries in Sub-Saharan Africa (Kemeny, Munro, Schiavone, van der Horst & Willans, 2014:228). At 68 gigawatts (GW), the entire generation capacity of the 48 countries of Sub-Saharan Africa is no more than that of Spain (Lahimer, Alghoul, Yousif, Razykov, Amin & Sopian, 2013:314).

4.3.5 Supply chain risk in Nigeria

It is not a misrepresentation to argue that the development path of the Nigerian economy, particularly in the previous three decades, has been firmly connected with improvements of the electrical energy sector, especially inside the oil subsector (Oyedepo, 2012:1). The electrical energy sector has played and continues to play a vital role in Nigeria's expansion process. The impact of the electrical energy crisis, which has hampered Nigeria for nearly two decades, has been tremendous and has to a great extent contributed to the prevalence of poverty by incapacitating industrial and commercial activities during this period (Dada, 2014:1003). The insufficiency of the national grid, particularly the failure of electrical energy generation capacity to coordinate expanding demand throughout the country, has promoted growing agitation for a more prominent entrance of renewable-energy sources in electrical energy supply combinations (Aliyu *et al.*, 2013:354).

The absence of access to the grid in the rural regions and poor quality electrical energy supplied to the on-grid areas has prompted many houses throughout the country turning to small-scale electrical energy generation stations, utilising mostly fossil-fuel sources (Emodi & Boo, 2015:356). Many people have died due to the exhaust fumes of a generator left running overnight in their living room, and at times an entire family has been wiped out of existence (Adekomaya, Jamiru & Sadiku, 2016:1). The struggling economy has resulted in a situation where those that cannot manage the high cost of installation and the maintenance cost of independent generators have moved their businesses to neighbouring countries, causing a colossal financial loss to Nigeria (Rafindadi, 2016:1209). The risk of losing more lives will increase if the federal government does not deal with the situation, either by introducing more stringent policies for electrical energy generation or by introducing improved safety measures.

For a developing country like Nigeria where neediness is endemic and is briskly expanding into new structures and measurements, the generation and utilisation of electrical energy has become a distraction for the government. This has resulted in the requirements it poses for limiting industrial usage and employment creating opportunities (Shaaban & Petinrin, 2014:72). Poor economic performance has likewise assumed a role in the misfortunes of the electrical energy industry in Nigeria. The National Electric Power Authority (NEPA) collects compensation for 50 percent of the electrical energy supplied. In this situation, it is almost impossible for NEPA to meet its service

commitments and investment requirements (Rafindadi, 2016:1209). Further, depreciating of the local currency against other vital currencies exacerbates NEPA's budgetary position and further debilitates the capability of NEPA to import spare parts for maintenance and substitution of old parts and equipment (Emodi & Boo, 2015:356).

Researchers have established that electrical energy is a crucial factor in the achievement of economic objectives in Nigeria, as well as throughout the entire world (Oyedepo, 2014:255). Numerous indigenous researchers have investigated the accessibility of renewable electrical energy resources. Table 4.3 illustrates the sources and the reserves in Nigeria, to building up their feasibility in the country (Mohammed *et al.*, 2013:257). Efficiency will develop through a much better organised electrical energy system and capital investment and by decreased electrical energy use, peak demand and fewer energy losses (Bogataj *et al.*, 2016:68).

Table 4.3 Nigerian energy reserve and capacity (2005)

Source of energy	Estimated reserve
Crude oil	36.5 billion barrels
Natural gas	187.44 trillion cubic feet
Tar sands	30 billion barrels of oil equivalent
Coal and lignite	Over 40 billion tonnes
Large hydropower	11,235 MW
Small hydropower	3500 MW
Fuel wood	13,071,464 ha
Animal Waste	61 million tonnes/yr
Crop residues	83 million tonnes/yr
Solar radiation	3.5–7.5 kW h/m ² /day
Wind	2–4 m/s at 10 m height

Source: Oseni (2012:3967)

With the abundance of natural energy available, aside from filling in as a mainstay of wealth creation in Nigeria, electrical energy is also the core of operations and hence the engine of development for all segments of the economy, Table 4.3 illustrates the energy reserves and capacity. (Adekomaya *et al.*, 2016:1). Electrical energy utilisation affects the scope of financial exercises and significantly improves the expectations for the everyday comforts of Nigerians.

For crucial financial improvement and foreign investments in Nigeria, the present unsatisfactory quality and inefficient electrical energy supply system throughout the country needs to be addressed (Dada, 2014:1003). A reliable national grid is relied upon to perform its required capacity for electrical energy conveyance to the consumer, as they need it (Oseni, 2012:3967), without any risk of taking a life or injuring humans. The country needs a market-oriented policy that will expand renewable-energy investors' cooperation in the forceful advancement of the accessible resources (Mohammed *et al.*, 2013:257). The essential focus of the electrical energy system in any country is to keep up a consistent and sufficient electricity supply to its customers at a reasonable rate of return. This goal is a farfetched ideology in Nigeria.

4.3.6 Supply chain risk in South Africa

Electrical energy supply chains are critical assets for our societies. An interruption could have a significant economic impact on organisations dealing with the generation and distribution of electrical energy products.

The capacity to deal with the full scope of risks inside the electrical energy environment is critical to its success. The RSA government has recognised the absence of access to guaranteed electrical energy as one of the critical obstacles to economic growth, and as such is under serious examination (Pollet, Staffell & Adamson, 2015:16685). Due to delays in further capacity expansion to meet electrical energy demand and an inability to accomplish cost-intelligent tariffs, the electricity supply industry in post-apartheid South Africa, is defined by shortages of supply (Pegels, 2010:4945). Impromptu blackouts, electrical energy deficiencies, outages, high electricity tariffs, numerous instances of underinvestment in electrical energy infrastructure and energy poor, low-income households are the main issues (Nel *et al.*, 2016:62).

Electricity price increments have broad ramifications for South Africa that affect economic growth and add to inflationary cost pressures and pressurise the margins of industries across different

sectors of the economy (Adams, 2010:243). Eskom Holdings Ltd and the Department of Energy (DoE) have embarked on an extensive program to bring the electrical energy supply and distribution system into balance (Eberhard, Rosnes & Shkaratan, 2011:1). However, this comes at the cost of an infrastructural sticker price of around US\$30 billion for the development of new coal-fired power stations. Such stations include Medupi in Limpopo and Kusile in Mpumalanga (Nel *et al.*, 2016:62). South Africa, at present, depends almost exclusively on fossil fuel-based electrical energy sources, especially coal-generated electricity (Krupa & Burch, 2011:6254). Eskom holds an aggregate installed generating capacity of practically 42,000 megawatts (MW), with a peak capacity of around 34,200 MW (Pollet *et al.*, 2015:16685). Notwithstanding a continuing electrical energy crisis from its coal-fired sources, South Africa has recently turned out to be one of the primary destinations for renewable-energy investment (Joubert, Hess & Van Niekerk, 2016:809). Renewable and sustainable alternatives are becoming increasingly critical as individuals become distinctly mindful of the negative impacts of fossil-fuel emissions on their wellbeing and the environment (Nakumuryango & Inglesi-Lotz, 2016:999). This sense of resolve is reflected in the current resurgence of enthusiasm for the creation of renewable energy for use as an alternative for the electrification of industries and households, depending on sound economic feasibility studies (Amigun, Petrie & Görgens, 2011:3178). The South African energy industry is doing an extraordinary number of feasibility studies to decide the benefits of embarking on renewable energy. By doing so, there is more and more enthusiasm for the lessons learned about its application to a vast number of activities. The experience gained from past energy ventures can likewise be utilised to give a preventative guide for all purposes regarding risks.

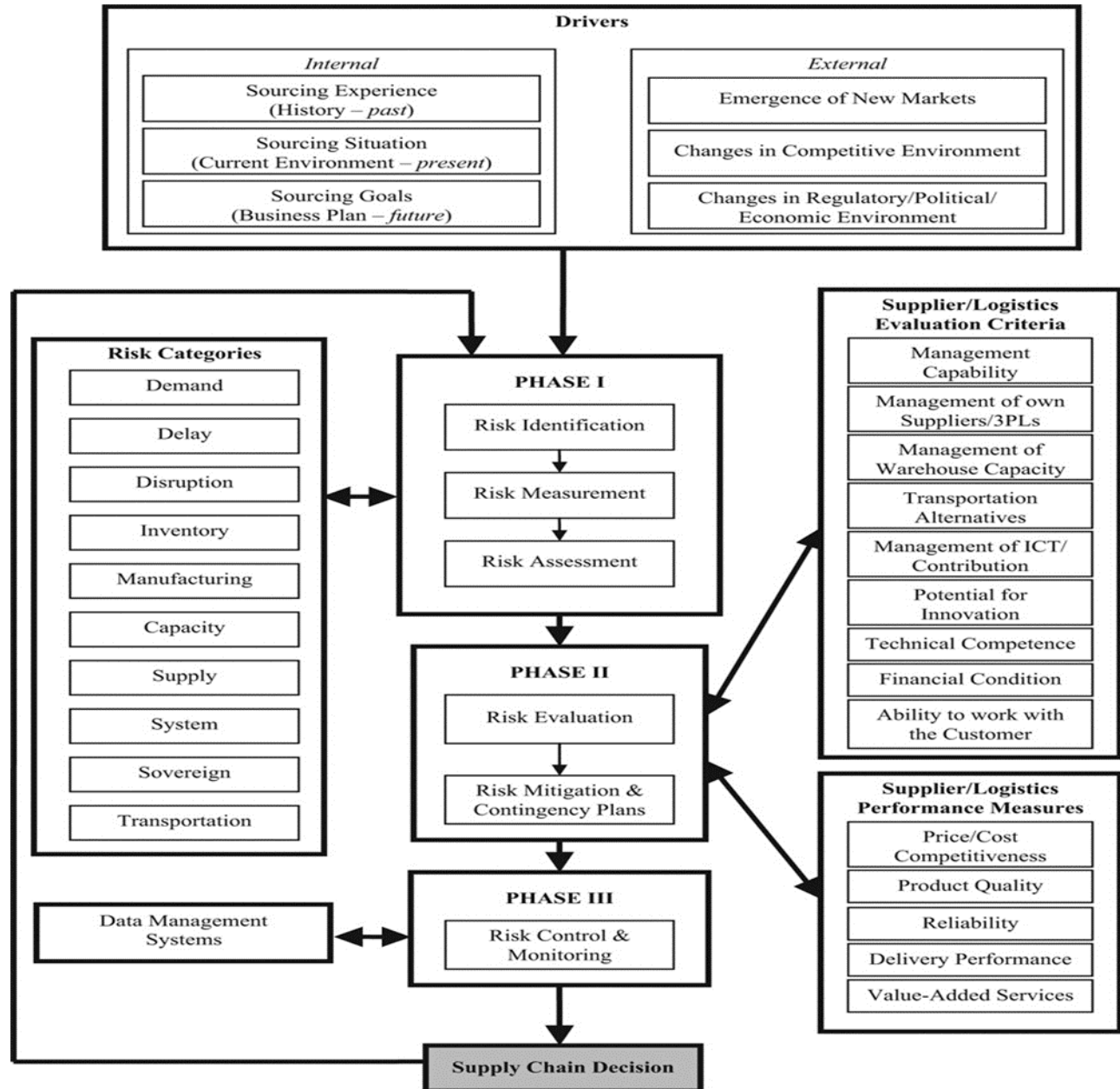
4.4 SUPPLY CHAIN RISK FACTORS AND MITIGATION IN THE SOUTH AFRICAN ELECTRICAL ENERGY SECTOR

When global rivalry escalates and supply chains become more extensive and more complex, the probability of not accomplishing the anticipated supply chain (SC) execution rises, primarily because of the risk of SC failures (Tummala & Schoenherr, 2011:474). It is essential that companies plan for interruptions and develop contingency plans for outline segments of their supply chains. It is imperative to comprehend supply chain interdependencies, categorise potential risk factors, their probability, significances and likely severity levels. (Qazi *et al.*, 2017:189). Regardless of the area of importance, risk is associated with an embarrassing misfortune, i.e. an

undesirable negative significance, and instability (Taponen, 2017:269). The identified risks can form part of a strategy, preferably to avoid them, or if that is unrealistic, at least to mitigate, hold and control them.

Although the assessment and management of risk in supply chains is, to a great extent a recent phenomenon, studies exist that have investigated risk management approaches from an assortment of points of view (Zhao, Yan & Zhang, 2017:170). Expanding on these reviews, Tummala and Schoenherr, (2011:474), by following on from acclaimed research projects, developed an organised Risk Management Process (RMP) comprising six phases: risk identification, risk measurement, risk assessment, risk evaluation, and risk control, and observing such risks. The RPM has been changed and is now referred to as the supply-chain risk management process (SCRMP), as illustrated in Figure 4.2. Risk identification, risk measurement, and risk assessment encompasses Phase one of the SCRMP, which will be discussed throughout this section.

Figure 4.2 Supply chain risk management process



Source: Tummala and Schoenherr (2011:474)

4.4.1 Risk identification

Risk identification comprises a comprehensive and structured assurance of potential SC risks, associated with a given issue (Fan, Li, & Sun, 2017:63). Understanding risks, correlated to such categories are highlighted in **Error! Reference source not found..** These risk categories have also

been incorporated into the overall framework, as illustrated in Table 4.4, which tables supply chain risk categories and their triggers:

Table 4.4 Risk identification

Risk category	Risk triggers
Demand risks	Order fulfilment errors; Erroneous forecasts due to lengthier lead times, product diversity, swing demands, seasonality, short life cycles, and small customer base; Information distortion due to sales promotions and incentives; Lack of SC visibility
Delay risks	Excessive handling due to border crossings or change in transportation mode; Port capacity and congestion; Custom clearances at ports; Transportation breakdowns
Disruption risks	Natural disasters; Terrorism and wars; Labour disputes; Sole source of supply; Capacity and responsiveness of alternate suppliers
Inventory risks	Costs of holding inventories; Demand and supply uncertainty; Rate of product obsolescence; Supplier fulfilment
Manufacturing risk (process) breakdown risks	Inferior quality (ANSI or other compliance standards); Lower process yields; Higher product cost; Design changes
Physical plant (capacity) risks supply (procurement) risks	Lack of capacity flexibility; Cost of capacity; Quality of service, including responsiveness and delivery performance; Supplier fulfilment; Inflexibility of the supply source; Inferior quality or process yield at supply source; Supplier bankruptcy; The rate of exchange; Percentage of a critical part or raw material obtained from a sole source
System risks	Information infrastructure breakdowns; Lack of effective system integration or extensive system networking; Lack of compatibility in IT platforms among SC partners
Sovereign risks	Regional instability; Communication difficulties; Government regulations; Loss of control; Intellectual property breaches
Transportation risks	Paperwork and scheduling; Industry strikes; Late deliveries; Higher costs of transportation; Depends on which transportation mode is chosen

Source: Tummala and Schoenherr (2011:474)

Without endeavouring to be fully comprehensive, this list is illustrative of the considerable number of risks that might be present. Prejudiced parts should be distinguished, and significances should be seen so that risk alleviation strategies can be implemented (Amigun *et al.*, 2011:3178). Risk identification might be more systematic because it depends on a variable perspective of risk rather

than predefined risk categories (Cagliano, Grimaldi & Rafele, 2015:232). Nevertheless, risk classifications characterised before the risk identification may falsely distort the complete risk representation which should be re-created at later phases of the Enterprise's Risk Management (ERM) programme (Kmec, 2011:1489).

Understanding the assortment and interrelationships of SC risks is, therefore, significant. Such comprehension can be carried out by recognising threats and resources. According to Tummala and Schoenherr (2011:474), threats allude to a broad scope of forces, which could produce antagonistic outcomes. Resources refer to assets, individuals or income, which could be influenced by threats. In the case of excellent development construction ventures, for example, with Eskom, the fleeting perfect perspective risk rises, takes shape, and continues or vanishes as the enterprise's activities advance over time (Tempelhoff, Ginster, Motlounge, Gouws & Strauss, 2014:77). Typical construction projects, such as that of Eskom, may encompass the identification of all forms of risks; for example, environmental, contractual, financial, operational, political and technical risks (Taponen, 2017:269). It is, therefore, a respectable start to first specify every single conceivable risk that could create antagonistic consequences for the execution of the supply chain.

Kusile, meaning 'good morning' in Ndebele, will be the first coal-fired power station in South Africa using the Flue Gas Desulphurisation (FGD) technology, an air outflows reduction device used to eliminate sulphur oxides (SO_x) from coal-burning power stations (Eskom Holdings Ltd, 2016b: 1). As with any vast construction project, there are numerous environmental risks brought about by construction procedures (Cinar *et al.*, 2016:7). The broader project had to confront challenges with the number of different contractors who were working in or near wetlands. Another environmental risk, waste management, is one of the close encounters that contractors are confronted with, which could have dangerous environmental consequences if not appropriately managed (Riekert & Koch, 2012:52).

Medupi is a Sepedi word for "rain that douses dried grounds". Medupi Power Station is a dry-cooled coal-terminated power station being run by Eskom. When it is finished, the power station will have six boilers each fuelling an 800 MW turbine, delivering 4800 MW of force (Eskom Holdings Ltd, 2016:1). Zhao, Hwang and Phng (2014:27) called attention to the fact that the construction industry has had a poor reputation for overseeing risks, with many activities

neglecting to meet due dates and cost targets. Delay risks occurred on Medupi, as outlined by Riekert and Koch (2012:52). The power station employed around 17 000 workers on site location, 6 000 of whom are associated with the National Metalworkers Union of South Africa (Numsa). These workers challenged decisions made regarding salaries and bonuses in mid-January 2013. The strike ended on 6th March 2013 (Bohlmann, Bohlmann & Inglesi-Lotz, 2016:450). The unions have denied that the strikes are exclusively at fault for potential deferrals on the venture. The usual explanations behind poor project risk management incorporation are not restricted to contractual workers having an absence of data and training to work with and inadequate assets; for example, cash and time, and the absence of mastery in hazard-avoiding methods (Tummala & Schoenherr, 2011:474).

4.4.2 Risk measurement

Risk measurement, known as the second stage of the first segment in the supply chain, as illustrated in Table 4.4, involves the assurance of the results of all probable SC risks, collected with their degrees of impact. Significances are characterised as the way in which or the degree to which the risk demonstrates its effects on the resources (Cagliano *et al.*, 2015:232). Manifestations may incorporate loss of or harm to resources, loss of revenue, and intrusion of service levels, cost overruns, programme delays, poor process execution, liabilities gained, impairment repair expenses, or injuries (Kmec, 2011:1489).

Risks can be categorised as four types of undesirable results, with different attributes of recurrence, seriousness and consistency. The consequences are characterised by simplified classifications; namely, insignificant, small, medium and large (Fan *et al.*, 2017:65). Accordingly, trivial effects occur with a high recurrence, have a low significance and a high consistency (Qazi *et al.*, 2017:189). According to Tummala and Schoenherr (2011:474), small consequences have a high regularity, modest severity and a reasonable consistency, with their occurrence being infrequent. Ghadge, Dani and Chester (2013b: 523) describe medium consequences as having results repetition, a median seriousness and additionally sensible predictability, with their occurrence being regular. Further elaborating, a global consultancy firm indicated that the risk measurement in a business setting, if managed and constructed on its historical contribution and groundbreaking analysis, is a certain requirement for credit risk mitigation (Ghadge *et al.*, 2013:523).

Finally, massive consequences can be characterised by very low regularity, a high level of sternness and negligible predictability (Hansen, Mena & Skipworth, 2016:1). A “large loss” is classified as the most major issue. Losses of this kind happen seldom, yet if they occur, it could be calamitous for the firm (Bohlmann *et al.*, 2016:450). Though not favoured, “medium misfortunes” would not bring about the firm’s genuine concern on the off chance that they occurred at standard intervals, for then their cost could be communicated as an annual amount, and preparations could be made.

The contractors at Medupi power station, have utilised the most recent technology in their construction and design, which although improving proficiency, has added extra risks and intricacy to the venture (Riekert & Koch, 2012:52). At the point when the contractors initially received the agreement, there were assumptions made about what should be produced and of what quality it ought to be (Nkambule & Blignaut, 2012:85). These actions resulted in delays and hurt the reputation of Eskom. However, risk measurement in supply chains is limited by functional and financial obligations.

4.4.3 Risk assessment

Risk assessment, the third step of the first-phase in Table 4.4, is synonymous with the evaluation of instabilities and is concerned about the assurance of the probability of each risk factor (Tummala & Schoenherr, 2011:474). Equitable data can evaluate fluctuations and probability conveyances for significant SC risks or consequences can be inferred (Zhao *et al.*, 2014:27). Assuming, nonetheless, that objective information is not accessible, subjective data, convictions and judgment can be utilised to surmise propagations (Ghadge *et al.*, 2013:523). Practices, for example, the Delphi strategy or master centre gatherings, can help in the induction of probabilities (Taponen, 2017:269). Risk assessment instruments are developed and shared with all the stakeholders by the procuring company to assess the types of risks in the value chain, and they were conceived to prepare for the risks.

Before the commencement of such a big project, risk assessments are essential to ensure that the project meets its deadlines and stays on budget. The risk assessment instruments identify and measure the risk of a supply disturbance, utilising a framework that portrays the attributes of suppliers, their relationships, and their associations with the organisation performing the

assessment (Lockamy III, 2014:755). These assessment instruments are developed from the view of evaluating the risk of each supplier. The final data will include several sources requested to provide a 360-degree view of a supplier's risk profile (Torabi, Giahi & Sahebjamnia, 2016:201). The prerequisite for operative management of supply chain risk is impaired in extensive supply networks where distances between suppliers and commercial centres are usually higher, and business environments are more compounded than in domestic supply chains.

It is known that the prevailing Eskom coal power stations are ageing, regularly operating above their recommended unremitting rating, and are occasionally compromised as a result of coal quality issues (Eskom Holdings Ltd, 2016:1). The mining, transportation and combustion of coal for electricity generation yields damaging environmental and health impacts that are borne by South African culture, as well as by individuals across the globe (Nkambule & Blignaut, 2012:85). Commonly, coal mining stresses the environment by the extraction, beneficiation and transportation of coal to a power station (Inglesi-Lotz & Pouris, 2012:113). Eskom employed different experts to guarantee that risk assessments were carried out by endorsed principles for projects of this size. The risk assessment will incorporate the avoidance of loss of life and will likewise protect the environment against unnecessary harm delivered by humans.

4.5 RISK MITIGATION AND CONTINGENCY PLANS

The risk mitigation and contingency plans stage, which is the second step of Phase two, includes the improvement of risk reaction activity arrangements to hold and control the risks. The strategic consequences of SCRM – characterised as the identification, evaluation and management of supply chain-related risks to diminish overall supply chain exposure - are progressively blameless (Ho, Zheng & Yildiz, 2015:5031). However, despite the significance of overseeing and keeping down the variables that signify the supreme threats, comparatively little is known about how firms can mitigate most viable moderate effects of supply chain risk (Qazi, Quigley & Dickson, 2015:1). Today's supply chains are progressively faced with the probability of encountering impeding supply chain disruptions (Son & Orchard, 2013:684), and because of their full size, dynamic nature and intricacy, also increasing customer demands and expectations (Chang, Ellinger & Blackhurst, 2015:642).

Catastrophes such as the tsunami had a tremendous effect on the economy of the regions where they occurred. However, their impact was also felt by companies in Europe and USA as their suppliers existed in countries like China, India or South-East Asia (Fan *et al.*, 2017:63). Supply-chain risk mitigation strategies allude to organisational activities aimed at decreasing the probability of disasters and the adverse effects of risks (Mishra, Sharma, Kumar & Dubey, 2016:183). Since it is not credible and concrete to produce mitigation and prevention strategies for every risk distinguished, risk-planning begins with the examination of the costs required to execute every preventative activity to contain and deal with known SC risks (Tummala & Schoenherr, 2011:474). Supply chain risks can, for instance, be lessened by cushion stocks, information technologies, strong associations with providers and downstream customers, a contribution of substitute or various vendors, risk pooling, and the carrying out of "what if" analyses (Taponen, 2017:269). Although SCM has developed substantially as a discipline, risk management in the general setting of the supply chain is still in its embryonic stage.

Although the commitment of South Africa to add up to worldwide emanations is still moderate (1.1 percent in 2005), its per-capita discharge rate of 9 tonnes CO₂ per individual in 2005 was over the international norm of 5.8 tonnes. This is more than six times higher than the Sub-Saharan standard of 1.4 tonnes (Krupa & Burch, 2011:6245). Throughout 2002 and 2009, the country expanded its coal production from 124.1 to 141.2 million tonnes of oil proportionately every year and turned into the sixth most abundant coal producer (Rafey & Sovacool, 2011:1141). This generating capacity routinely works at peak levels to a great extent because of overwhelming industrial utilisation (Gawer & Cusumano, 2014:417). Given that the expenses of these coal-fired power plants have been almost entirely amortised, the country forms part of a network with the most minimal electrical energy costs throughout the world, making any future changes politically and economically tricky (Krupa & Burch, 2011:6254). Consequently, preventative maintenance is ignored, and potential long-term grid functionality is less consistent.

Various government procedures are in progress to address numerous characteristics of the electrical energy challenge. The Department of Trade and Industry, for example, has been counselling with regards the second reiteration of its Industrial Policy Action Plan that aims to bolster the shift towards an alternative, green economy in the presently carbon-intensive South Africa (Pienaar & Nakhooda, 2010:1). For present and future monetary and social needs, the ideal

utilisation of sustainable resources is fundamental since it limits environmental effects and creates minimal measures of secondary waste (Pazheri, Othman & Malik, 2014:835). Renewable energy is profoundly intertwined with numerous policies of possible advancement, yet historically, policies have not anticipated renewable-energy technologies and instead, have directed themselves at increasing private and public sector subsidisation for more productive, heavily polluting energy generation technologies with energy polluting effects (Krupa & Burch, 2011:6254).

Ultimately, the supply chain is vulnerable to market risks; for example, the missing of market opportunities that may exist. The supply chain cannot be accessible to fluctuating market tendencies and customer preferences if the accurate market indicators cannot be perceived (Scholten & Fynes, 2017:413). According to Helmold and Terry (2017:35), sufficient correspondence and coordination among all components of the supply chain are crucial to its success. The absence of trust is one of the leading considerations that contribute to supply chain risks. Trust established through practical correspondence can create resources that lead to competitive advantage (Ho *et al.*, 2015:5031).

4.6 RISK CONTROL AND MONITORING

In the last phase of the SCRMP, risk control and observing give the opportunity to scrutinise the progress made to stimulate risk response action plans. Restorative actions can be taken if deviations transpire in accomplishing the coveted SC implementation (Tummala & Schoenherr, 2011:474). This is Phase three in Table 4.4. The process is a way to decide conceivable preventative methods and to give strategies for advanced enhancement. Data management systems can support this undertaking; for instance, by the accompanying measured structure, a register of the acknowledged SC risks factors, significant severity levels, risk probabilities, risk command hierarchy analysis, government regulations/policies, charges and customs policies, transport timetables, and SC risk triggers (Amigun *et al.*, 2011:3178). The data management system can be utilised for both successful monitoring and taking remedial action. Also, for continuous improvement of risk evaluation and management, related risk data can be stored and updated as needed.

A power plant building project is a requested, arranged and one-off production. Also, each plant has its individualisation, which requires the power plant building supply chain to be adaptable and responsive to the market in time (Shaaban & Petinrin, 2014:72). A power-station building supply chain is a compounded chain, which is a utilitarian system chain comprising various phases, and what's more, it reflects the connections among phases (Kemeny *et al.*, 2014:228). In the chain, power station building undertakings lie in the primary focus and assume the responsibility of the station. They also collaborate for their portion of competitive power acquired from its plant (Oyedepo, 2014:189). Partners, for example, is a crude material industrial facility, supporting production lines and coordinating processing plants, etc., which are many and diverse and have a significant impact on the station cost.

Similarly, to what has been investigated above, there is a broad range of risks in the operation of building a power-station production supply chain which causes a lot of damage (Helmold & Terry, 2017:35). Therefore, it is imperative to discover valuable ways and techniques to control and avoid every one of the risks involved (Rafey & Sovacool, 2011:1141), which might become an obstacle in achieving the desired goals. A single provider leads to many risks, so the supply chain requires enough adaptability to create a profitable situation, which also needs to set up a multi-supplier system and deal with all providers (Scholten & Fynes, 2017:413). In this way, it is essential to present a motivation technique and system for selecting the superior method and eliminating the inferior, which implies giving more benefits to an excellent accomplice (Mishra *et al.*, 2016:183). Considering the provider's characteristics and operational state, a risk counteractive action motivation mechanism is set up correctly.

4.7 CONCLUSION

This chapter deals with the topic of the research. The information covering this topic was found to be limited. Researchers say that while the capacity to oversee risk is essential to guaranteeing a smooth stream of items through the supply chain, this field of study has similarly acquired considerable supply chain research information. However, this chapter shows that the management of supply chain risk has collected a large body of information from supply chain professionals and practitioners due to the damaging effects that supply chain anomalies or interruptions can have on supply chain performance.

Risk identification is a subjective segment of supply chain risk. Each company is accountable for its risks and must diagnose them as per the organisation's perceptions. Notwithstanding those risks documented by firms, there are mutually occurring risks to organisations within its industry and similar other industries.

While the global rivalry is increasing and supply chains are becoming more comprehensive and multifarious, the probability of not carrying out a coveted supply chain (SC) accomplishment increases, predominantly because of the risks of SC frustrations. It is along these lines that fundamental organisational strategies are devised to deal with interruptions and produce alternative plans as they outline or upgrade their supply chains.

Firms need to understand supply chain interdependencies, distinguish potential risks factors, their probability, results and severities. Risk management activity arrangements can be produced, ideally, to circumvent the documented risks, or if this is unrealistic, at least mitigate, hold and control them.

Lastly, supply chain interferences can bring about an assortment of issues, for example, long lead-times, stock-outs, ineffectiveness in meeting customer demand and cost escalations. Eventually, these difficulties adversely affect the commercial presentation of the company.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 INTRODUCTION

This chapter sets out the aims and methodological approaches used for this research, including the primary data collection, using a variety of qualitative approaches. The primary research strategy used semi-structured interviews from purposively selected participants, backed up by data, and a review of literature such as conference reports and non-indexed journals as a secondary source of data. The data collected from these sources was analysed using a “qualitative content analysis’ framework”. The focus of this research is to look at the supply-chain risk mitigation factors in the electrical energy sector in South Africa. The nature of such a topic of discussion means that the networks of participants and stakeholders involved stretches through the entire Commercial Group of the electrical energy utility. The multifaceted dimensions of electrical energy supply chain risks and the multi-level nature of transitioning to a centralised supply chain system mean that there will need to be a diverse choice of research participants in the commercial department. The choice excluded individuals outside the supply chain department. Therefore, the research participants are only from the supply chain department. This chapter begins by setting out the research aims. It then finds and discusses the primary research methodology, including how the participants were found and the potential pitfalls surrounding this. It will also set out the process used to analyse the primary data. The analysis of this data will then be discussed in Chapter six to prove any correlation between the risk theories.

The study gives reasons for the choice of the research paradigm as well as the approach and the design of the study. Finally, this chapter discusses the application of trustworthy issues under the institution.

5.2 INDUCTIVE VERSUS DEDUCTIVE REASONING

Some single- and dual-process hypotheses give contending expositions concerning how reasoners assess restrictive contentions. Some of these philosophies are commonly connected to different guidelines; to be precise, deductive and inductive directions (Johnson-Laird, Khemlani &

Goodwin, 2015:201). The reasoning is the intellectual procedure of drawing interpretations from given information. Philosophically, induction and deduction constitute distinctive categorisations of thought (Van Biesen, Mactavish & McCulloch, 2016:377). An essential open question in cognitive research disquiets the construction amid induction and deduction (Heit & Rotello, 2010:805). While deductive reasoning, in rationale, alludes to the necessary results of an arrangement of conditions, inductive reasoning is apprehensive about defining the probability of a result (Pfeifer & Kleiter, 2011:145).

In deductive reasoning, the premises fundamentally involve or infer the conclusion. It is unthinkable that the assumptions are valid and that the conclusion is false (Sonnleitner, Keller & Martin, 2013:289). Deductive reasoning is sometimes known as 'top-down' reasoning, which distinguishes it from the bottom-up approach of inductive reasoning (Melville, Christie & Burningham, 2017:12). This capacity to ensure the conservation of fact when moving from premises to conclusion is what differentiates deductive reasoning from inductive reasoning (Holyoak & Morrison, 2013:674). The basis for the accuracy of contention is its logic from the premises.

In this study, the inductive reasoning approach was followed, and it was based on the motivations as said. Inductive reasoning entails making forecasts about unique circumstances considering existing information. These expectations are fundamentally probabilistic (Hayes, Heit & Swendsen, 2010:278). Inductive reasoning parallels in a significant part, to the thinking that individuals do in daily existence (Gelman & Davidson, 2013:327). A good example is predicting whether stock markets will ascend throughout the following six months. This includes some induction. Commonly, the application of the inductive approach is correlated with qualitative research methods for data accumulation and data analysis, while the deductive approach is seen to be identified with quantitative methods (White & Poldrack, 2014:385).

The essential method of study is the improvement of categorisations of the primary information into a model or structure that apprehends vital themes and procedures decided to be significant by a researcher during interviews. To produce the acutest risk factors in supply-chain management, this research will utilise inductive reasoning, principally using qualitative research methods.

5.3 RESEARCH PARADIGMS

The paradigm of a study will mirror the researcher's essential assumptions, and these presumptions oblige as the base for the research strategy (Burns, 2014:71). Research paradigms address the philosophical measurements of sociologies (Carter & Baghurst, 2013:1). A research paradigm is an arrangement of crucial assumptions. Moreover, convictions follow regarding how the world is apparent, which then fills in as a reasoning structure that aids the behaviour of the researcher (Wahyuni, 2012:69). The two primary philosophical dimensions that differentiate existing research paradigms are ontology and epistemology. Ontology is the perspective of how one perceives reality, while epistemology comprises the convictions on the way to initiate, comprehend and utilise the information that is considered to be satisfactory and substantial (Szyjka, 2012:110).

Customarily, research philosophy has many branches that have found an extensive variety of disciplines within the scope of business studies. Individually, there are principle research paradigms (Saunders, Lewis & Thornhill, 2012:300). In that sense, a paradigm can compel scholarly interest and inspiration and can direct researchers towards characteristics of social phenomena, or even new phenomena and hypotheses, or it may limit creative sociological ability. Within the field of qualitative research. Burns (2014:71) identified five dominant research paradigms. These paradigms are discussed briefly.

5.3.1 Positivist paradigm

Positivist paradigms seek to acquire law-like speculations, termed nomothetic, by conducting value-free research to approximate social phenomena (Wahyuni, 2012:69). Positivists trust that diverse researchers who discern the same realistic issue will create a similar outcome by cautiously utilising statistical tests and applying comparative research prepared in investigating a large sample (Szyjka, 2012:110). Their consistent opinion is the manifestation of an all-inclusive assumption that can be associated transversely, which is presently called new pragmatism.

5.3.2 Realism paradigm

The realism paradigm relies on the possibility of autonomy of reality from the human mind. This philosophy depends on the presumption of a scientific approach to the advancement of information (Guercini, 2014:662). There are two groups of realism paradigms, namely, direct and critical.

Direct realism can be depicted as, ‘what you see is what you get’. In other words, direct realism portrays the world through individual human senses (Biedenbach & Müller, 2011:82). Direct realists acknowledge the world as moderately perpetual. They focus on just a single level, be it an individual, a gathering or an association. Critical realism, on the other hand, disputes that individuals do encounter the sensations and images of reality (Truong, McColl & Kitchen, 2015:709). Critical realists, value the significance of the multi-level study.

5.3.3 Interpretivism paradigm

Interpretivists trust that reality is constructed by social actors and individuals’ impression of it (Wahyuni, 2012:69). This paradigm perceives that personalities with their own diverse experiences, expectations and understandings, contribute to the ongoing development of reality existing in their great social setting, through social collaboration (Guercini, 2014:662). In the interpretivist approach, it is significant for the researcher to contrast differences between individuals. Interpretivism studies typically concentrate on the significance and may utilise various methods to reflect distinctive aspects of the issue.

5.3.4 Pragmatism paradigm

This study follows a pragmatism paradigm. Instead of questioning ontology and epistemology as the first step, pragmatism supporters begin by researching around the research question to decide on their research framework (Feilzer, 2010:6). In particular, pragmatism distances itself from both value neutrality and value relativism, by apprehending information generation as a social and impulsive method whereby principles of scientific reliability and authenticity are cooperatively characterised within a community of examination (Popa, Guillermin & Dedeurwaerdere, 2015:45). Pragmatism, when viewed as an alternative paradigm, evades the combative issues of truth and reality. It acknowledges, philosophically, that there are particular and different realities that are interested in the empirical examination and arranges itself toward explaining practical problems in the “real world” (Heyvaert, Hannes & Maes, 2013:302).

Both objectives, as well as subjective inquiry, endeavour to harvest knowledge that best parallels or signifies reality. The dissimilarities between phenomena as objective or subjective are predominantly as a result of political divisions among social researchers, who are concerned with the advancement of particular aptitude sets for quantitative and qualitative research (Feilzer,

2010:6). Pragmatists are hostile to dualists scrutinising the dichotomy of positivism and constructivism and instead, necessitate for a convergence of quantitative and qualitative methods (Rorty, 2013:653).

In particular, SCRM incorporates an enormous aggregate of processes research, which is often based on the electrical energy sector and the pragmatism paradigm. Additionally, implementations of hypotheses from applicable sectors need inductive testing. The practice-oriented and results-based research practice of SCRM pursues appropriateness and simplification, which unquestionably needs a functional paradigm.

5.3.5 Phenomenology paradigm

This study adopted the phenomenology paradigm because phenomenology, as both a philosophy and a methodology, has been utilised in both organisational and consumer research to advance comprehension of multifaceted concerns that may not be instantly understood in surface reactions. Phenomenology ought to be viewed as an approach to educate perception on realism. It ought to be viewed as an approach to change and refine a perspective, to construct and characterise a mental attitude, and to expand the way the world is seen (Gallagher & Francesconi, 2012:1). To study the data in a phenomenological research project, it is imperative to transcribe all the participants' recorded articulations. Once transcribed, it is substantially less demanding to code the statements for specific themes and essences, utilising the available software to discover several words or phrases that may demonstrate a quintessence of the phenomenon (Gullick & West, 2012:532).

At the heart of supply chain research is the researcher's impression or question about a specific phenomenon. Once the phenomenon has been found, the researcher hones the concentration of the proposed phenomenon by developing research questions. The phenomenon of intrigue was new, dynamic, and sophisticated. Significant factors were not easily found, and extant hypotheses were not accessible to clarify the phenomenon. In this circumstance, a qualitative approach is regularly the favoured preliminary phase to accumulate an understanding, grounded in a thorough depiction of the phenomenon shaped by accumulating field data (Golicic & Davis, 2012:726). The qualitative approach offers researchers access to further levels of comprehension of new or multifaceted phenomena by yielding an abnormal state of detail.

5.4 RESEARCH APPROACH

Research is directed in the spirit of investigation, which depends on realities, experiences and information, philosophies and progress, hypotheses and ideologies, and standards and laws (Saunders *et al.*, 2012:345).

A research approach alludes to the procedural structure within which the research is directed (Feilzer, 2010:6). There are many components to be deliberated upon when selecting an applied research approach, with the subject to be researched, and the particular research question being principal drivers (Popa *et al.*, 2015:45).

Although there are different refinements in the research approaches, the most common classification of research approaches is by looking into quantitative, qualitative and mixed methods. Quantitative research approaches were primarily established in the natural sciences to study natural phenomena (Saunders *et al.*, 2012:360). On the other hand, qualitative research approaches were developed in the sociologies to empower researchers to study social and cultural phenomena (Wahyuni, 2012:69). A few researchers prefer to utilise a mixed method approach by exploiting the contrasts between quantitative and qualitative approaches (Mackey & Gass, 2015:215). They join these two methodologies for use in solitary research, which strategy is contingent upon the sort of study and its methodological establishment.

This research adopted the qualitative approach to discussing the research objectives. This is an unavoidable decision, which is not because the research that follows is in an SCRM framework, which has continuous progress. This is because the research objective for each phase can be best discussed by utilising a single research approach, incorporating the research paradigm addressed in Section 5.4. A qualitative design was proper because this study sought to explain, understand and explore developments in the electrical energy sector in South Africa about the application of supply-chain risk mitigation strategies. No hypotheses were put forward, and no relationships were tested; hence, a quantitative approach was considered inappropriate.

In qualitative research, diverse information claims, enquiry approaches, and information accumulation strategies and analysis are employed to answer the research question (Silverman, 2011:12). Qualitative data sources incorporate surveillance and participant opinion (fieldwork),

meetings and surveys, documents and texts, and the researcher's impressions and responses (Saunders *et al.*, 2012:360). Researchers are attracted towards gaining a rich and complex comprehension of individuals' understanding and not towards obtaining data which can be comprehensive to other more significant assemblies (Truong *et al.*, 2015:709). Thus, case study research should preferably be performed with the utilisation of qualitative data collected from multiple sources, and predominantly qualitative analysis procedures are applied in a progressive design (Mackey & Gass, 2015:235).

5.5 RESEARCH DESIGN

The research design can be considered as the rationale or groundbreaking strategy of research that sheds light on how the study is to be conducted (Yin, 2013:75). It shows how most of the research study tries to discuss the research question. Research design deals with logical difficulty and not logistical challenges. It gives direction from the fundamental philosophical expectations which are then directed towards research design and data collection (Creswell, 2012:45). As specified in Section 5.3, the qualitative research approach was preferred for use in this study. Various research designs may be used in qualitative studies. Typical examples include grounded research, ethnography, case studies and narratives (historical research) (Creswell, 2013:15). In this study, a case study design was selected. A case study design is one in which an approach to research eases investigation of a phenomenon, within its perspective, spending an assortment of information sources. In this study, the focus is exclusively directed to a single entity (case), which is the electrical energy sector in South Africa. Hence a case study design was considered proper.

According to Yin (2013:75), the admittance of realism, understandability, and the quality of data makes case studies more favourable. Creswell (2012:45), further states that case studies give the opportunity to comprehend the nature of the subject studied in practice; the techniques, methodology and frameworks utilised, and the mode in which they are used. An exploratory (or pilot) case study method was performed before implementing a large-scale investigation. An essential entanglement of this sort of study is that underlying discoveries may appear to be persuasive enough to be discharged prematurely as conclusions (Heyvaert *et al.*, 2013:302).

The research goal was to build comprehension of the way the electrical energy sector runs and the risks it has confronted in recent times, and how supply chain management would be involved in

the alleviation of supply chain risks in South Africa. Distinctive techniques to gather the case information were utilised, including interviews, group workshops and historical data analyses. It was of crucial significance for this research that this electrical energy organisation consented to take part in an in-depth study on the underlying drivers of the risks in the electrical energy sector.

The research design was made up of two parts, namely, (1) a literature review and (2) an empirical study.

5.5.1 Literature review

A literature review was directed and the outcomes are presented in Chapters two, three and four. The literature review aimed to close areas where copious quantities of research exists and shows areas where research is desired. The literature was sourced from internet sources such as Scopus, ScienceDirect, EBSCOHost, Web of Science, ACM Digital Library, ProQuest, Emerald Insight and JSTOR as well as magazines, and textbook searches. Chapter two focused on the electrical energy sector and covered topics such as the utilisation and production of renewable energy and fossil fuels in both developed and developing countries. Chapter three focused on strategic sourcing in the electrical energy sector as well as general processes and procedures followed to set up strategic partnerships. Chapter four focused on supply chain risk management in the global electrical energy sector, such as supply chain risk factors, with a focus on the supply risk, the demand risk and the operational risk.

5.5.2 Empirical study

The empirical study involved sampling design, data collection procedures, data analysis and measures of trustworthiness.

5.5.2.1 Target population

The target population for a study is the entire arrangement of units for which the study information is to be utilised to make interpretations (Duong & Davies, 2012:224). Thus the target population characterised those units for which the results of the study are intended to streamline. It is essential to differentiate among the diverse categories of target populations first. Researchers are alarmed at the degree to which the apparatuses or assessment procedures utilise/measure the hypotheses they are anticipated to measure (Millsap, Bolt, Ark & Wang, 2014:156). In this research, the target population included supply chain management professionals at a South African national power

utility who were stationed at various power stations and head offices in the Mpumalanga and Gauteng provinces in South Africa. The target population has vast experience and knowledge about the number of supply chain developments and practices in the South African energy sector.

5.5.2.2 Sample frame

A frame determines the components of a population out of which a sample can be attracted, to evaluate a specific distinctive of the full population (Baltar & Brunet, 2012:57). At the point when the population is restricted, the frame might be characterised by an unambiguous list of its components (Ritchie, Lewis & Nicholls, 2013:115). Frame scope is an essential element in judging whether it is appropriate for a study, or, regardless of this, whether it can be renovated (Dworkin, 2012b: 1319), or supplementary generated to make it reasonable (Silverman, 2011:254).

In a perfect world, a sample frame ought to be naturally existent for it to satisfy the properties of satisfaction and precision. The sample frame has been compiled from the list of professionals in the South Africa National Electricity Utility. The sample frame includes the various professional and management levels in the group.

5.5.2.3 Sample size

Some issues can affect the sample size in qualitative research; however, the guiding principle should be the concept of saturation (Sarantakos, 2012:160). Samples for qualitative studies are mostly significantly smaller than those utilised in quantitative studies. There is a state of reducing returns to a qualitative sample as the study continues; more data does not necessarily prompt more data (Mason, 2010:20). Qualitative samples must be sufficiently colloquial to guarantee that most of the more significant part of the discernment that may be significant are discovered, yet in the meantime, if the sample is too extensive, data becomes noticeably monotonous and unavoidably ineffective (Dworkin, 2012:1319). Researchers depict three methods that can be utilised to legitimise the sample size of interviews in qualitative research. Firstly, some qualitative research methodologists present general procedures for a sample size of interviews. These guidelines differ from methodologist to methodologist, yet there is considerable commonality in the differently prescribed ranges (Marshall, Cardon, Poddar & Fontenot, 2013:11). Researchers suggest that for phenomenological studies, satisfactory ranges should incorporate approximately five to ten interviewees as a sample size per interview (Galvin, 2015:2). Case studies are among the most

challenging forms of qualitative research to arrange (Yin, 2013:148). Creswell (2014:232) suggests close to four or five cases. He additionally prescribes three to five interviewees for each case study. The second method of deciding on sample size is making use of the point of reference (precedent) (Marshall *et al.*, 2013:11). Researchers further recommend that before determining suitable sample size, qualitative researchers ought to consider distinguishing the number of interpretive studies that utilised the same design as in the anticipated research and wherein the data saturation was reached (Malterud, Siersma & Guassora, 2016:1753). In this circumstance, researchers appraise and legitimise sample size by referring to comparative studies that asserted data saturation at specific points.

Marshall *et al.* (2013:11) further suggest that a third method for legitimising sample size is through a measurable demonstration of saturation during data collection. The point of saturation is defined as the point where no additional information can be found to propagate new properties of classifications, and the interactions between the categories are unravelled, such that sampling more data will not prompt more data identified with the research questions (Golicic & Davis, 2012:726). In other words, there is a predetermined sample size, but the sample size is decided by the amount of information collected. Prokopy (2011:11) positively stated that there is dependably a danger in deciphering the expressions of others. The researcher might be affected by his or her perspective. Researchers make use of a data coding procedure when interviewing participants during a qualitative study, to illustrate statistical evidence, to the point of saturation. This is similar to contemporary code prevalence, ascertained as Cronbach's Alpha to gauge the trustworthiness of code recurrence dispersion, as the research progresses (Malterud *et al.*, 2016:1753). An observation made by Marshall *et al.* (2013:11) during a phenomenological study in which interviews conducted on women in Nigeria and Ghana, was that most of the data saturation had occurred by the twelfth interview. In this research, the sample was drawn from the database of the South Africa National Electricity Utility supply chain departments that consist of 1300 procurement professionals at different level professionals with more than ten years' working experience in the supply chain environment. Participants were interviewed until the point of saturation was reached with the fourteen interviews.

5.5.2.4 Sampling approach

Sampling implies choosing a specific group or sample to signify the total population. Sampling approaches are suggestively separated into two classifications: probability sampling and non-probability sampling (Palinkas, Horwitz & Green, 2015:533). Researchers making use of probability sampling in studies expect that a frame of all units in the population can be assembled. Each unit in this frame has a positive probability of being chosen for the sample, and that the probability can be processed for each sampled unit (Acharya, Prakash & Saxena, 2013:333). Once sampled, the attributes of the considerable number of units can be measured truthfully. Approximations are delivered by utilising a reference circulation of every single conceivable sample that could have been chosen, using similar techniques (Brick, 2011:872). Probability sampling enables the researcher to generalise the results of the sample to the target population. Probability sampling includes simple random sampling, systematic random sampling, stratified random sampling, cluster sampling, etcetera.

This study adopted the non-probability sampling approach that embraces the purposive sampling technique to choose the sampling components from the target population. Researchers working with the opinion of purposive sampling proclaim that non-probability approaches are more reasonable for in-depth qualitative research in which the concentration is frequently to comprehend complex social phenomena (Denscombe, 2014:32). One of the recompenses of non-probability sampling is its lower cost contrasted with probability sampling; additionally, the in-depth exploration of a small-N purposive sample or a case study empowers the "finding" and identification of patterns and causal mechanisms that do not draw time and context-free expectations (Yin, 2013:76). The sample for the research was taken from the workforce at the head office based in Johannesburg. This was cost effective as no travelling took place during the study. The number of people based at the head office eligible to be part of the sample was more than 300 persons who were the sample based at the Johannesburg office. Due to the knowledge of the researcher regarding both the sample as well as the organisation, the purposive sampling technique was considered as most suitable for the study.

5.5.2.5 Sampling technique

The sampling technique applied to this research is purposive sampling, which was selected based on qualities of the population and the objective of the study. Purposive sampling is utilised as part

of qualitative research for the identification and collection of data-rich cases associated with the phenomenon of interest (Palinkas *et al.*, 2015:533). This type of sampling can be extremely valuable in circumstances where the researcher needs to influence a focused sample rapidly and where sampling for proportionality is not the principal concern (Barratt *et al.*, 2015:238). Regardless of its extensive use, there are various encounters that are applicable in identifying and applying the appropriate, purposeful sampling strategy in any research; for example, the scope of variables in a sample from which a purposive sample to be taken is frequently, not by any stretch of the imagination, known at the beginning of a review (Leung, 2015:324).

The case study method was applied because it does not study the entire organisation. The case study approach was explicitly valuable where the research needed to comprehend a specific issue or circumstance in remarkable profundity and where the study could recognise cases rich in data (Robertson, Casali & Jacobson, 2012:822). However, sampling must be reliable with the aims and expectations inherent in the use of any qualitative method. Methods chosen for this study are planned to carry out profundity of understanding. In this current study, the sample was taken from the professionals with supply chain knowledge who could contribute to the study. The sample did not include individuals outside the supply chain environment.

5.5.2.6 Data collection procedures

A variety of data may be collected to help extend comprehension of the case, and in qualitative studies, this incorporates interview, observation and document analysis (Palinkas *et al.*, 2015:533). The essence of phenomenology is on accepting the excellent lived understanding of individuals, by investigating the importance of a phenomenon (Petty, Thomson & Stew, 2012:378). Interviews and focus groups remain the most widely recognised strategies of data collection in qualitative research and are utilised with expanding recurrence in supply chain and management research. It is especially to access areas not amenable to quantitative methods and where profundity, knowledge and comprehension of specific phenomena are required (Golicic & Davis, 2012:726).

For this study, the data being collected was done by utilising two main avenues of inquiry, namely, focus group discussions and in-depth interviews. The decision for using the interview technique depended on the need to access individuals that have practical experience with the explored issue. Focus group discussions were selected since they coordinate contentions of the reality with the

utilisation of inductive rationale; in-depth analysis of the object (case) and interaction between the researcher and the question of research (Yin, 2013:157).

5.5.2.7 Focus group discussions

Focus groups are valuable when the study aims to gain a scope of perspectives about a specific case. Hence the composition thereof needs extraordinary care to get the best quality of discourse. This method includes a group interview on a specific topic, with around five and ten individuals, and can be structured, semi-structured or unstructured (Petty *et al.*, 2012:378). Depending on the research question, the chosen group may be similar or diverse; that is, they may have comparable or distinctive experience, background or position (Yin, 2013:157). One of the advantages of focus groups interviews is the different interactions among participants, as well as the sharing of high data quality, contrasted with typical interviews and the portrayal of a population using small groups (Kuvykaitė & Tarutė, 2015:654). In this study, a progression of focus group exchanges was completed to collect more general and efficient thoughts about risk occasions and risk clusters.

The focus groups were drawn from the supply chain department, officially known as Procurement and Supply Chain Management (P&SCM), as shown in Table 5.1. The focus group approach can be descriptive, exploratory or explanatory, given the study objective. In this study, the focus group method was adopted for the exploration of the risks, as well as the mitigation in the electrical energy sector. It was further afforded the top categorisation for data analysis, considering that there is little empirical research on the topic (Gullick & West, 2012:532). The venue and time for focus group discussions were chosen in such a manner not to interfere the participants' working hours, and to ensure the most significant participation without any disturbance during the sessions.

Table 5.1 Focus group participants

Groups	Designation	Area of responsibility	Years' experience	Qualification	Gender
Focus group 1 =8	Senior Manager	Sourcing	5 years	B Com Hons	M
	Middle Manager	Sourcing	7 years	MBL	F
	Senior Manager	SCOPs	14 years	MBA	F
	Middle Manager	Supply Risk	17 years	MBA	M
	Senior Advisor	Supply Risk	7 years	B Tech	M

Groups	Designation	Area of responsibility	Years' experience	Qualification	Gender
	Senior Advisor	SCOPs	12 years	B Acc	F
	Middle Manager	Contracts	5 years	M Sc	M
	Senior Advisor	Sourcing	16 years	LLB	F
Focus group 2 =6	Middle Manager	Sourcing	22 years	MBA	F
	Senior Advisor	SCOPs	18 years	B Com Hons	F
	Senior Manager	SCOPs	6 years	LLB	F
	Middle Manager	Supply Risk	8 years	M Com	M
	Sourcing Specialist	Contracts	9 years	M Sc	M
	Sourcing Specialist	Contracts	9 years	B Acc	F

Source: Case firm database (2018)

All related functions exist in this group, which include sourcing, demand forecasting, contracts management, business enablement and supply chain operations. All the participants are based in the Gauteng Province and report to the Johannesburg offices of the subject company. The participants were chosen based on their experience in the supply chain environment as well as the contribution to the research question. Individuals who worked in any of the departments with outputs not related to a supply chain were not considered for this study. The participants for focus group discussions were chosen by making use of purposive sampling, one of the non-probability sampling techniques, to meet the group criteria and to guarantee adequate industry experience.

In SCRM research, some researchers primarily used this method to find risks in supply chains and transport respectively. The focus group method was also applied to SCRM research as the secondary method to enhance or support the findings from interviews (Rodrigues, Piecyk, Potter, McKinnon, Naim & Edwards, 2010:75).

The balanced focus groups consists of all the people that attended the scheduled meeting. Even numbers were issued to both meetings, although some members could not attend due to work commitment. The acronym SCOPs stands for Supply Chain operations which in the case firm includes, Warehousing, Logistics and Transportation.

5.5.2.8 In-depth interviews

Interviews are utilised widely in qualitative research as a method for information collection. Interviews may be structured, semi-structured or unstructured (Byrne & Power, 2014:431). The utilisation of in-depth interviews in qualitative research provides the capacity to the researcher to gain a greater, more noteworthy profundity of comprehension of a participant's viewpoint when contrasted with more structured apparatuses such as questionnaires (Petty *et al.*, 2012:378). The in-depth interviews do this, enabling the researcher to further question viewpoints when in individual topic areas such as the electrical energy sectors.

The purpose of interviews for this thesis was to set up the participants' perceptions of the risks in the electrical energy sector and the mitigation factors thereof. The perspectives and understandings of the participants originated from their level of involvement in an area within the supply chain section. The semi-structured interview enabled the topic to be narrowed down. Additionally, it offered adaptability to the questioning process and provided the capacity to pose extra questions (Rabionet, 2011:563). On the contrary, an utterly unstructured interview has the risk of not eliciting from the participants the topics or themes more firmly identified with the study questions (Byrne & Power, 2014:431).

The purposive sampling method was used to select the eleven senior managers from the supply chain department, whereby semi-structured interviews were conducted with each respondent. The interviews were held at the meeting room at the Johannesburg offices of the case study company. All participants provided, as asked, signed consent and permission forms before the commencement of the in-depth interviews. Table 5.2 shows the participants interviewed.

Table 5.2 In-depth interview participants

Participant number	Designation	Area of responsibility	Years' experience	Qualification	Sex
Participant 1	Senior Manager	Sourcing	18 years	MBA	M
Participant 2	Senior Manager	Contracts	12 years	Masters	F
Participant 3	Middle Manager	Sourcing	5 years	B Com	F
Participant 4	Middle Manager	SCOPs	7 years	N Dip	F

Participant number	Designation	Area of responsibility	Years' experience	Qualification	Sex
Participant 5	Senior Manager	Contracts	11 years	B Tech	M
Participant 6	Senior Manager	Demand planning	21 years	MBA	M
Participant 7	Senior Manager	Demand planning	6 years	M Sc	F
Participant 8	Senior Manager	Contracts	8 years	B Com	F
Participant 9	General Manager	Sourcing	13 years	M Sc	M
Participant 10	Middle Manager	Demand planning	12 years	B Eng	M
Participant 11	Senior Manager	SCOPs	10 years	LLB	F

Source: Case firm database (2018)

This approach allows the study to be conducted in a fair and ethical manner (Rabionet, 2011:563). Most of the interviews were 45 minutes to an hour. The meetings were recorded, utilising an advanced voice recorder. However, there are many methods for recording interviews.

5.5.2.9 Recording the focus group and interview data

According to Soosay and Hyland (2015:613), the most generally utilised recording methods are notes composed at the time, notes composed shortly after the interview, audio recording, and video recording. One of the primary segments during the interview stage is the introduction. It is critical to set up affinity, to create a sufficient situation, and to evoke reflection and honest comments from the focus group (Creswell, 2014:145). Beyond what many would consider possible, the interview questions were indistinguishable, even though the diverse parts and duties of the participants unavoidably implied that there was a degree of tailoring each focus group to reflect distinctive areas of ability.

All the recordings were done making use of a digital recorder, which was unquestionably the most suitable method of recording. The critical advantage of conserving the full-voiced part of the interview was their availability to then be transcribed for analysis. Participants were asked to express any reservations concerning the recording of the interview.

5.5.2.10 Capturing and transcriptions

Transcription is the transference of spoken language with its specific arrangement of tenets to the composed word with an alternate arrangement of guidelines (Peredaryenko & Krauss, 2013:1).

This procedure of transforming continuous dynamic oral language, spoken in a specific setting to a static form of portrayal (written language) is fundamental to the management and organisation of data. Only written language can be managed, as it were, sorted, replicated, inspected, evaluated and cited (Mero-Jaffe, 2011:231). The researcher's demeanour influences the transcript about the subject and by his or her presumptions concerning the data. It is further influenced by the foundation information on the research and the interviewees, which is either given or withheld from the transcribers in cases where the researcher is not the transcriber (Richards, 2014:35). This is because the interviewer/the transcriber is not the researcher.

This current study employed the services of an expert transcriber who took between two to three hours to transcribe one interview. The demands justified a reward, which was agreed upon in the first stages. Specialised transcriptions were needed which included precise documentation of lengths of pauses and intonations, among different elements. The transcript is prejudiced by the qualified capability of the transcriber, including his or her language knowledge and the attributes of constructing discourse, and additionally, the consideration granted the undertaking and potential weakness amid the translation procedure (Mero-Jaffe, 2011:231).

The transcriber's choices and decisions amid transcription may likewise affect the nature of the transcript. These are communicated in the way he or she treats background commotions, covering dialogues in the occurrence of more than one individual (for example, in a focus group), delays in the discussion, and paralinguistic components, for example, loose parts of content (Richards, 2014:35). The quality of the recording equipment affects the value of the transcript. The utilisation of inadequate or inappropriate equipment may lead to inaccuracies in the transcript.

Miles, Huberman and Saldaña (2014:489) maintain that giving the transcripts to the interviewees is, notwithstanding clarifying unclear portions, likewise expected to animate discourse on different themes specified in the content. This depends on the acknowledgement concerning the part of some researchers that transcripts are copied, not of a specific reality, but instead, are interpretive structures. Daymon and Holloway (2011:301) mention three purposes for sharing the transcripts with the interviewees: politeness or compensation to people who donated their time to the study, validation of the information or discoveries, and the providing of data and proposals that could enhance conditions by empowering people. Transcripts of this current study were shared with the

interviewees for quality and correctness of the interviews. It was found that innovative ideas were formed since the actual interview, which the interviewee shared and contributed to the data.

5.5.2.11 Data analysis and interpretation of results

Data analysis in qualitative research is a progressing, rising and iterative or non-linear process. Before the analysis starts, data is transcribed, as discussed in paragraph 5.5.2.10. These transcriptions can be analysed either manually or by making use of available and suitable Qualitative Data Analysis Software (QDAS) programmes. To analyse denotes to dismantle words, sentences and sections, which is an essential demonstration in the study venture, to comprehend, translate and theorise such information (Robinson, McCarthy & Smyth, 2010:134).

Data analysis in qualitative research alludes to thinking and argumentation that does not relate directly to statistical relations between 'variables', by which specific articles or perception units are portrayed (Richards, 2014:65). To analyse qualitative data one needs to break it up into miscellaneous items or to separate the information, which is sometimes labelled as "coding" and is referred to as "categorising." One of the aims of an analysis is to depict the information and to portray the items or occasions to which the information alludes.

This study utilised the latest version of ATLAS.ti for the data analysis phase. The capacity of ATLAS.ti to create visual portrayals of data assisted this study with the analysis and conceivably would assist potential readers to profoundly comprehend the interpretations (Rademaker *et al.*, 2012:1). The capacity of ATLAS.ti to create visual portrayals of data contributed to the study, along with the analysis, and conceivably would aid potential researchers to understand the elucidations significantly.

Dependably, there is a desire when conducting qualitative interviews, that many transcripts will be produced. The modern software utilised by researchers has eased the coding and added some credibility to the results. This study followed the steps as detailed by the ATLAS.ti manuals for coding of data. These steps are detailed as follows:

- Step 1: Creating of multiple codes;
- Step 2: Merging of codes;
- Step 3: Producing labelling codes and links in graph format; and

- Step 4: Generating a table of codes count.

The coding process included the NCT analysis, as described by Rademaker *et al.* (2012:1), as the essential segments of the analysis procedure are: Noticing things, Collecting things and Thinking about things. The transcripts added in ATLAS.ti can be viewed in a window called the primary document manager. The labels are composed of a linguistic structure that transforms families into ostensible factors when exporting them to an Excel table. In the wake of allotting the information to ATLAS.ti and understanding it, after that the process of noticing and collecting began. For this current study, the utilisation of elucidating and beginning coding was found to be proper coding. This implies the creating of codes inductively and closer to the data information. The code labels were still extraordinarily descriptive and, in some instances, taken unswervingly from the data.

The sorting of the code list in ATLAS.ti was in alphabetic order. It was beneficial to work with prefixes, which resulted in all codes belonging to a category to appear as a group. In addition, the original code "supply chain risks" was renamed as "SUPPLY RISKS", for it to show up as the main category label on top. Some of the engaging codes with low frequencies alluded to only the consequences of the interviews, and in that capacity added to the intuition of knowledge encompassing the supply chain risks. As the code list is sorted in alphabetic order, the codes alluding to singular outcomes seemed to be everywhere. Setting a filter shifted the focus on the specific consequences of codes, and it wound up being noticeably less demanding to sort and order the codes by changing the name of the code labels (Gläser & Laudel, 2013:23). Codes that had comparable substance were converged under a typically higher totalled code label. After this procedure of part and conglomerating, the code system included twelve fundamental class codes and their sub-codes up to two levels, profoundly signifying a total number of 176 codes. This procedure was repeated until a point of saturation was achieved, which is the point at which the themes started to appear repeatedly, and consequently the information being drawn was improbable to change (Hennink *et al.*, 2017:591). This eased the identification of common themes that were pervasive in the data. These universal themes were distinguished as the findings of the study.

5.6 MEASURES OF TRUSTWORTHINESS

The qualitative content analysis is regularly utilised for the evaluation of qualitative data; however, few articles have researched the trustworthiness of its utilisation in management science studies (Elo, Kääriäinen & Kanste, 2014:1), explicitly supply chain and the risks thereof. The trustworthiness of qualitative content analysis is regularly introduced by utilising terms; for example, credibility, conformability, transferability, dependability and authenticity.

5.6.1 Credibility

Credibility is the important perspective or criterion that must be established. It is the most critical aspect or criterion in establishing trustworthiness (Elo *et al.*, 2014:1). Credibility requires that the research is linked to the study's findings with reality to show the truth of its findings. In this study, credibility was set up using a purposive sample, which guaranteed that only those individuals who had information related to the aim of this study were recruited as participants. To be specific, the sample was composed of managers drawn from the supply chain department of the electrical energy utility. This ensured that they had in-depth information about the operations of the organisation concerning issues such as risk management, which is the subject of scrutiny in this study.

5.6.2 Confirmability

Confirmability alludes to the objectivity, that is, the potential for consistency between at least two independent individuals about the information's meticulousness, importance or significance (Miles *et al.*, 2014:365). All interviews were audio recorded, each participant signed a consent form, which method was followed to ensure confirmability with an audit trail. In the audit trail, all fourteen of the interview transcripts were e-mailed back to several participants to confirm their trustworthiness and to thank them for taking part in the research.

5.6.3 Transferability

Transferability depends on the rationale that findings can be generalised or exchanged with different settings or groups (Brick, 2011:872). Transferability is recognised by giving scholars evidence that the study's findings could be relevant to different environments, circumstances, times, and populations. This data collection process took place at one office block, in various meeting rooms. The in-depth interviews were conducted in closed offices occupied during the day

by the senior managers as workstations. These offices are locked by either the manager or the secretary who are the only other people with access to the offices. Experience and qualifications were considered when selecting the samples. In this study, transferability was found through analysing the specific details of the study conditions and methods and then contrasting them with similar circumstances that are more recognisable within the electrical energy sector. In this case, the specifics of the electrical energy industry in Gauteng and other South African regions were considered similar. This confirms that the findings of this study may be transferred (generalised) to the electrical energy industry in other regions of South Africa.

5.6.4 Dependability

Dependability of study findings requires researchers to make judgments about the "soundness" of the research, about the application and appropriateness of the techniques embraced and the integrity of the conclusions (Mero-Jaffe, 2011:231). Subjective research is, as often as possible, censured for lacking logical meticulousness with the inadequate support of the strategies received. The absence of transparency in the analytical methodology and its discoveries is merely an accumulation of particular conclusions subject to researcher bias (Galvin, 2015:2). The data collected during this study was consistent by making use of two audio recording devices. This process ensures an available backup system should one of the recording devices be dysfunctional during the procedure.

5.6.5 Authenticity

Authenticity is portrayed by an extensive variety of terms in qualitative studies (Smith, 2017:121). This concept is not a single, settled or widespread idea, yet instead an unforeseen construct, unpreventably grounded in the procedures and expectations of specific research methodologies and projects (Thorne, 2016:231). Furthermore, authenticity determines if the study genuinely measures what it was expected to quantify or how accurate the research results are (Galvin, 2015:2). Authenticity also focuses on how much researchers dependably and genuinely portrayed participants' encounters.

This study concluded that it is essential to explore the trustworthiness of every phase of the analysis process, including the preparation, organisation and reporting of the conclusive results.

5.7 ETHICAL CONSIDERATIONS

Research ethics include prerequisites on daily work, the assurance of the poise of the participants and the production of the data in the study (Mantzorou & Fouka, 2011:3). The major ethical issues in researching, according to Ponterotto (2010:581), are:

- a) informed consent;
- b) protection of participants;
- c) confidentiality;
- d) authorisation of the study;
- e) intellectual property; and
- f) respect for privacy.

It is essential to recognise that qualitative research methods demonstrate some remarkable ethical challenges, given the researcher's regularly extraordinary, individual, and delayed cooperation with participants in their community environments (Fusch & Ness, 2015:1408).

5.7.1 Informed consent

Informed consent is a procedure in which a person learns critical certainties about research, including potential risks and advantages, before deciding whether or not to contribute to a study (Hackett *et al.*, 2015:184). One of the essential ethical guidelines administering research is that participants must give their informed consent before partaking in a study (Cohen, 2013:3). This involves more than acquiring a signature on a form. Researchers must, therefore, guarantee potential research participants be given adequate information about a study in a format they comprehend, to empower them to exercise their entitlement to make an educated decision, regardless of whether they contribute in the given research (Gordon, 2012:2273).

In this study, participants were informed about the background of the research and the reasons for choosing them as participants. The consent forms were signed by all participants who took part in the study, irrespective of the type of involvement. The processes were explained to the participants, contact details were provided, and the participants asked if they needed added information from the electrical energy utility or the research department at VUT. Consents were acquired from the potential participants to make an electronic entry in the individual's electronic diary. The

participants were further informed that there would be no compensation for taking part in the research.

5.7.2 Protection of participants

The researcher must educate the participants in research on how far they would be afforded obscurity and confidentiality (Corbin *et al.*, 2014:316). This assurance of confidentiality and anonymity given to participants must be honoured by all beneficiaries of the study unless there are clear, and superseding motivations to do otherwise (Holloway & Galvin, 2016:61). Researchers should not rupture the duty of confidentiality and not pass on identifiable information to third parties without participants' consent (Hackett *et al.*, 2015:184). However, research data given in confidence does not enjoy the legitimate benefit and may be at risk of a subpoena by a court of law (Corbin *et al.*, 2014:316) of insignificant conditions, when participants to the study should be made aware of this reality as part of the consent process.

The protection of participants' rights was spelt out to them before the commencement of the data collection procedure. They were informed of their rights regarding taking part in the research and the type of protection available for this type of study. No group bookings were made, rather, individuals were booked, which this was to ensure that no prior discussions took place before the actual meetings. Participants only discovered each other's participation on the day of the interview. To allow the data collection process to flow, participants could make use of designations rather than refer to the identifiable names. Before commencement, participants were informed that the recordings would become the property of the university and would be kept under the guidelines of the VUT for the prescribed period. Furthermore, the transcribed interviews would be edited and the names of the participants would be omitted as well as the names of the references made during the data collection process.

5.7.3 Confidentiality

The ethical obligation of confidentiality incorporates obligations to protect information from unlawful admittance, usage, revelation, alteration, forfeiture or theft (Yin, 2011:36). Initially, issues of confidentiality are addressed at the time of information collection. Discussing confidentiality at the outset is fundamental for procuring informed consent and building trust with potential participants (Holloway & Galvin, 2016:51). The next notable stage where confidentiality

is addressed is the data cleaning stage, which includes the removing of identifiers to create a “clean” data set (Ellingson, 2017:156). An uncontaminated data set does not contain information that recognises participants (Dewey & Zheng, 2013:23), such as a name or address (such classifying evidence might be stockpiled away, in separate and secure files).

The purpose and framework of the study were discussed with every individual before each interview, guaranteeing a comprehension of the research involved. All the recordings and transcripts were archived according to the guidelines given by VUT. All data naming participants were removed during the transcribing phase. The consent forms signed by the participants highlighted the individuals who would have access to the data.

There is a list of the participants in Table 5.1, which includes all the individuals who took part in the focus groups and in Table 5.2, individuals who took part in the in-depth interviews. All contributors were guaranteed that their explanations would be non-inferable within the study. Participants completed consent forms before the interviews for both ethical reasons and as an audit trail. The explanation behind obscurity is that it gives the interviewee a chance to talk uninhibitedly and honestly about the researched topic. This provides an entire dialogue where the interviewees are less likely to restrict the profundity of information provided so as not to repudiate the company’s position.

5.7.4 The authorisation of the study

Before commencement of the study, in line with the protocols, rules and procedures of the Vaal University of Technology, approval was obtained from the Higher Degrees Committee. This study followed the ethical guidelines, which were explained to the participants prior to, during and after the interviews and discussions.

Further permission was obtained from the ethical office of the participating company. This permission is valid until 2020 and is attached to this study as Appendix A. The process of obtaining authorisation allows the study to collect data in line with the guidelines of the participating company. The company has been chosen because it has a national footprint and has a large procurement budget for both goods and services and faces different risks daily.

5.7.5 Intellectual property

Intellectual Property (IP) alludes to manifestations of the mind; for example, inventions, abstract and creative works, projects, and cryptograms, names, and images used in commerce. IP is ensured in law by, for instance, licenses, copyright and characteristics, which empower individuals to acquire acknowledgement or financial advantage from what they invent or make (Bently & Sherman, 2014:31). As “plagiarism” is a genuine issue with important legal and ethical ramifications, academic institutions should establish guidelines for maintaining a strategic distance from the theft of ideas or works under the umbrella of intellectual property in their respective environments (Foltýnek *et al.*, 2014:21). Plagiarism in academia can be described as the “unjust adoption” and “pilfering and publication” of another author's "language, contemplations, ideas, or expressions” and the portrayal thereof as one's own innovative work (Elander *et al.*, 2010:157). Whereas plagiarism in some contexts is considered theft or stealing, the notion does not exist in a legal sense, although the custom of using someone else's work to increase academic credit may meet some legal meanings of extortion (Doró, 2016:15).

5.8 CONCLUSION

This chapter proposed the overall research design of this thesis and explained in detail the methods to be applied to each research phase. Firstly, it discussed research philosophy, research approach, research strategy and time horizon, and research choice as an overarching idea of the research methodology. Subsequently, it presented and justified the data collection and data analysis methods, model development and model validation. The sampling process, administration and data analysis method of focus groups and the in-depth interviews and statistical analyses, including ATLAS.ti, were discussed in detail to define the methodology. The results will be discussed in detail in Chapter six.

CHAPTER 6

FINDINGS AND DISCUSSIONS

6.1 INTRODUCTION

This chapter reports on the analysis of data and the interpretation following the collection of the data that applies the qualitative research approach. The primary investigative undertakings in the data preparation process include interview schedules' checking, editing, coding, and tabulation. The particular qualitative methodology of the case study was utilised to gather an assortment of useful and dependable information, including interviews, focus groups, direct observation and historical records. The research incorporated all risks present in the electrical energy industry in South Africa, with the case company being the national electricity supply utility.

6.2 SAMPLE REALISATION AND DATA ANALYSIS

The participants consisted of different supply chain professionals based at the head office of the utility; they had numerous qualities in common, yet essential contrasts can also be noted. The adherence to ethical considerations by the researcher was of extreme significance; participants who partook in the study did so out of their own time. In data analysis, the names of the members would not be revealed but instead pseudonyms in some cases utilised to ensure their personalities remain anonymous and to illustrate their confidence in the research (Vanclay, Baines & Taylor, 2013:243). The researcher may provide more points of interest to elucidate and confirm future investigations on this subject. The findings would be introduced on a case-by-case premise, and commonalities indicated and discussed. In this analysis, a significant portion of the participants were exceptionally well spoken in explaining the difficulties confronted by the power utility in executing their supply chain activities efficiently. Methods of face-to-face, semi-structured interview schedules directed the interview guides (see Appendix C); both the semi-structured interviews and focus group sessions were the primary source of data collection for this research. Due to the complexity of the qualitative analysis, the researcher employed ATLAS.ti version 8 to separate data into stakeholder groups, analysed codes in seclusion and matched the different statements that developed (Saldana, 2015:211). This stage reflects the codes and group codes by making use of the network diagrams, which the researcher will indicate in an attempt to answer the research questions.

6.3 THEMES EMERGING FROM THE STUDY

The themes emerging in this study were directed at the empirical objectives as stated below:

6.3.1 Themes related to strategies of reducing supply chain risks in the electrical energy sector

The third objective of the study sought to establish the the strategies of mititating supply chain risks in the electrical energy sector in South Africa. The data analysis process yielded ten themes related to strategies of reducing the supply chain risks in the electrical energy sector. The themes and their operational definitions are presented in Table 6.1.

Table 6.1 Themes and operational definitions reducing supply chain risks

THEME	DESCRIPTION	OPERATIONAL DEFINITION
1	Identification of supply chain risk drivers	The risk drivers refer to the conditions (institutionalisation of agreements and provider reliance) with risk-consequence implications that influence the magnitude of the loss.
2	Leadership involvement with supply chain risk strategies	This entails a proactive methodology that aims to minimise the probability of risk occurrence.
3	Legislation application in the supply chain	This entails the application of the different laws of the country in the execution of the supply chain duties by a state-owned entity.
4	Knowledge management in the supply chain	This is the process of creating, sharing, utilising and managing the knowledge and data of an organisation. It alludes to a multidisciplinary method of accomplishing authoritative targets by making the best use of knowledge.
5	Monitoring and auditing of supply chain effectiveness	The benefit of utilising strategic corporations in the company, for example, Internal Audit, to enhance the auditing and monitoring parts of the program and to achieve more with restricted resources.
6	Supplier rankings and listings	The acquisition is relied upon to know where they are defenceless and support their groups for progress. Supply chain teams that put a more unusual accentuation on qualitative and quantitative supplier information analysis will have the capacity to distinguish risks and opportunities rapidly and concisely.
7	Leveraging supply chain risk information	This entails the type of risk information related to the supply chain and how it is combined and used to the advantage of the firm.
8	Supply chain environmental management	Supply chain environmental management undertakings can comprise collaboration with suppliers upstream in the supply chain, but also with downstream wholesalers and customers.
9	Supply chain performance during risk	This entails how the supply chain activities get funded and the risks it faces in the different markets.
10	Objective orientation	This entails the alignment of all the stakeholders to ensure the supply chain department performs on its mandate.

Source: E Jonathan (2018)

The individual themes and empirical evidence to support these themes are discussed in the next section.

6.3.1.1 Theme 1: Identification of supply chain risk drivers

The first theme to derive from the interviews was the discussions regarding *Identification of supply chain risk drivers*. The participants concurred that not all risks are the same; some are more continuous than others. Supply chain risk impacts drivers, which incorporate both probability and influence. Drivers are possibly inclined towards competitive pressures with the risk-source implication, which might in few cases, increase or decrease the supply chain vulnerability, for example, to emphasise effectiveness and consolidate it with the lean methodologies, which can cause supply chain vulnerability. The impact drivers referred to in the case firm are the conditions (institutionalisation of agreements and provider reliance) with risk-consequence implications that influence the magnitude of the loss. The findings of this research uncovered that most professionals associated with risk management decisions in the case firm, and view its supply-chain risks management processes as efficient and current. The researcher further observed that the participants' primary concern was about the delays in the upgrade of the current infrastructure, based on the two statements recorded during the interviews.

“What I have experienced is first of all linked to the ageing infrastructure so in South Africa our energy sector or our electrical energy sector is ageing, the power plants most of them are past midlife and facing closure so we kind of like...and we are running them above design specifications.” (senior manager with 15 years experience). In agreement with the statement was a senior advisor with ten years experience, *“So if they are at the end of their life, they at forty years and the resource was forty years. So, it is likely that the resources are also depleting. Moreover, what happens next? Where you may have had a conveyor supply you now have to go and fetch the resources from further away.”* A further observation was that the risks are in the entire value chain as described by the middle manager with over 20 years of experience. *“The other things that happen again around the communities is that we have seen of late service delivery unrests. Where people are, are obviously unhappy with the service delivery. Moreover, they start to, to interrupt the services. They interrupt everybody, so there's striking of coal. Moreover, all that so for me it is, it is a big risk because any interruption affects your stocks and you have may to replenish them at a cost.”* The comprehension of the specified risk drivers will

undoubtedly assist with the expulsion of both the probability and impact drivers (Chen, Sohal & Prajogo, 2016:853). The sharing of risk information to the supply chain department by other line departments can assist with the management of potential risks, which will assist with the proper identification and prioritisation of these risks. Specifically, the research found that the majority of participants contradicted the statement that they create a supply-chain risk management plan to make sense of how to best deal with risks in their industry.

6.3.1.2 Theme 2: Leadership involvement with supply chain risk strategies

As indicated, approximately 26 percent of the articles gathered (91 out of 354) incorporated attention on risk identification (Fan & Stevenson, 2018:1). The procedure for classifying risks engendered disagreements in the literature because most of the empirical research is more context-specific, in which data collection occurs in diverse industries and countries. There is an oversimplification of the supply chain as linear and static reaching from source to sink, which, on the contrary, is a complex web of changes coupled with the adaptive capability of an organisation to respond to such changes. Due to the nature of the supply chain of the case firm, based on the interview remarks, the company performs a dual implementation process of both reactive and proactive strategies. The strategies must participate in ex-ante, but proactive instruments are cause-related, which can lead to exceptionally noticeable impacts (e.g. longer term contracts), although reactive instruments are impact arranged and can demonstrate their ex-post effect (Thun & Hoenig, 2011:242).

The feedback related to whether the management distinguished the supply chain risk results. The researcher established that the management's ingenuity in determining the company's supply chain risk aims and objectives were foundationally unsuitable. The organisation business strategy failed to address the extension, results, objectives, and pattern of the company's risks for the previous period. There were no execution displays of risk that could be contrasted with similar approaches to correct the issues. One of the middle managers with over ten year's procurement experience expresses [his] frustration:

"So with that it opens up just all the other problems. So if you do not have even leadership, how can there be effective leadership if there is no leadership." The comment is further seconded by a

senior manager with over five years' supply chain experience *"I think firstly it is like where we are right now is stability in management. I think that for us today is the biggest challenge. Is that firstly there's no stability in our management."* To clarify this and to give context to the issue during an in-depth interview, the senior manager with more than ten years experience clarifies *"This subject never was an issue for dialogue in our formal management review meeting we may have dissected the risks infrequently. Yet that was most certainly not in light of a strategic plan and conclusions depended on sentiments as opposed to realities."*

The researcher observed that there was a lack of authority at the senior management level that holds full responsibility to discuss the different proof of risk results with top management. The interview showed that the sources of risk were recognised as the practitioners saw and comprehended them. Most of the risks identified are internal risks that are natural and constrained opportunities. The managers concentrated on the risks in their capacities of accountability in an offhand manner.

The case company applies a strategic sourcing methodology, which allows it to test the market for all the products and services it intends to procure. The participants demonstrated an appetite for the procurement of environmentally friendly capital projects. The risk, which stood out in this initiative was the lack of resources to procure commodities that have more technological attributes, which could cause unnecessary delays. These delays are related to the shortage of electrical energy in the last decade, which has affected almost all stakeholders. The researcher further observed that the suggested strategies are both reactive and proactive, with most of them tested with possible results. This study, however, did not focus on the results and the number of the strategies, which are available or implemented over a period, hence, no mention is made of the strategy outcomes or implementation.

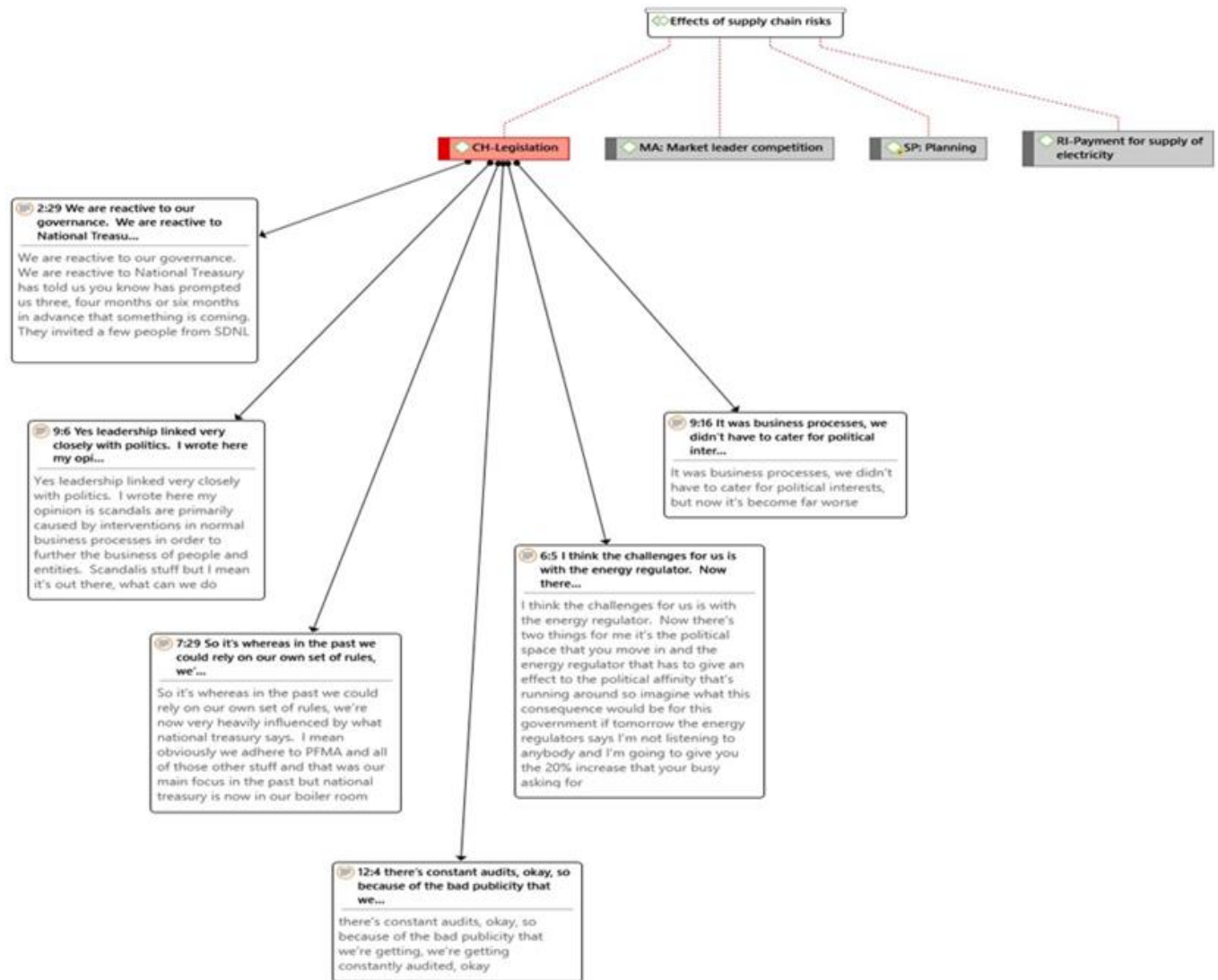
6.3.1.3 Legislation application in the supply chain

As stated in Eskom's Annual Report (2016:1), "Eskom keep(s) abreast of the latest developments in legislation and continually assesses the impact of legislation on its business. Eskom's policy is, as a minimum, to comply with legislation." Eskom's supply chain adheres to the policies and

procedures as distributed to the different State Owned Entities (SOE) by National Treasury, updated on a regular basis.

The participants highlighted, as indicated in Figure 6.1, that the supply chain operates more reactively regarding the updated policies and procedures. These actions can cause postponements to the supply chain department with regards to establishing contracts in light of solicitations from the business. Its effect has additionally put the case company at risk regarding supply should the appropriated changes be of such nature as, for example, ownership of suppliers or on the importation of items. The case company in certain instances has found itself competing with exportation quality, particularly as far as coal is concerned.

Figure 6.1 Comments from participants on legislation application in the supply chain



Source: Jonathan (2018)

The leadership has no unswerving board members, so much so that some participants commented that some of them are politically connected. Reading from prepared answers, the senior manager who has over ten years experience commented:

“Yes, leadership [is] linked very closely with politics. I wrote here my opinion is scandals are primarily caused by interventions in normal business processes to further the business of people and entities. Scandalous stuff but I mean it is out there, what we can do.” Political connections at that level should still not have a negative influence on outputs. This was emphasised by the middle

manager with more than 25 years' experience who added. *"We are reactive to our governance. We are reactive to National Treasury has told us you know has prompted us three, four months or six months in advance that something is coming."* There are cases where confusion regarding reporting to the shareholder exists. On the topic of legislation, the supply chain is not clear but follows guidelines regarding required law and its application. The researcher observed during the interviews a senior manager's response in the contracts section with 12 years' experience: *"I think the challenges for us is with the energy regulator. Now there's two things for me it's the political space that you move in and the energy regulator that has to give an effect to the political affinity that's running around so imagine what this consequence would be for this government if tomorrow the energy regulators says I'm not listening to anybody and I'm going to give you the 20% increase that you're busy asking for."* The observation is precise that there is some confusion on what the shareholder's immediate mandate is in relation to the political climate of the country.

6.3.1.4 Knowledge management in supply chain management

The knowledge created by supply chain information can be diffused within the organisation by enhancing the capability that human capital resources can bring about. As educated employees are essential to risk management, employees are required to comprehend all characteristics of the supply chain and equip themselves with the essential skills to make an appropriate and suitable risk management decision. The impact of this education and training can be maximised with the dissemination of past experiences. Some portion of past learnings will incorporate the successful treatment of interferences which accompanies present interruptions investigating to determine the lessons learned for preparedness for future similar occurrences (Spiegler, Naim & Wikner, 2012:6162). Lessons drawn from imperfect reactions to interruptions can likewise constitute past encounters, which merit being disseminated through the inventory network.

Knowledge management is the capacity to learn from past disruptions, thereby observed as a critical property of versatility. Researchers have identified knowledge and understanding of the supply chain structures and risk propensities as a critical management factor (Blackhurst *et al.*, 2011:374; Khan & Zsidisin, 2012:1). Despite the fact that the method for overseeing knowledge can change diagonally over organisations and the viability of strategy may vary, contextual

analysis companies have consistently voiced that management of disturbance-related knowledge is an arbitrary action to mitigate future risks.

However, there are still mixed reactions to the way knowledge is shared by the case company. This was an observation based on the comments by various participants on who should convey messages. A senior advisor in contracts management with over ten years' experience commented: *"There have been workshops and then those people get back to their desk, and nothing happens in the organisation? You know they kept the information to themselves. They were aware of it, but there was no communication until we have had it with the infrastructure procurement that came out last year."* The statement was contradicted by one of the general managers in sourcing with over 13 years' experience in senior management. *"On every first Thursday of the month in the morning at nine, we have our monthly meeting whereby we share the risks of the previous month and the mitigating factors. This is to ensure it does not happen and should it happen again there is at least knowledge on how to handle it."* The knowledge sharing initiatives within the case firm are in place although the observation from the research shows that it is was not implemented as an enterprise-wide initiative. The point was further emphasised by a senior manager in sourcing with over ten years' experience: *"For significant risk issues we have weekly presentations, discussing the risks this is due to the culture of transparent operations, we share all the causes of risks we experienced. In some cases when it is a high risk we share it with the risks stakeholders."* Despite the fact that the method for overseeing information can change across organisations and the viability of techniques may likewise vary, the participants consistently voiced that administration of disturbance-related learning is an arbitrary action to alleviate future risks. Most companies incline towards a consistent meeting time slot to share and report sporadic cases with the goal to make all aware of the risks.

6.3.1.5 Monitoring and auditing of supply chain effectiveness

Firms monitor and individually audit nodes within their supply chains to forecast the most vulnerable node to risks to empower employees to utilise the most appropriate measures to maintain a strategic distance from disturbances together with their accomplices (Blackhurst *et al.*, 2011:374). Furthermore, the continuous supplier monitoring generates the knowledge of external risks that are often concealed due to the insufficiency of control. Efficient supplier monitoring and

auditing guarantees the control of a supplier's discrepancy to perform results and risky practices, consequently accomplishing risk management objectives (Aqlan & Lam, 2015:5640). The focus groups discussed the issue and made some significant points.

“And we are also not getting the best deal for the organisation or the country, remember we are spending public money.” (Sourcing Specialist: contracts - 9 years' experience). *“Usually, we recognise the problem just before it happens or after it happens. If the supply chain management or the monitoring were well functioned, there are many cases that wouldn't be led to the risks or problems.”* (Senior Manager: Sourcing - 18 years' experience).

The interviewees likewise concur that they attempted to exchange risks to some degree to their suppliers.

“Even though we did not have a specific agreement, we have to tell our suppliers to handle the problems in the first place and to show our intention that we will leave the issue to the supplier to carry it out. If we do not do so, those little details of supply chain related issues come to us, and if this keeps happening, we need to deal with all the problems that we do not know.” (General Manager - 13 years).

The reason for this was due to the trust that suppliers know best about the dangers they need to tackle on issues in their authority. Risk exchange may be included in future contracts but can also be applied obliquely with mutual agreements between parties.

6.3.1.6 Supplier ranking and listing

Supplier relationships can be utilised to dispense particular assignments to the most fitting supplier, thereby diminishing risks from the ineptitude of the provider. The probability of exasperating occasions can be lessened by supplier selection and a ranking process since it inspires suppliers to agree to the firm's supply chain prerequisites. As the ranking endorsement does not keep going forever, it likewise influences suppliers to attempt their most extreme amid the agreement time frame to limit disturbances for future business (Bai & Sarkis, 2010:252). The listing programme can be either unequivocal or specific. Regardless, qualified suppliers can be supported by specific ones while taking an interest in tendering for outsourcing contracts. The

researcher observed that the participants well understand the ranking process and the supplier selection. *“I think for we need to have sessions with the smaller suppliers that we want to bring across and show them how to meet the specifications. We have to meet them halfway.”* (Senior Advisor: Sourcing - 16 years). The statement was further confirmed: *“Only registered companies can participate in the bidding process for outsourcing. For newcomers, they can register after the support team assesses multi-dimensions of their quality.”* (Senior Manager: Contracts - 10 years). The researcher further observed that not all participants agree regarding the said process. *“So yes we have created a monopoly with certain suppliers, and we should try to break that monopoly. However, just because we have created that monopoly does not mean that they have a monopoly, we have created that monopoly. I do not know if that makes sense.”* (Senior Advisor: Contracts - 16 years). The interviews also show that the said process is not abuse-proof, and is an inappropriate way to rank suppliers for particular services or products.

6.3.1.7 Leveraging supply chain risk information

Supply-chain risk mitigation strategy focuses on the proficiency to process the evidence needed, and subsequently react sufficiently to risk occasions. Interviewees distinguished that the essential corporate strategy to enhance information processing ability is leveraging supply chain information, which encompasses accumulation, management and utilisation of the information. The participants demonstrated that the capacity to react to risk events and update the network promptly should form part of the correct and continuing data accessible to all staff. Specifically, they advised against information meandering by entities engaged with the extended global supply chain networks that additionally deferred central leadership because of inadequate and impending data. Therefore, prominent companies in international supply chains who have heavily invested in an integrated supply chain information system can consolidate end-to-end supply chain information from supply chain partners as well as customers.

Different literature associated this strategy with the concept of visibility enrichment, which numerous studies have advocated (Kam, Chen & Wilding, 2011:428). The essential advantage from expanded visibility is that it can demonstrate where the risk is situated and how disturbances replicate through the supply chain networks. Visibility was accentuated by researchers because increased visibility of demand information can limit the bullwhip effect from information

distortion across the supply chain members. The information provided by the line departments are not the final requirements. During the one of the focus group sessions, the participants discussed the fact that line departments in some instances take control of the supply chain, to their frustration:

“Associates are found nearest to the data identifying the risks. ‘How to draw the information’ is the substance of relations. If the partnership is well established, we could have the precise or at times even ‘characterised’ data. Moreover, ‘how to utilise the information’ is the matter of our ability as a company.” (Middle manager: Sourcing - 5 years). *“For instance, it looks like I always go to a meeting when an engineers try [to] fiddle in my supply chain. I say to the engineer the day you will allow me as a supply chain to redesign your turbine is the day I will allow you to redesign my procurement process or my supply chain process.”* (Senior advisor: Sourcing – 16 years).

It shows that the supply chain professionals are taking ownership of the processes which they are responsible for performing. Expanded visibility makes it conceivable to screen the supply chains progressively and to make a suitable choice on the moderation in both prescient and deceptive conduct (Blackhurst, Dunn & Craighead, 2011:374). Fundamentally, visibility is one instrument or ability for risk management; instead, how to leverage supply chain information acquired from visibility appears to be vital to manage global supply chain risks.

6.3.1.8 Supply chain environmental management

The eighth theme is *supply chain environmental management*. The best supply chain environmental management activities frequently include cross-functional teams of conditioning and sourcing staff as well as others; for example, item engineers, planners, communication and in some instances quality management. Numerous organisations are attempting to streamline their supply base and grow more cooperative, long-term affiliations with critical suppliers, a practice that has cultivated more noteworthy prospects to cooperate on environmental issues. Many companies that have embraced supply chain environmental management initiatives have discovered that working with suppliers on environmental issues not only produces significant environmental advantages but also offers prospects for cost suppression and strategic and competitive improvement. The participants specified, based on their answers, which supply chain environment management has evolved from just being a topic in publications to a management

practice that has vast implications on how companies interact. This is a clear indication that the case firm is actively involved in the protection of the environment and that the practice is ongoing.

“In the transformer space for the past twenty, thirty years company has been using mineral oil and currently as all the transformers that we are procuring we [are] forcing the suppliers to use what is called ester oils which its, it is an oil made of vegetable.” (Senior Manager: Demand Planning - 21 years). *“Then the other thing that the organisation is doing to ensure that we are environmental compliant is to incorporate into our procurement or supply chain processes the environmental requirements which it’s mandatory because be it prior to awarding a contract to any suppliers we need or we have an obligation to ensure that that particular supplier has complied fully complied with all the environmental requirements of the organisation.”* (Middle Manager: Sourcing - 20 years). *“Legislatively we are apparently governed by legislation regarding emissions. If you look at emissions, there are emissions limits that affect mainly the plant. Moreover, then the people that we deal with, which are the coal miners, there’s also a limit to which we can accept some of the qualities that they can supply to us. The quality of coal that they supply to us. So, find with the stricter emissions limits we also have to look for coal that is of higher quality so that there are doesn’t impact on the emissions licensing.”* (Senior Manager: Contract - 8 years).

The management of the case company has come to understand that an immense and accumulative quantity of environmental risk can be found in almost every organisation's supply chain. This acknowledgement features the fact that pronouncements in this area are expanding in significance. The researcher observed that the participants are entirely mindful of the environmental policies in the case firm and are confident that they will be maintained. The case firm has a significant emphasis on environmental issues as it is producing electrical energy mainly using fossil fuel, and has a noteworthy carbon footprint, as discussed in Chapter two.

6.3.1.9 Supply chain risk management performance

Decisions identifying with changes in the supply chain structure and relationships should include the investigation and assessment of the related potential results as far as advantages, expenses and risks are concerned. Performance and risk are interconnected and require the considerable and

vigorous application of supplier management tools and controls to enhance implementation while monitoring the serious risks. The participants expressed great concern on how the finances and performance of the case firm have been handled and hope for potential future changes.

“I would say that for now, I regard it as fairly poor. We have done poorly maybe in the last three to four years in the sense that there hasn’t been enough capacity for growth. I think that is shown by the economic growth figures. So, there hasn’t been that much growth in the, in the economy due to the lack of capacity. It’s only in the last maybe eighteen months that we have tried to sort of make amends.” (Senior Manager: Sourcing – 10 years). *“Well, we are not sure because there’s no clear message that comes through but there’s the perception that there’s a lack of maintenance, a perception that we were sweating our assets. That we were running them into the ground. However, again, it’s just a perception, so I don’t know if it’s actually out there.”* (Senior Advisor: Sourcing - 10 years). *“So the funding threat, it has caused us to look at innovative ways to get funding and of course now we’ve started a private sector participation programme, which in effect is also partially privatising the industry.”* (Middle Manager: Contracts - 12 years).

The researcher observed that the participants are fully aware of the numerous risks faced by the electrical energy sector. The participants know that the capital projects took more time and apparently money than projected. It is more expensive to repair assets than to maintain the same assets. From the discussions it is clear that the case firm is in reactive mode in terms of maintaining its capital assets. The repairing has proved to be costly, especially with the assets reaching high-end stages.

6.3.1.10 Objective orientation

Objective orientation is defined as the situation where a case firm can accomplish its internal objective by achieving the goals of its supply chains, as those two objectives are well associated. To simplify the statement refers to the case firm’s strategic supply chain objective and the visions of its supply chain partners. The comprehension of these components is critical to risk management since they can prompt changes in the current supply chain business model, which may thus generate unexpected weakness and vulnerabilities. Goal alignment, consequently, happens when organisations are being built, or another business is on the edge of the transaction.

The case firm has a strong government backing, and so changes happen as soon as the shareholder representative changes. The results can have an adverse effect on the firm. During the interviews, the participants made their feelings known about the changes.

“We came out of a wonderful period in the early 1990’s where everybody was on a high, and I do not know; people seem to have lost momentum. Politics have got a lot to do with that of course.” (Senior Manager: Business enablement – 10 years).

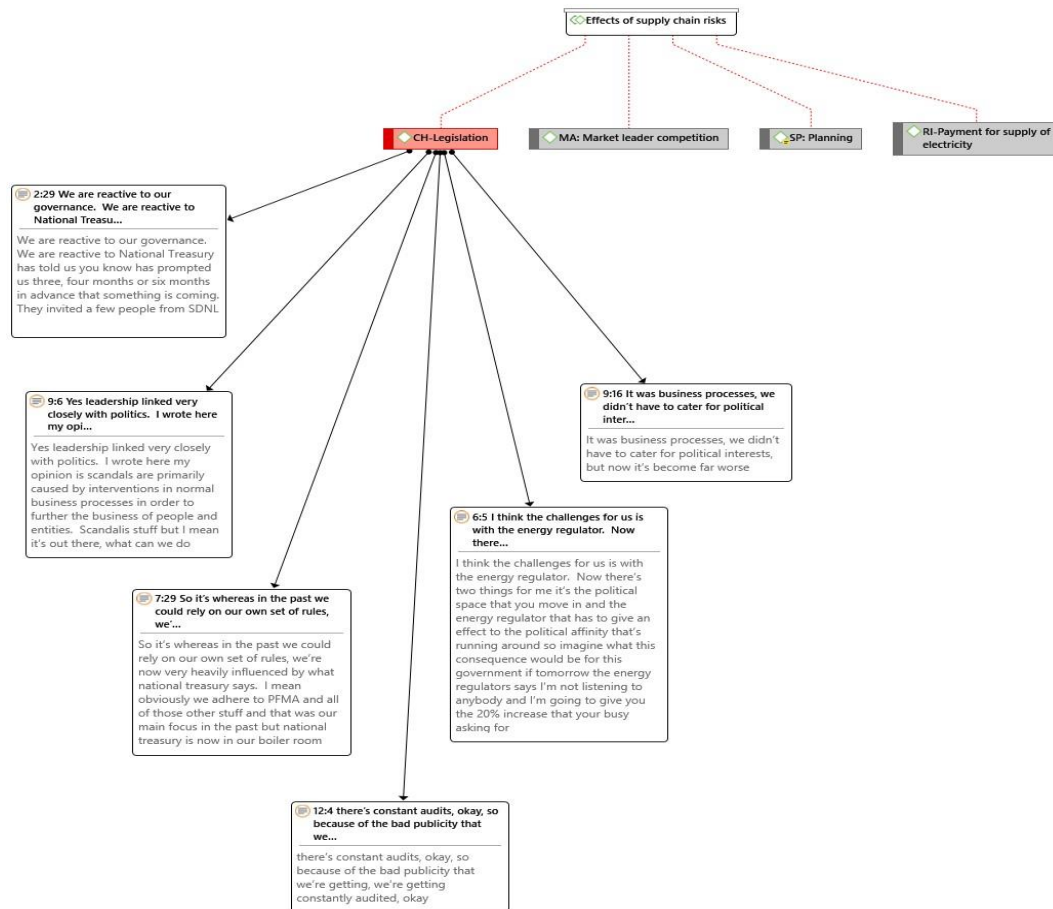
“There’s no business at one stage we as a country as closed a foundry a month and foundries are heavy energy consumers because it involves metal so that’s how bad that industry is because we import cars from China, so the demand shrinks and then the Madupi and Kusile’s comes on board obviously and I did say I’m not going to talk politics but the dynamics that we are faced with is so as a normal business we then said to ourselves you know there are four power stations in Mpumalanga that are way past their sell by date, we need to now sell them because of the surplus, and then from a labour point of view we are told thou shall not do it so what do you do? Do you now run an inefficient, expensive plant that potentially pollutes the atmosphere and to keep 400 people in a job? I do not know what the answer is but that is the dynamics so now you run a power station just because 400 people need a job not because you need the megawatts.” (Senior Manager: Supply Chain - 30 years).

“We have no leadership, and that is the problem. If we had a clear strategy as case firm, any leader that comes in, yes he will alter the strategy, but in theory, the strategy should talk for itself we do not have a long-term strategy. The closing of this power station may be the correct answer, it might maybe always have been the design as per case firm’s mandate, but the politics get involved when you change it. Now the one guy comes in because he needs to answer to the labour unions, he plays a political game and answers.” (Senior Manager: Supply Chain - 15 years).

It is clear that during the interviews the researcher observed that change management is understood but not accepted by some participants. To justify the extracts the researcher further states that the changes happen too rapidly; in some instances, it derailed the projects. In defence of the participants, these changes happen over short periods. The participants' intention, to the observation of the researcher, did not seem to be negative other than illustrating their frustration

with the short turnaround time in the political space. Figure 6.2 clearly indicates the codes given to the various topics and it is a further illustration of the usage of ATLAS.ti 8.1.

Figure 6.2: Codefication of conversation



Source: Atlas t.i 8.1 (E Jonathan 2017)

6.3.2 Empirical objective 1: To identify supply chain risks in the energy sector in South Africa

The first empirical objective of the study sought to identify supply chain risks in the electrical energy sector in South Africa. The data analysis processs yielded five themes which represent the supply chain risks facing the electrical energy sector. These themes, their descriptions and operational definitions are shown in Table 6.2.

Table 6.2 Themes and operational definitions for empirical objective 1

Themes	DESCRIPTION	OPERATIONAL DEFINITION
1	Delays	Delays in the supply chain include both internal and external disruptions, there is a combination of risks.
2	Disruptions	Disruptions anywhere in the supply chain are capricious and uncommon yet regularly very harming to all in the value chain.
3	Forecasting risk	Forecast risk consequences from a discrepancy between the projections and the actual demand.
4	Single Sourcing risk	Single sourcing, the intentional procedure of selecting and using one source of supply, has increased boundless recognition in the electrical energy industry
5	Operational disruption	The supply chain disruptions can and do have substantial monetary and calculated effects

Source: Jonathan (2018)

6.3.2.1 Delays risk

Delays in supply chain flow often transpire when a supplier, through extraordinary utilisation or another cause of rigidity, cannot respond to changes in the demand of the procuring firm. This was further highlighted by a sourcing specialist with nine years experience *“We’re also finding that there are limited coal resources so it’s not only the export markets that we are fighting against, that we’re competing against, we’re also competing against limited coal resources so we can’t guarantee security of supply for Eskom for the next 40 years for example out in Mpumalanga because the coal is being depleted. So because the coal is being depleted, the price is also increasing.”* Companies such as Eskom can avoid delays, or conceivably get ready for them, by appropriately and financially setting and evaluating their capacity and stock stores or in the case of coal looking at the mines. One essential arrangement is to keep up excess versatile capacity in existing plants. This is justified during an interview with a senior manager in demand planning with more than 25 years experience *“Our transportation costs are becoming higher because the coal resources are getting further from the power stations. Beyond that the resources themselves because if you look at a big resource that someone will have designed for a station even the mining thereof was easier.”* Other than decreasing the requirement for additional, station-particular specialists to cover nonattendances, Eskom must have a procedure that likewise guarantees that

day by day creation objectives are met, notwithstanding when minor mechanical production system issues happen. This was further detailed during one of the focus group sessions by a Sourcing Middle Manager with 15 years experience; *“But if that resource depletes its highly likely that you are now going to earn resources that are not easy to mine. So, the costs goes up because the resource itself is not easy to mine and it’s even further from the station so that compounds the logistics costs around it. And if you look at other things besides the difficulty of the mining you may then end up going to resources that may have been ear-marked for export. Now you are competing with export prices.”* Any supplier to an organisation that provides crucial products or services and countenances financial strain could meddle with the client's supply chain and production (Dartey-Baah, 2014:203). This is especially evident when the provider is the single source supplier of the supply to the client, and the product or service is not promptly accessible on the open market. For this reason, early exposure is crucial to providing the customer with the most options for addressing production-debilitating supplier circumstances.

6.3.2.2 Disruptions

It is beneficial to equate the supply chain strategies of companies and their subsequent capacity to adapt to portions of the interruptions experienced by themselves or other firms. The disruption Eskom phased was funding, because the funding model was that government provide them with all funding whilst they produce electricity for all. During the interview sessions a senior manager with over 10 years experience said: *“So the funding threat, it has caused us to look at innovative ways to get funding and of course now we’ve started a private sector participation programme, which in effect is also partially privatising the industry.”* Maybe the most significant test organisations confront is mitigating supply-chain risks without dissolving profits. *“We’ve always been a dominant supplier but we’re still a dominant supplier but IPPs are making a big in-road into our market. So specific risks to Eskom’s internal risks supply chain I would say is the availability of funds. We had to build capacity very quickly, obviously funds had to be diverted to that, which means less funds are available for operational requirements, which we buy.”* Given the density of numerous supply chains, encountering interruption is perceived by several companies as being unavoidable (Lorenczik & Panke, 2016:179). As a general rule, it is anything but a matter of a supply chain network experiencing an issue, but instead an issue of when a risky event will happen and the seriousness of the occurrence.

6.3.2.3 Forecasting risk

In the event that forecasts are too low, products might not be accessible to offer. Forecasts that are too high outcome in superfluous inventories and, unavoidably, price reductions. This point was emphasised during the interview with a senior manager in a supply chain with more than 20 years experience *“Planning is definitely lacking and it’s causing unnecessary bloated supply chain. If we could just get better planning around our projects, our maintenance programmes, that would help us already to make supply, well demand and supply more predictable.”* Forecast inaccuracies can likewise effect from data misrepresentation within the supply chain, which can also incorporate promotions and incentives that prompt forward buying; batching of purchases, goads higher instability in orders; and absence of information of end-users demand at upstream localities. The sentiments of technology to assist forecasting was echoed by one of the participants in the focus group session, *“Because technology will give visibility and brings with it efficiencies which speak to the attrition issue also. And it’s just, I mean I personally, it’s been three years that I’ve been trying to get a business case going with IM to bring in some level of technology which by other standards is actually a very low level of technology which is bar coding.”* (Middle Manager: Sourcing 20 years experience). Forecast risk can be decreased by explicitly holding stock and building responsive creation and conveyance capacity (Taponen, 2017:269). Keeping stock is fitting for commodity items with abstemiously low holding costs; approachable conveyance is better for costly items with short life cycles and comparing colossal forecast errors.

6.3.2.4 Single Sourcing risk

The practice depends on an agreeable association between the purchaser and the dealer. As fundamental as this relationship might be, a progression of apprehensions can create issues over the long haul (Jiang, 2016:870). This type of relationship can also be influenced by political connections within the organisation, such as Eskom, as resonated by one of the participants during the focus group sessions, *“I think the challenges for us is with the energy regulator. Now there’s two things for me, it’s the political space that you move in and the energy regulator that has to give an effect to the political affinity that’s running around, so imagine what this consequence would be for this government if tomorrow the energy regulators says I’m not listening to anybody and I’m going to give you the 20% increase that your busy asking for.”* (Senior manager in sourcing

with over 12 year's experience). Supply chain management must play a proactive part in decreasing the risks related with the current practice of single sourcing. The Parliament of the Republic (ZAR) has taken the public in their confidence by calling high profile politicians and directors of State Owned Companies to account in open sessions. This was emphasised during an interview with a Senior Manager in sourcing with over 20 years experience *“And we're also not getting the best deal for the organisation or the country, remember we're spending public money. I feel very strongly that there's also a positive there funny enough because I've seen a backlash to this happening, just in very recent past where people are being suspended, people have resigned and you know, I think politicians are coming to the realisation that the level of interference that we're experiencing now is so public that the public has decided that they've had enough of it and the politicians are starting to respond to the public perceptions of what's going on.”* The conclusion to use a single source in-lieu of multiple sources is one of the most significant actions in which a procurement professional takes an interest. Nonetheless, it must be founded on a cautious and occasionally conscientious investigation of potential suppliers and their competence to yield the product to determinations.

6.3.2.5 Operational disruption

Operational strategies, if accurately outlined and executed can successfully mitigate the economic and strategic risk concomitant with supply chain interruptions. The researcher observed that the case firm experienced different operational disruptions that were manageable at all levels; and the lack of role clarity can also result into operational disruptions. This was stressed during the interview session with one of the senior managers with over 25 years experience in contracts management; *“We can reduce our time lines by people firstly understanding what it is, the other problem for our supply chain is they don't have the same status in the business as engineering, for instance. You make an engineering decision first and supply chain must follow and because of that if the supply chain doesn't agree with the engineering decision there's always an adversarial relationship at that point in time to get to an understanding and then we move.”* Operational disruptions are not only linked to role clarity in the case firm as well as an understanding of the activities within the supply chain functions. The researcher further found that the supply chain professionals are fully aware of the economic and political situation which create operational disruptions, echoed by participants during the focus group sessions. *“Another one is how do we as*

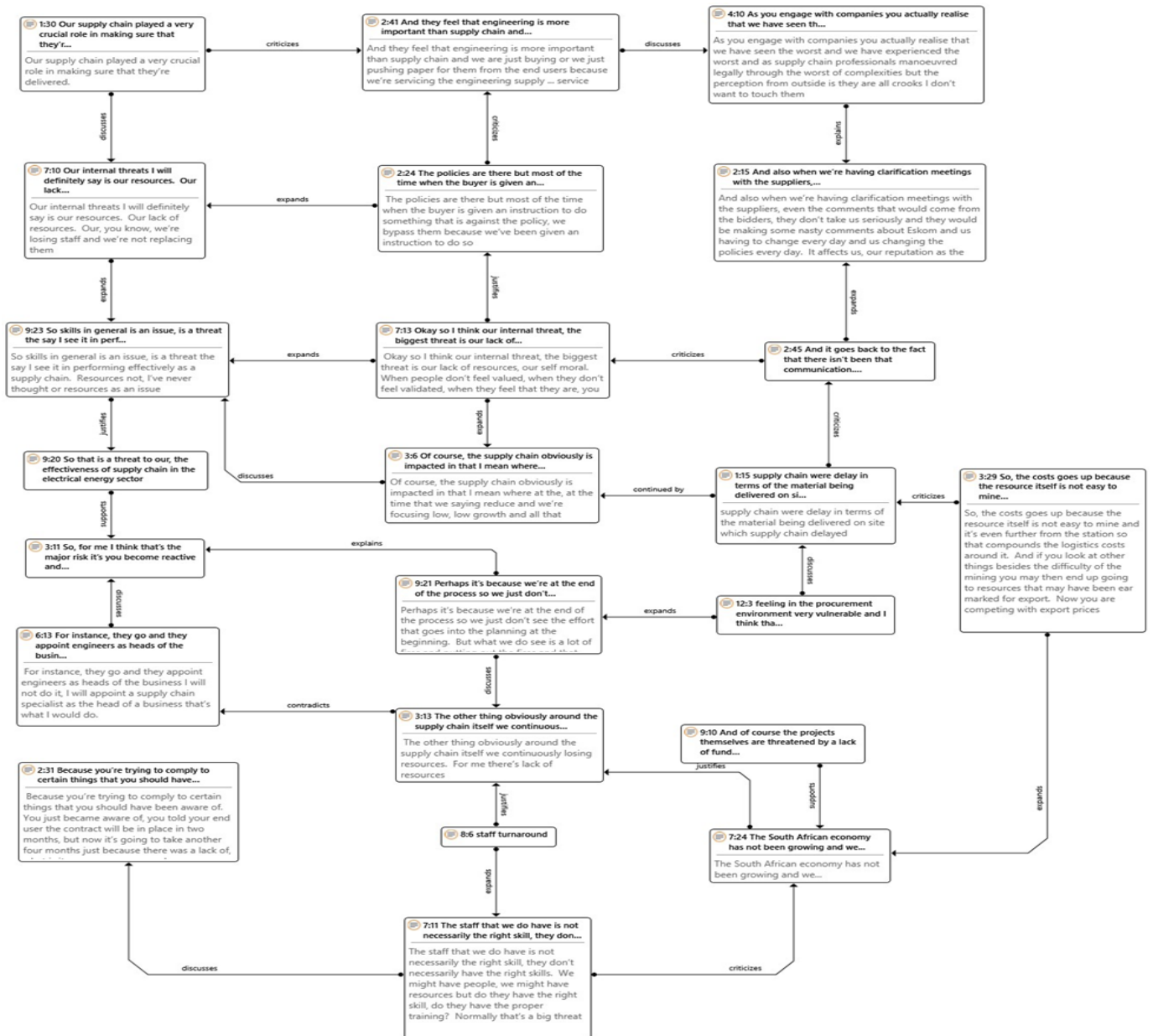
an energy sector grow if the county is growing at 0.7% to 0.9% a year economically, if the economy is growing at those low levels? I mean we, there's no way that we can grow as an energy sector because there are such slow growth levels, (Senior Manager: Supply Chain with over 25 years experience), who added this statement: "I mean who is going to take up the capacity? I mean technically we're in recession now the last two months we've been in a recession. So that in itself says there cannot be a greater uptake of any energy. So the energy sector can, even if we want to produce more, who's going to take it up? And that's an issue for me."(Middle Manager: Sourcing more than 20 years experience).

The interviews revealed that SCRM is not scholastically plainly understood in the South African supply chain community; it is a developing term in the electrical energy sector, particularly inside the case organisation. According to Sodhi, Son and Tang (2012:1), SCRM is seen as a procedure to oversee both routine and exceptional risks along the supply chain, given consistent risk assessment with the objective of reducing vulnerability and guaranteeing congruity. Further, this study found that its pattern raises the prospect that the company does not adequately control and deal with the risks posed by the industry, which can be contributed to the lack of risk ownership by the supply chain department. The electrical energy resources are fundamental to control advanced procedures in the supply chain, while their utilisation is additionally a significant contributor to carbon emissions. The integrative awareness of SCRM affords conditions for improvement in the usage and availability of electrical energy, which can encourage the research towards the replacement of non-renewable energy sources with the development of a system of supply and transformation of the sustainable power source.

This exploratory case study aimed to examine how the participants identify risks in the supply chain environment. Available research does not analyse risks in the supply chain in electrical energy in South Africa, so this SCRM study on South Africa can close the knowledge gap in the supply chain management literature. Fan and Stevenson (2018:2), acknowledge past reviews but also note that these have only partially tended to conceptualise issues and have not methodically examined the utilisation of the hypothesis. According to Ho, Zheng, Yildiz and Talluri (2015:5031), the last decade only produced 15 "traditional" (non-systematic) literature reviews with an emphasis on SCRM, while increasing the value to scholarly studies (Tang & Nurmaya Musa, 2011:25). These accounted for under 140 articles with a particular focus on quantitative

models or a specific industry (Heckmann, Comes & Nickel, 2015:119). Amid the meetings, it has turned out to be evident that as much as there is constrained literature around SCRM, the interviewees could express the different views to the best of their understanding. Some of these views were either contradictions, criticisms, justifications or simply agreements. Figure 6.3 illustrates how the participants conversate on the identification of supply chain risk. These has been captured on Atlas ti and was coded as shown in Figure 6.3.

Figure 6.3 Participant identify supply chain risks



Source: Atlas ti (Jonathan 2018)

The participants further illustrate with their different statements that supply chain risks are infrequently disengaged episodes; there are habitually inter-relationships with the risks and the impacts thereof, which affect the entire supply chain. The comprehension of the thump-on effects and inter-relationships assist practitioners with risk prioritisation, who evaluate the criticality of supply risks, make risk management strategies, and execute useful risk management activities

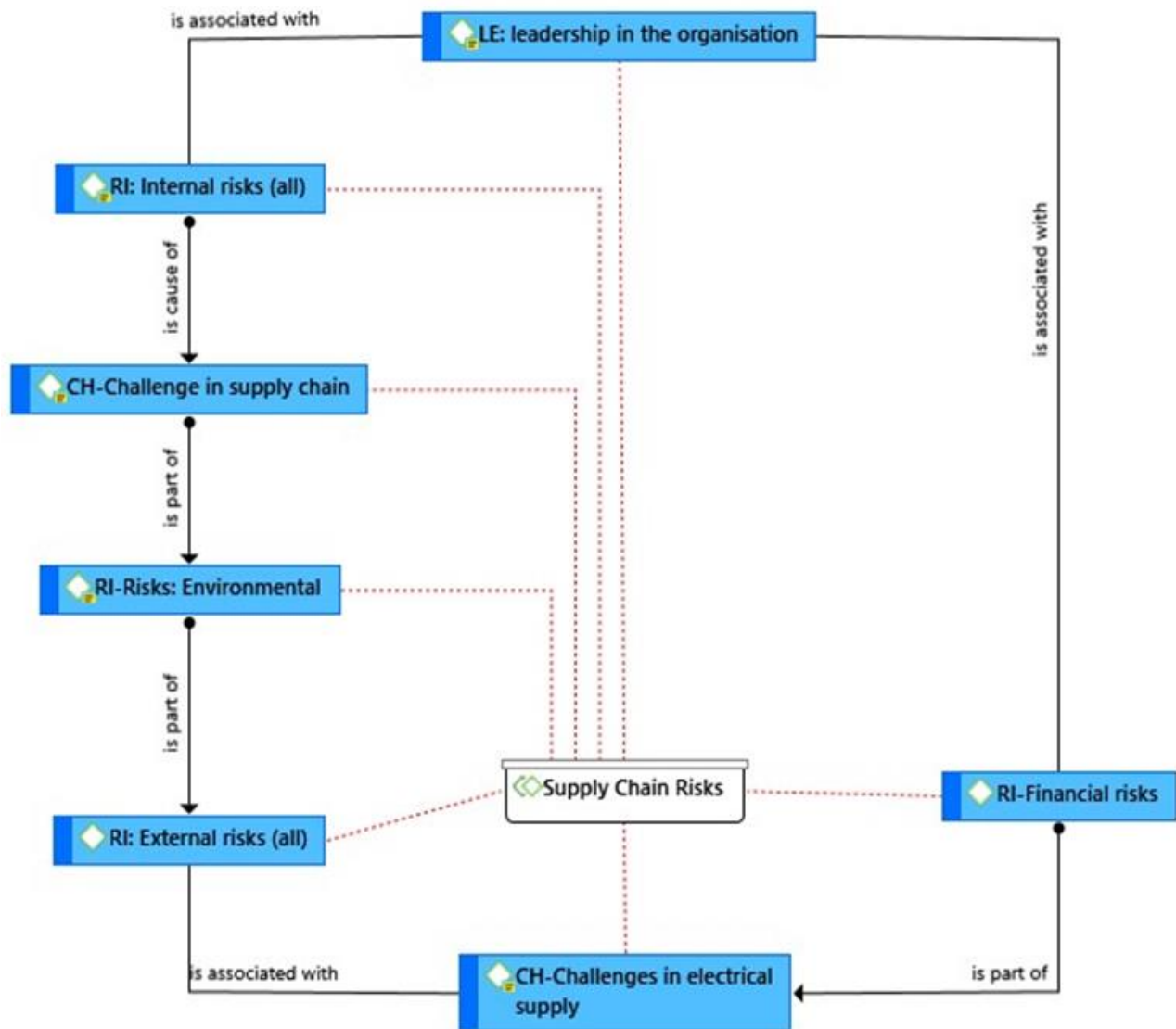
(Guertler & Spinler, 2015:224). The participants commented on the over-reliance on engineers in the supply chain department, primarily because the electrical energy sector leans more towards innovation and almost disregards supply chain risks. The SCRM manages different business exposures to severe interruptions emerging from risks, internal and external to the supply chain.

A standout amongst the most critical concerns raised as opposed to only a remark was the accessibility of the workforce or the deficiency in in the supply chain department. To overcome this gap, SCRM must intend to build capacity and capability to minimise the vulnerability and guarantee business coherence (Wieland & Wallenburg, 2012:887). The case firm does not have any significant competition in the electrical energy sector in South Africa hence it is fundamental to take the lead in the supply chain profession. By doing so the risk management in the sector would improve and the recruitment of a correct workforce can be accomplished.

It is imperative, from a financial perception, that SCRM encompasses cash-flow management to guarantee profitability and reduce expenditures. The participants raised concerns about financial constraints in the electrical energy sector in South Africa and the implications thereof in the supply chain.

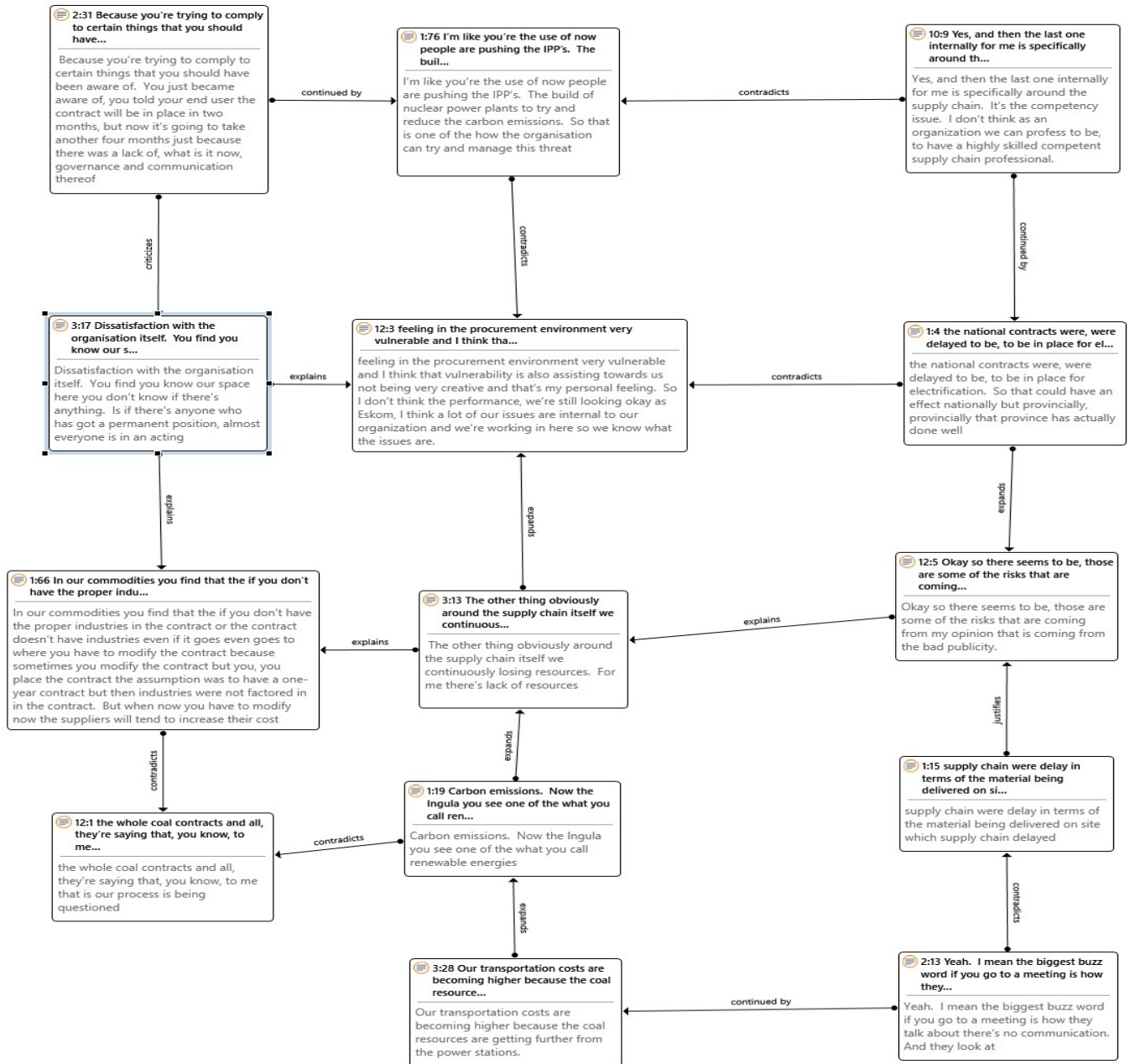
This section aims to determine and distinguish the substantial risks and future vulnerabilities to manage them proactively in the supply chain division. The risks, as identified during the interviews, will contribute to the SCRM literature. The following risks were coded, and sub-coded making use of ATLAS.ti 8, and are further discussed to illustrate the inimitability of the supply chain risks in the electrical energy sector. Figures 6.3 and 6.4 illustrates the data as coded and captured.

Figure 6.4 Identified risks



Source: Atlas ti (Jonathan: 2018)

Figure 6.5 Conversations as captured on Atlas ti



Source: Atlas ti (Jonathan 2018)

6.3.3 Empirical objective 2: To establish the effects of supply chain risks in the electrical energy sector in South Africa

The second empirical objective of the study sought to determine the effects of supply chain risks in the electrical energy sector. The data analysis process generated five themes, which are the effects of exposure to supply chain risks in the electrical energy sector in SA. These themes, their descriptions and operational definitions are presented in Table 6.3.

TABLE 6.3 Themes and operational definitions for empirical objective 2

Themes	DESCRIPTION	OPERATIONAL DEFINITION
1	Financial effects	Supply chain disruptions has great financial impacts on all in the value chain of the effected firms.
2	Processes deviations	Disruptions anywhere in the supply chain are capricious and uncommon yet regularly very harming to all in the value chain.
3	Supply Contracts	Relationships among suppliers and purchasers are established utilising supply contracts that determine evaluating and volume rebates, delivery lead times, quality, returns, et cetera.
4	Staff turnover	This part of the risk is looking at the staff turnover at the case firm
5	Service delivery	Consistently providing service to the customers, grow a supply chain

Source: **Jonathan (2018)**

6.3.3.1 Financial effects

The risk effects of supply interruptions are fundamental in light of the fact that changes in risk can evocatively affect the firm and its numerous stakeholders, as in the case with the researched firm. It might make the company's equity less appealing for potential acquisitions as prospective targets may be less eager to do transactions that hinge on variable equity costs (Bensch & Schrödl, 2011:100). Skitmore (2014:97) examines how disruptions affect the profitability and hence the cash flows of the firm. More of the participants of the focus group sessions expressed concern on the financial effects on the case firm and further mentioned the consequences in parts of Europe: *"Consequences, financially or otherwise. You know there's no sanction. There is nobody in the world coming to South Africa and saying well, because you're not conforming to certain*

requirements, there will be some form of sanction. So until that happens I think everybody's just going to plod along. And you know the French are in the same boat that we are, the Germans are in the same boat that we are but nobody is saying we are now going to impose any sort of sanctions on any of you guys who are transgressing" (Middle Manager: Sourcing 12 years experience). The apparent risk has a significant and negative effect on supply chain professionals' perceptions of the longevity of the company, which defends and influences both current and future investors. *"No I don't think enough is being done. I mean these are not new things to us. If there was an awareness or willingness, political awareness to do something constructive about it, it would've happened. So I don't think enough is being done. And it's as endemic in our economy as a whole, you know that, I think it's almost become part of the course and that's the sad part for me."* It would be valuable for the electrical energy industry to focus on such risk-reducing behaviour strategically; It would help guide the development and implementation of appropriate and cost-effective marketing strategies.

6.3.3.2 Process risk

Whenever an organisation fundamentally changes the manner in which it gets things done, there is "process risk," i.e., the risk that the business will endure crucial financially related calamities or damage to its notoriety for being a consequence of the change (Magretta, 2011:10). Selecting the appropriate strategies based on the industry and the customers the company services can assist to conquer these effects in the electrical energy sector. Inability to adequately oversee process risk explains why most major change activities eventually fall flat. Supply chain should take the lead in process changes where business are involved, which was resonated during one of the focus group sessions *"If the seven by seven within Eskom is followed properly and if the policies and everything ... you know we are the leaders in this whole game of procurement as in we are leading engineering. We are the leaders of the procurement process. We are the first people that form the team. We are the people that set up the kick-off meeting. We set up the project charter. We do the internal analysis. We advise the business on which supply should go to which industry should focus on. Our role is so big however Eskom's structure is built around the people."* (Senior Manager: Sourcing 20 years experience).

The risk in the supply chain is frequently deciphered as inconsistent and unstipulated resources creating interruption, while vulnerability can be clarified as coordinating risk between supply and demand in supply chain processes; vagueness tends to affect the supply chain execution. What's more, demand risk is possibly the most unembellished risk since it emerges from an unpredictable demand or erroneous forecasts. The change in processes can also result in a company losing its core focus, the case firm's core focus is on electricity supply. *"So diversify is a better word than unbundling, to say maybe they should have key focus areas, key businesses looking at key parts look at case firm's business, they've got, besides the electricity supply you mentioned the telecoms side of it. But then you've got the construction side, the project management side, the transmission side, distribution. So there are so many elements. You could call it unbundling but I wouldn't say you unbundle it but you give, you almost create PTY's within the case firm and I think many years ago it started to do that but it confused itself and then it became too scared and they dissolved the companies"* (Senior Manager Sourcing 20 years). Most working individuals want to complete a pronounced job. Few process activities take into account the emotional process by which individuals adjust to change. The opposition is dependably part of any change procedure and, in this manner, must not be naturally regarded as something turned out badly.

6.3.3.3 Supply contracts

In conventional supply chain strategies, each party in the sequence emphasizes on its profit and consequently settles on choices with little respect for their effect on other supply chain partners. The question, obviously, is whether supply contracts additionally can be utilised to supplant the customary supply chain strategy with one that optimises the entire supply chain execution (So & Sun, 2010:474). It is a fundamental guideline of contracting that "risk should lie where risk is best managed". The party best ready to deal with risk, therefore, conveys that risk under the contract except if there are convincing purposes behind another party to carry the risk. *"How does our leadership affect the supply chain? I think, look the company is still known as a good payer. We're still known to honour our debts, do what we need to do. So when it comes to suppliers out there, I don't think dealing with our firm, entering into contracts are really, I don't think the leadership really affects them because they know that we've always historically been a good payer. We've never given any indication that we're not going to pay. I think perhaps the leadership, at the moment we're operating without a CEO on an acting chairman, I don't think that really affects*

outside people so much” (Middle Manager: Supply chain risk 10 years experience). Executives of organisations, whether public or private, ought to have a legitimate valuation for any risks to their business that could affect the manner in which that they interface with their key partners - fundamentally, clients, specific risks emerge because of supply and procurement undertakings.

Purchase responsibilities are non-cancelable contracts with suppliers for products or services, generally more than one to three-year period (Platts & Song, 2010:320). The vast majority of these contracts utilise fixed-price provisions. This can have a big affect on the way a company will do business as in the case firm’s situation. *“If X supplier doesn’t want to do business with us any more, there’s at least five or ten other people who can do the same thing. So yes we’ve created a monopoly with certain suppliers and we should try to break that monopoly. But just because we’ve created that monopoly doesn’t mean that they have a monopoly, we’ve created that monopoly. I don’t know if that makes sense?”*(Senior Manager: Sourcing 23 year experience). Firms, however, may have other inspirations to use procurement obligations. Supply contracts can help circumvent hold-up challenges between suppliers and customers. Thus, reporting the expansive utilisation of purchase orders does not adequately demonstrate that they have a fundamental risk management role.

6.3.3.4 Staff turnover

Employer stability ended up being a standout amongst the essential variables for recruiting and retaining supply chain employees, while financial motivating forces have pretty much zero or nothing to do with supply chain employee’s turnover. *“In my space as part of the supply value chain I find that I have quite a high attrition rate attributable to age. I mean we have people, I have a medium age of about 57 in my area in supply chain operations. And that in itself is a risk because it’s primarily with the physical people doing the physical work on the ground”*, this is the sentiments during an interview (Middle Manager: SCOPs 10 year’s experience).

Most of supply chain management is about critical intellectual and common sense, more established labourers convey more great points of view to the table. *“Our internal threats I will definitely say is our resources. Our lack of resources. Our, you know, we’re losing staff and we’re not replacing them. The staff that we do have is not necessarily the right skill, they don’t*

necessarily have the right skills. We might have people, we might have resources but do they have the right skill, do they have the proper training? Normally that's a big threat. I made a note on my other threat. The other big one is not the lack of corporate governance but the lack of adherence of good governance, it's a big threat for us. You're not making a note, do you not think that's important?" (Senior Manager: Sourcing 20 years experience). They are accustomed to settling on sharp choices, making exchange offs, and seeing how to adjust expenses and advantages. Companies will do well if they can make use of the available human capital which is available to the organisation to have in our more established labourers.

6.3.3.5 Service Delivery

Procurement managers in the public sector work in an unforgiving situation in which to take risks. Managers confront changing the scope from a range of informed public to safeguard that risks to them are limited or disregarded; while many are concurrently subject to condemnation, through private practice models, that they are excessively risk-averse. Working for a state owned enterprise expose procurement to the reality of service delivery. *"As the supplier of electricity as well as the supplier of affordable electricity. Especially during winter, you find that within certain areas there is that constant failure of getting electricity. And that thing is happening quite often. Certain areas they are experiencing it almost daily. On certain areas it's on a weekly basis. Then I think is a challenge that needs secured and robust supply chain strategies from the organisation to address the shortage especially when it is in our domain"* (Middle Manager: Sourcing 10 years experience). Simultaneously, management from public enterprises is looked for in drives to guarantee quality in public services. Risk and quality appear emphatically inter-linked, albeit managerial discourse of their interrelationship seems generally uncommon, at least in the public service domain.

The apparent connection amongst risk and quality was formed during the interviews and focus group sessions. The connection was further and all the more acknowledged from provisional strides by the author to endeavour to supplement the comprehension of the idea of risk as comprehended in authoritative terms, using the "illustrative" method for apprehending respondents' perspectives of their company's behaviour. *"Supply chain that brand preference constitutes less than ten percent of your decision making. But unfortunately, with us it almost like*

ninety percent is brand and you have your user that would not budge. And you have a, a supply chain that is not confident or bold enough to say I put my head against the block. To say this is a new entrant and these are the benefits they're bringing. These are the warranties they're providing and these are the valued added services they're providing. We will get this at a fraction of the normal service provider" (Middle Manager: Sourcing 20 years experience). Benchmarking - a word frequently over utilised and misjudged. Benchmarking gives similar information on the present level of execution of a specific service or function. Performance is observing, and practical benchmarking are viable tools to permit a more profound comprehension of the service or product under review and have the ability to compare its execution (and procedures) against past outcomes.

There seems to be widespread recognition that supply chain interruptions can cause substantial adverse commercial impacts. Recent events in the electrical energy sector in South Africa have demonstrated that an interruption influencing an element anywhere in the supply chain can have a direct effect on the case firms' provision of critical services to the market and the customers they are serving. Frequently, organisations who are under the impression that they are managing the risks in the company disregard the essential exposure along with their supply chains (Wieland & Wallenburg, 2012:887). Corporate insolvencies were on the rise, amid the financial crisis in 2008 and 2009, which contributed to a remarkably extensive number of prominent bankruptcies. There are particular framework impacts, which can influence the supply chain adversely.

Supply chain interruptions in the electrical energy sector are not new, deceptively; they have existed as long as supply chains have, so why the recent explosion of attention? The economic significances of instabilities can be substantial. Literature emphasised that the lack of control over the supply chain networks compromise the management of the supply chain interruptions (Snyder, Atan, Peng, Rong, Schmitt & Sinsoysal, 2016:89). While a given type of interruption in the electrical energy sector (earthquake, fire, strike) may occur irregularly, a vast number of possible disruption causes, combined with the tremendous size of modern supply chains, makes the probability that some disturbance will strike a given supply chain in a given year very high.

During the interviews with the participants, making use of the ATLAS.ti tool, the researcher created codes, which can illuminate the results of the topic.

6.3.4 Empirical objective 3: To determine the strategies of mitigating supply chain risks in the electrical energy sector in South Africa

The first empirical objective of the study sought to identify supply chain risks in the electrical energy sector in South Africa. The data analysis processs yielded five themes which represent the supply chain risks facing the electrical energy sector. These themes, their descriptions and operational definitions are shown in Table 6.4.

TABLE 6.4 Themes and operational definitions for empirical objective 3

Themes	DESCRIPTION	OPERATIONAL DEFINITION
1	Information sharing in value chain partners	Sharing all information with stakeholders in the value chain is essential .
2	Supply chain agility	The readiness of the supply chain during challenging times of the business
3	Reliance in supply chain	Trust issues is one of the critical elements that can add to supply chain risks.
4	Social responsibility	Socially responsible companies consider the full scope of their impact on communities
5	Strategic risk	The supply chain disruptions can and do have substantial monetary and calculated effects

Source: **Jonathan (2018)**

Risk mitigation seeks to diminish the risk to an acceptable level efficiently; it applies both to the reduction of the probability of a risk occasion and to the significance (Fan & Stevenson, 2018:1). Mitigation strategies are suitable, but not limited, for operational risks with moderate to high probability and low impact. The selection of a risk mitigation strategy also depends on the risk-type and the organisational budget over the risk period (most instances linked to a financial year) (Chen *et al.*, 2016:853). Due to the expanding level of supply risk, it is vital to acquire a better

comprehension of the idea of risk, which is fundamental to evolving informed risk mitigation strategies.

6.3.4.1 Information sharing within value chain partners

Expanding the permeability of demand data across supply chain decreases the risks, information sharing as a criterion for trust and existing models for supply chain management (Wang, Hong & Chen, 2012:3323). That way it will concur that the sharing of business data is a critical component, which ties supply chains together from end-to-end the advantages of sharing factual information on both demands and inventory levels among suppliers and clients. Communicate to suppliers why certain actions are performed can improve performance *“One of the other success that I can remember well is that when it came too the empowerment are giving the business to the black owned suppliers as per our compact with the government, in that area I strongly believe that we did well as the organisation because we managed to meet and exceed what our target that was set for us”* (Senior Manager: Sourcing – 20 years experience). The idea of communicating with all in the value chain was further echoed, *“I think for Eskom we need to have sessions with the smaller suppliers that we want to bring across and tell them and rather have yes, we rather have sessions with them and show them how to meet the specifications. We have to meet them halfway”* (Sourcing Specialist: 10 years experience). It can be concluded that data sharing can meaningfully limit the consequences of the bullwhip effect. It can be proposed that information is an important sanctioning influence for constricted synchronisation in a supply chain.

6.3.4.2 Supply chain agility

Agility is characterised as the capacity to flourish in a constantly changing, erratic business condition (Zare, Moghaddam & Sheikh-El-Eslami, 2011:1826). It is a business-wide competence that embraces organisational structures, data frameworks, supply processes and specifically, mindsets. *“There’s designation set by DTI when it comes to transformers. So, designation doesn’t support the export, the export market. More than seventy percent of the equipment has to be manufactured locally. So hence I’m saying that incubating and making sure that the current suppliers that we have as smaller as they are they have to be brought in together with the bigger suppliers to share the cake. I think for the firm it’s important that we communicate if I was a*

supplier myself without looking at the volatility of the market I would, I would of course we want to, want a bigger share” (Senior Manager: Sourcing 23 years experience).

Organisations can limit inventory risks by working with an exceedingly responsive (Platts & Song, 2010:320). Supply chain agility is a crucial to inventory decrease, adjusting to market disparities more proficiently, permitting enterprises to respond to consumer demand more rapidly, and coordinating with suppliers more efficiently. *“You know, first of all with nuclear first being punted and then being taken out for instance. You know, Eskom moving away from or moving out of the load shedding scenario, Eskom’s maintenance programs, new programs actually playing a role. Also with demand obviously, demand not having grown as it was foreseen, that also contributed to this. The other thing that comes to mind is the introduction of independent power producers, IPPs, and also what comes with that is the big debate, you know, about should Eskom be forced to buy from these guys at higher prices, then we can support it” (Senior Manager: Sourcing 25 years experience).* The current business condition can be portrayed by consistent change, shorter product lifecycles, and expanded demand vulnerability (Platts & Song, 2010:320). As these conditions have turned into the standard, companies and researchers alike have swung to the concept of agility in their pursuit for an economical source of competitive advantage. Subsequently, supply chain agility has developed as the overriding competitive vehicle for companies functioning in such an indeterminate and ever-changing business atmosphere.

6.3.4.3 Reliance in supply chain

Trust can be developed through successful communication, can generate resources that lead to a competitive advantage for the company. Trust is a desire that partners in the value chain will not act unscrupulously regardless of whether there are short-term motivators to do as such and can contribute essentially to the long-term dependability of an organisation and its supply chain (Jiang, 2016:870). All partners must be communicate the actual issues rather than distorting the communication. *“Yes I think obviously the messages that gets sent out from such an office needs to be 100% clear, consistent, don’t backtrack on them, you know, make sure you are communicating on the right thing. Rather keep quiet on something you’re not certain yet, tell the people where you still need to analyse something. Tell the people when you don’t have the answer, for instance say, customers we don’t know yet about the debate between nuclear, coal and IPPs,*

we need to do more work, we will have this work done by that date. Then people know they're going to look at this" (Senior Manager: Sourcing 20 years experience).

Trust is established through reliable and probable acts of the partner over an expanded period and has a significant role to fulfil in the sound operational of lean, approachable, and agile supply chains. *"You know the thing is I think you need to win the trust of everybody out there. You need to win the trust. You need to deal with all the negative publicity, you need to deal with that. You need to get to the point that a company 'A' that loses a tender doesn't run to lawyers to say challenge it. You know? I accept that there is a system that's fair and transparent and equitable and competitive in cost, they've got their principles, no point in having it when you don't trust the system. You need people to trust it. You need the country to trust it"* (Sourcing Specialist: 10 years experience). If a business wishes inaugurate its commitment, at that point it should first discover ways, for the other association to see them as reliable of exhibiting their assurance to the relationship (Zare, Moghaddam & Sheikh-El-Eslami, 2011:1826).. Keeping up the trust of another company or organisation requires the utilisation of a self-denying mandate about a few activities, which, in the short term, would have been helpful, regularly in regards to categorised reactions being non-opportunistic.

6.3.4.4 Social responsibility

Alongside the benefits of borderless companies, firms should likewise be set up to deal with the parallel risks mirror the outcomes of the collaborators' policies and activities on ethical and environmental issues. *"And then I spoke about the local communities which understandably are not happy with, you know, BHP Bulletin and Anglo America and those guys, they all have a program of local community involvement and they have this responsible citizen concept about being a responsible citizen in the communities in which they operate. So they see themselves as a citizen of the community and they want to be contributors to the community* (Middle Manager: Sourcing 20 year expereince). *Eskom doesn't seem to embrace that concept, maybe I don't understand, maybe I haven't seen it and it does exist, but we just build a power station, run it for thirty years, forty years, fifty years and then we stop it. It's like this decision that came out in the media about closing down three power stations, I mean that to Eskom is just a business decision. To the communities where those power stations exist, it is a major issue and we're so insensitive*

to the communities and we're feeling the pain of that now because the communities are rebelling. They're becoming unhappy. That's a threat to the supply chain funny enough" (Senior Manager: Sourcing 25 years experience). Socially responsible organisations deliberate the full extent of their effect on communities and the environment when making pronouncements. Adjusting the necessities of stakeholders with their need to make a profit confirmed that corporate social responsibility plans to uncover data that guarantees the general population that their rights are protected and allows them the opportunity to protest if and when they feel it is necessary.

6.3.4.5 Strategic risk mitigation

At the strategic level, supply chain risk management is moderately new and promptly extending discipline that is converting the manner in which business and non-manufacturing procedures address the issues of their clients. It is further suggested that more suppliers should be on board with strategic equipment as further eluded during the focus group session by the Senior Manager in sourcing with over 20 years of experience ... *"I mention in terms of the transformers, the barriers to entry are a threat there because when it comes to the distribution transformers which are the, are the Class Zeros. The pole tops and the, and the mini subs you, you only find only four suppliers that can meet Eskom's specification. And also, that have factory accreditation so that we don't have a lot of suppliers especially black suppliers in that space. Same as the bigger transformers. Class Ones, the main players there is only two suppliers, Actom and Powertech. The bigger transformers its ABB it's mainly international. The ABB's and, and the Siemens. So, I'll say that's a huge threat considering the amount of money that you spending ..."* The streamlining of the entire supply chain is proficient through effective planning choices and hence supply chain policy is progressively perceived as a strategic means commensurate to the company's other functioning strategies.

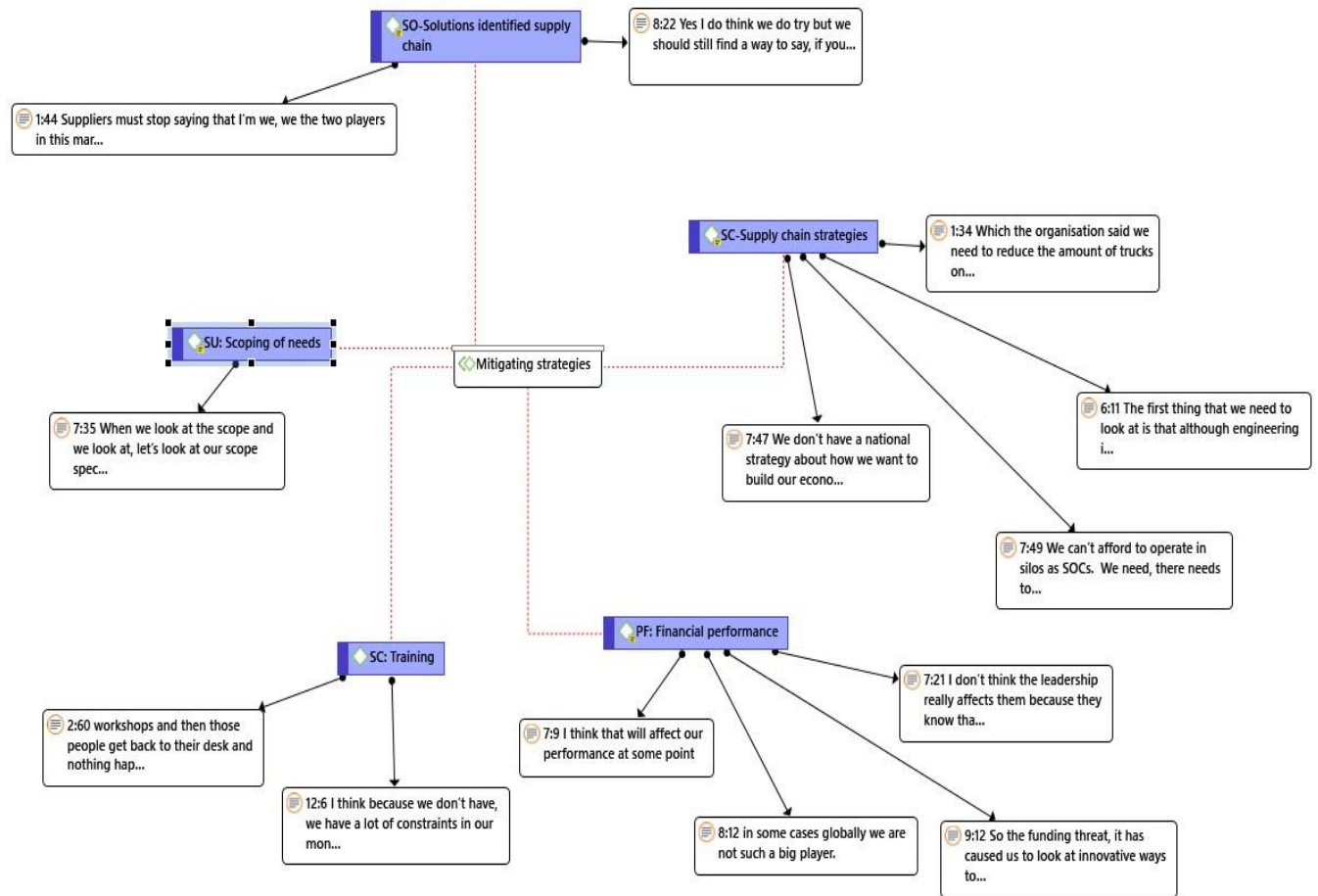
At the point when manager construct a supply chain risk management strategy they should develop a common company comprehension of what supply chain risks are as well as the adoption of universal risk mitigation methodologies fitting to the circumstances of their firm. *"On consultants. The firm is relying more, on consultants and spending lots and lots of money in asking those consultants to review the strategies whereas reviewing a strategy, can be done by the supply chain department,* (Sourcing specialist 20 year experience)...this was also echoed during one of the

interviews with a senior manager with 25 years experience *“For me if you want to manage the risk in supply chain you need a cross functional team that’s the first thing that understand the specific components so I want to see a leader I’m not saying a manager I want to see a risk management leader that’s supplied with a cross functional team that understands the various components in the supply chain that can identify all these risks where this leader must build the link between these things and then in return which is the most prudent want to start looking at because one supply chain person is not going to do it because remember if I work on a supply chain I start with the project engineering department which have got their own risks but it’s part of the supply chain then I go into the strategy phase where it’s the legal portion for procurement, make sure legal understand their risks thereafter you go into the finance things where they understand the risk in finance so I feel it would be nonsensical to take one person and say one person you must manage the risk in supply chain and it would also not make sense to me to establish a team here in supply chain and say you manage supply chain risk.*

Supply chain risk management undertakes significance in the wake of business understanding that their risk vulnerability is reliant on different elements of their supply chain, a methodology to active supply chain risk mitigation by following the progression between numerous enablers that assist to alleviate risk in a supply chain.

According to Zhao, Hwang and Phng (2014:27), risk-mitigating strategies are "strategic moves companies intentionally attempt, to alleviate the vulnerabilities distinguished from the different risk sources." The observation amid the interviews and group sessions brought to light the supply chain risk categories in the case firm: namely, operational disturbance, tactical disruptions and strategic uncertainty. Among them, the strategic element of risk mitigation specifies the collective of a progression of operational and tactical decisions, which lead to premeditated or developing patterns. **Error! Reference source not found.**⁵ illustrates the codes, which will form part of the discussion.

Figure 6.6 Risk mitigation semantics as captured in ATLAS.ti



Source: Atlas ti 8 (Jonathan 2018)

The participants highlighted the fact that training is not occurring on a regular basis due to constraints in the case firm.

“I think because we do not have, we have many constraints in our money, in our situation, I think that is mainly affecting, yes it is affecting training.”

On its own, this is an indication that the necessary training is not occurring, which can derail the supply chain strategy. One of the mitigation factors is the successful implementation of training programmes related to modern supply chain strategies. There are a diversity of training systems available; for example, intermediary and advanced training, making use of the alert levels, conveying of load shedding data to employees, training videos, online courses as well as education

from higher learning institutions. The supply chain used by the case firm is unique. As it is the only provider in the electrical energy sector, training on the available programmes is essential for the practitioners.

The debate in the focus groups centred on the remainder of the codes, on the issues of SCRM practice; namely, financial performance, scoping needs, supply chain strategy and solutions in the supply chain. The focus groups further discussed contingency and continuity plans as part of the mitigation of risk in the electrical energy sector.

“We do not have a national strategy about how we want to build our economy.”

It is critical to ensure that the customisation of business endurance or exigent course of action to an individual company's needs involves calamity recuperation planning for the essential areas (Cagliano, Grimaldi & Rafele, 2015:232). The monitoring of the risk must not be based on judgemental assessments but also on formal processes. With a specific end goal to lessen vulnerability, an organisation may have methodologies to decrease the data dispensation needs and additionally the strategies to augment the information handling ability.

Supply chain risk sources emerge from the network between organisations, when there is always the probability that it will influence a few companies through undulating impacts (Taponen, 2017:269). A supply chain is a network of firms with an interlink through upstream and downstream in different progressions and activities that yield an incentive to consumers. The size of the network has significant variations, which can influence the performance unpredictably and at the same time increase the level of risk in the electrical energy sector. In the case of this research, the supply chain needs to understand the engineering of the sector, as discussed by the focus groups.

“The first thing that we need to look at is that although engineering is quite important because your engineering output is delivering the service, however how you deliver is depending on the supply chain.”

The case company's supply chain is a multifaceted environment and is inclined to various sorts of risks. Attributes of the electrical energy sector are complicated and can include the following: (1)

conveying costs, (2) unreasonable request skews, (3) extensive alterations, and (4) capacity constraints (Aqlan & Lam, 2015:5640). In a challenging environment, as in the case firm, risks must be managed productively because the electrical energy sector characteristics upsurge the possibility of manifestation of the risks and their effect.

The variety in a supply chain incorporates every one of those factors influencing the flow of goods across the supply chain and the match between supply and demand (Rajesh & Ravi, 2015:343). These variations are raised mainly from three known sides: upstream (suppliers' performance), downstream (customers' demand), and internally from the production procedures of the case firm. Reliably, there are three known types of supply chain operational risk, namely: supply risk, demand risk, and process risk (Chen *et al.*, 2016:853).

The Theory of Swift, Even Flow as discussed by Barratt, Choi and Li (2011:329), states further that the swifter and more even the flow of materials through a procedure, the more efficient is that procedure, radically reducing time wastage in the supply chain. Consequently, the efficiency of any procedure falls with increments in the inconsistency associated with the stream, be that variability related to quality, quantities, or timing (Carter & Easton, 2011:46). When analysing the theory, there is apparently an undermining of the supply chain performance by the variance in supply chain risks (supply risk, demand risk or process risk), and based on the discussion with participants during the interviews:

“That is the focus shift needed by supply chain is the important part engineering must support supply chain; supply chain must not support engineering there is a need to swap the two now it is not the easiest of things to do.”

Supply risk is the potential deviation in the inbound supply regarding time, quality and quantity that may result in incomplete requests. This can happen, when the end user (engineering) conveys the requirement to the supply chain later in the value chain. In some instances, the communication will not meet the demand, which can result in the irregularity in the suppliers' execution, which will influence their performance negatively and thus escalate the supply risk. Numerous elements can affect suppliers' performance; for example, production capacity imperatives, lack of quality control, tailback in the production, the machine breaks down or in the case company, redundancy

of parts. All these can interfere with supply regarding lead-time, quantity and quality. During the interviews, the focus group further mentioned the change of transportation method with success.

“Which the organisation said we need to reduce the number of trucks on the roads by using trains which have resulted in fewer fatalities on the road. I mean the last two, two financial years I think they have made the target of excess of ten million tons per annum.”

Conflicting supply lead-time makes it capricious and subsequently increases the forecast error, notwithstanding the system used. Issues additionally occur at the point when suppliers cannot fulfil volume or blend prerequisites in the request. Since the case company depends on its suppliers to sustain capable production progressions, the incompetence of suppliers to deliver the required material, components or products will have prejudicial effects on the supply chain's capacity to serve its customers. Demand risk is known to have potential deviations of the forecasted demand from the actual demand received from the business. Substantial deviations are reflected in order changes make it more troublesome for suppliers to forecast demand and pervades high demand risk; these order changes could be accumulation, expediting or volume changes.

A fundamental purpose of a supply chain is to coordinate supply with demand (Lockamy III, 2014:755). However, the unforeseen changes in the demand diminish the accurateness of the forecast and make it more demanding to accomplish this objective. The discrepancy between the actual orders and forecast will destroy the proficiency and practicality of the supply chain. If the forecast is higher than the actual demand, it may have adverse consequences in excess inventory, ineffective capacity utilisation or price reductions (Sodhi *et al.*, 2012:1), which results in ineffectiveness of the supply chain for the case firm.

If the forecast is less than the actual demand, it may result in deficiencies in the supply of requests to both internal and external customers in the value chain, which results in the ineptness of the supply chain. Hence, demand risk is seen as a vital threat to the supply chain to serve its customer.

This supply-chain risk mitigation strategy focuses on the proficiency to process the evidence needed, and subsequently react sufficiently to risk occasions. Interviewees distinguished that the essential corporate strategy to enhance information processing ability is leveraging supply chain information, which encompasses accumulation, management and utilisation of the information.

The participants demonstrated that the capacity to react to risk events and update the network promptly should form part of the correct and continuing data accessible to all staff. Specifically, they advised against information meandering by entities engaged with the extended global supply chain networks and additionally deferred central leadership because of inadequate and impending data. Therefore, prominent companies in international supply chains have heavily invested in an integrated supply chain information system that can consolidate end-to-end supply chain information from supply chain partners as well as customers.

Different literature associated this strategy with the concept of visibility enrichment, which numerous studies have advocated (Kam, Chen & Wilding, 2011:428). The essential advantage from expanded visibility is that it can demonstrate where the risk is occurring and how disturbances replicate through the supply chain networks. Visibility was accentuated by researchers because increased visibility of demand information can limit the bullwhip effect from information distortion across the supply chain members. The information provided by the line departments are not the final requirements. During the focus group sessions, the participants discussed the fact that line departments in some instances take control of the supply chain, to their frustration:

It shows that the supply chain professionals are taking ownership of the processes which they are responsible for performing. Expanded visibility makes it conceivable to screen the supply chains progressively and to make a suitable choice on the moderation in both prescient and deceptive conduct (Blackhurst, Dunn & Craighead, 2011:374). Fundamentally, visibility is one instrument or ability for risk management; instead, how to leverage supply chain information acquired from visibility appeared to be vital to manage global supply chain risks.

The motivation behind the case firm's endeavours to collect continuous information and process it through an incorporated framework and knowledge management will enhance the corporate capacity for precise risk assessment and appropriate decision-making.

“As far as I know, supply chain information and knowledge are everywhere. All we need is the capability to combine the information and make the right decision to tackle the risks at the early stage. Some staff have this capability from their experience, and others from gathering as much relevant information as possible by contacting various sources.”

Although this proficiency regularly originates from collective knowledge and experience in handling many risks, firms can also cultivate this capability through training.

6.4 CONCLUSION

This chapter concludes that the focus groups and in-depth interviews in this study revealed that large firms, like the case company, are actively engaged in risk analysis and mitigation. In the case study interviews of this research, however, the case firms were found to initiate a part of or all risk management suggested, although their degree of investment can fluctuate. Practically, the case study firm was concerned about an overload of decision-making and information processing that a single supply chain interruption can bring about.

Managers taking part in the interviews and focus group members concurred that identifying risk was imperative using the SCRM approach. Consequently, in contemplation of the "worst-case scenario", they expected to accomplish something proactively and plan a fast reaction. In this sense, the idea of "add up to cost" mostly fused into the determination of techniques because the dedicated supply chain team must deal with all the risk manifestations, which substantially escalates the capacity and corporate resources.

The interactions between all members in a supply chain network were constructing a better understanding. The reviewing of the findings presents the risks that occur in the electrical energy sector in South Africa and the taxonomies. This chapter further provides a set of risk management strategies and practices based on data preparing hypotheses, a rigorous literature review and case study interviews. These hypotheses should also be tested by statistical investigations of analysis data. for a qualitative study

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

This chapter compresses the findings of the research and contribution, summarises its limitations and features the future study opportunities in the subject area. The fundamental objective of this thesis was to investigate the supply-chain risk mitigation strategies in the energy sector in South Africa. To accomplish this purpose, this study (1) identified and analysed various risks in the supply chain of the case firm, and subsequently (2) examined the strategies for managing these risks (3) in relation with organisational orientations and strengths.

The chapter begins with the study's conclusions, followed by its limitations and concludes with the exploration of future research opportunities. This last chapter follows the findings and discussions in Chapter six; the goal is additionally to discuss the five accomplished study tenants. Firstly, it seeks to present conclusions for all the characteristics that were studied, based on the objectives of this research. Secondly, the persuasion of recommending strategies that may be accepted and executed to ensure that supply chain performance is improved, in line with the findings emanating from this study. Thirdly, this chapter further recognises the limitations of the current research. Fourthly, the chapter proposes guidelines for conceivable future studies. Finally, it expresses a general conclusion in which the commitment of the research is outlined, with the emphasis on both hypothesis and practice.

7.2 REVIEW OF THE STUDY

The purpose of the study was to investigate the supply-chain risk mitigation strategies in the energy sector in South Africa. This thesis consists of seven chapters, which discuss various aspects of the research. Chapter one, the introduction of the study, discusses the background, the problem statement, the research objectives, the research design, ethical considerations as well as operational definitions used in the research. The second chapter demonstrates the extensive review of literature related to the international footprint of the electrical energy sector. It further discusses the history and development of the energy sector, as well as the challenges and opportunities currently faced by the electrical energy sector. The third chapter discusses strategic sourcing as an institutional procurement process

that continuously improves and re-evaluates the purchasing activities of a company. The discussion includes the application of strategic sourcing in the various industries, especially in the energy sector. The emphasis is on strategic sourcing as a fragment of the supply chain. Chapter four discusses literature concentrating on the objectives driving supply chain risk management as well as outlines models, tools and techniques, which have been developed to mitigate risks in supply chains. Moreover, this chapter also discusses the common barriers that organisations face when dealing with risks along the supply chain. Furthermore, it outlines how the traditional ways of running supply chains are not fit for purpose in today's volatile markets; while a detailed discussion about strategic sourcing and the application thereof is also included.

In the fifth chapter, an in-depth analysis of all methodological considerations employed in the study is conducted. This chapter serves as a clear guide to all actions taken from the commencement to the completion of the study. As a result, it discusses every detail considered when the research study was designed, from its ontological stance to the data collection and analysis stages. The sixth chapter compares the findings from the different interviews by critically discussing them. It draws out key insights into the relationship between organisational information and risk management in the supply chain. It gives clues about the influence an organisation's knowledge gap has on supply chain risk management, how different supply chain environments influence organisational cultures, which will generate understanding of how organisational cultures may be harnessed to support supply chain risk management. Chapter seven concludes the study and further summarises the thesis's fundamental contributions. More specifically, the chapter highlights general contributions made by the study, which contributes to theory as well as practice. In addition, the chapter also reflects on the research objectives as well as a discussion of the limitations of the research. Furthermore, this chapter also delineates directions for future research in this field.

7.3 CONCLUSIONS BASED ON THEORETICAL OBJECTIVES

This section discusses the conclusions drawn from the following theoretical objectives established for the study:

7.3.1 Conclusions based on literature review of the electrical energy sector

The first theoretical objective focused on conducting a literature review on the history and development of the electrical energy sector, as well as the challenges and opportunities currently faced by the electrical energy sector. This literature review forms part of the discussion in Chapter two. The study acknowledges that fossil fuels damage the environment as well as the usage thereof by the different users. There is an overall necessity to decrease the discharge and generating of fossil fuels. On paper, all nations are in concurrence with the goals and the timelines set by world bodies, for example, the United Nations. The challenge is to enforce and keep alive these rules and regulations.

The review also conceded that the developed countries, for example, England and the US are continually trying to execute more secure and cleaner electrical energy agreements. The analysis further highlights the difference from the utilisation of solar energy to the utilisation of hydro-generated energy. An exciting acknowledgement from the literature is the fact that both countries do not have sufficient solar energy to make up the deficit of coal usage. It will take significantly more research and budgetary muscle for both countries to meet the set thresholds. Owing to the population in China, it has become a challenge to enforce the eradication of coal-powered stations. It further recognises China as one of the biggest purchasers of fossil fuel from various parts of the world. China experiences high peak loads, which have negative results on the local grid. The government involvement has introduced a demand response strategy, which incorporates complete blackouts in some regions. This type of initiative can increase the lifespan of the infrastructure; this is a proactive action against risk.

The review also acknowledges that with all the difficulties confronted in Africa, the continent is rich in renewable energy sources. A substantial amount of literature further acknowledges that historically, coal was utilised to generate electrical energy in the more significant parts of Africa, with South Africa as the pioneer in both usage and export. There is adequate research which serves as confirmation that renewable energy is accessible in Africa. One of the most substantial challenges on the continent is that most of its occupants are poor. Renewable energy is expensive during the infant stages and needs the different African governments to support the electrical energy sector.

7.3.2 Conclusions based on a literature review of strategic sourcing in the electrical energy sector

The second theoretical objective concentrated on reviewing the literature on strategic sourcing in the electrical energy sector. The discussion forms part of Chapter three of this study. To be a leader in the market, buying companies such as the case firm must take the lead in finding global strategic partnerships. The review acknowledges the importance of knowing the position or ranking strength of the strategic partners in the industry, specifically in the electrical energy sector. Literature emphasises that strategic alliances should not hinder the growth of emerging companies, and should also not be used to strengthen the monopolistic position of the one party. This part of the review, with limited research material, explores opportunities for minority or small suppliers as part of the value chain. For the advancement of a strategic partnership with small suppliers, the postponement of strategic reviews could happen at the next purchase.

The review also focused on five pillars of strategic sourcing; it is essential to mention that the supply-chain department can decide based on importance, what to include and what to exclude. These decisions can be industry-driven, pending on the ownership of the company. The application of evaluation criteria further depends on the ownership of the enterprise, if the evaluation criteria are known to the suppliers at the tendering stage.

Sufficient literature supports the review that the tendering process forms part of the strategy development stage. Once adequately implemented this becomes statutory and can be part of an audit process, should the need arise. The review also found that in practice the tendering documentation and all the information gathered during the information gathering stages must form part of the strategy document. The initiative will assist the approval authority in deciding on a result.

The review found that the information obtained from the markets, either using analysis or bidding, can also be used to prepare for future negotiations. The case company will know the players in the market and will be able to negotiate better terms and conditions and in some instances, price. Researchers of the topic of strategic sourcing agree that an active winnable negotiation strategy goes with proper preparation, and adding to this, all members of the negotiation team must take

part in the preparations. The tenderer can obtain information either from earlier tendering events or, in the case of the researched company, from the public domain.

In concluding this review, the study also looked at the development of emerging suppliers by the buying company. The enterprises that do not win the bid are not always weak in all aspects of the evaluation. Developing and preparing those suppliers who did not win the bid to create a bigger pool of future competitive tenders also forms part of the strategic sourcing initiatives.

7.3.3 Conclusions based on a literature review of supply chain risk management in the electrical energy sector in South Africa

The third theoretical objective concentrated on reviewing the literature on strategic sourcing in the electrical energy sector. The discussion forms part of Chapter four of this study. This review dealt with the topic of the research. The information covering this topic was found to be limited. Numerous researchers find that while the capacity to oversee risk is essential to guaranteeing a smooth stream of items through the supply chain, this field of study has similarly acquired considerable supply chain research information. However, this chapter shows that the management of supply chain risk has collected a large body of information from supply chain professionals and practitioners due to the damaging effects that supply chain anomalies or interruptions can have on supply chain performance.

The literature acknowledges that risk identification is a subjective segment of supply chain risk. Each company is accountable for its risks and must diagnose them as per the organisation's perceptions. Notwithstanding those risks documented by firms, there are mutually occurring risks to organisations within its industry and similar other industries.

A further observation during the review is that as global rivalry is increasing and supply chains are becoming more comprehensive and more multifarious, the probability of not carrying out a coveted supply chain (SC) accomplishment increases, predominantly because of the risks of SC frustrations. It is along these lines that fundamental organisational strategies are devised to deal with interruptions and produce alternative plans as they outline or upgrade their supply chains.

Firms need to understand supply chain interdependencies, distinguish potential risks factors, their probability, results and severities. Risk management activity arrangements can be produced, ideally, to circumvent the documented risks, or if this is unrealistic, at least mitigate, hold and control them.

Lastly, in this review, supply chain interferences can bring about an assortment of issues; for example, long lead-times, stock-outs, ineffectiveness in meeting customer demand, and cost escalations. Eventually, these difficulties adversely affect the commercial presentation of the company. The case company is familiar with the management of risks in all other business units but are more reactive in the supply chain environment.

7.3.4 Conclusions based on a literature review of strategic sourcing risk mitigation factors in the electrical energy sector in South Africa

The fourth conclusion based on the literature focus groups and in-depth interviews in this study revealed that large firms, like the case company, are actively engaged in risk analysis and mitigation. In the case study interviews of this research, however, the case firms were initiating a part of or all risk management suggested although their degree of investment could fluctuate. Practically, the case study firm was concerned about an overload of decision-making and information processing that a single supply chain interruption can bring about. Managers taking part in the interviews and focus group members concurred that identifying risk was imperative by making use of the SCRM approach. Consequently, in contemplation of the "worst-case scenario", they expected to accomplish something proactively and plan a fast reaction. In this sense, the idea of "add up to cost" mostly fused into the determination of techniques because the dedicated supply chain team must deal with all the risk manifestations, which substantially escalates the capacity and corporate resources. The interactions between all members in a supply chain network were constructing a better understanding. The review of the findings presents the risks that occur in the electrical energy sector in South Africa and the taxonomies.

7.4 CONCLUSIONS BASED ON EMPIRICAL OBJECTIVES

In this section, the discussions based on conclusions drawn from the empirical objectives are presented.

7.4.1 Conclusions on the identification of supply chain risks in the electrical energy sector

The first empirical objective focused on the identification of supply chain risks in the electrical energy sector. The interviews with the focus groups uncovered that SCRM is not scholastically plainly understood in the South African supply chain community, but rather it is a developing term in the electrical energy sector, particularly inside the case organisation. SCRM is seen as a procedure to oversee both routine and exceptional risks along the supply chain, given consistent risk assessment with the objective of reducing vulnerability and guaranteeing congruity. Furthermore, the study found that this pattern raises the prospect that the company does not adequately control and deal with the risks posed by the industry, which can be attributed to the lack of risk ownership by the supply chain department. The electrical energy resources are fundamental to control advanced procedures in the supply chain, while their utilisation is additionally a significant contributor to carbon emissions. The integrative awareness of SCRM affords conditions for improvement in the usage and availability of electrical energy, which can encourage research towards the replacement of non-renewable energy sources with the development of a system of supply and transformation of the sustainable power source. This exploratory case study aimed to examine how the participants identify risks in the supply chain environment. Available research does not analyse risks in the supply chain in the electrical energy sector in South Africa, while this SCRM study on South Africa can close the knowledge gap in the supply chain management literature.

This section aimed to determine the substantial risks and future vulnerabilities to manage them proactively in the supply chain division. The risks, as identified during the interviews, can be discussed to contribute to the SCRM literature. The following risks were coded and sub-coded making use of ATLAS.ti 8, and are discussed to illustrate the inimitability of the supply chain risks in the electrical energy sector. The participants concurred that not all risks are the same; some are more continuous than others. SCR impact drivers incorporate both probability and influence. With the possibility of drivers inclining towards competitive pressures with the risk-source implication, they might, in a few cases, increase or decrease the supply chain vulnerability; an illustration is an emphasis on effectiveness and consolidating it with the lean methodologies, which can cause supply chain vulnerability.

7.4.2 Conclusions on establishing the effects of supply chain risks in the electrical energy sector in South Africa

The second empirical objective focused on the establishment of the effects of supply chain risks in the electrical energy sector in South Africa. Recent events in South Africa's the electrical energy sector have demonstrated that an interruption influencing an element anywhere in the supply chain can have a direct effect on the case firm's provision of critical services to the market and the customers they are serving. Frequently, organisations who are under the impression that they are managing the risks in the company disregard the essential exposure along with their supply chains (Wieland & Wallenburg, 2012:887). Corporate insolvencies were on the expansion amid the financial crisis in 2008 and 2009, which contributed to a remarkably extensive number of prominent bankruptcies. There are particular framework impacts which can influence the supply chain adversely, selecting the appropriate strategies, based on the industry and the customers the company services can assist to conquest these effects in the electrical energy sector. Supply chain interruptions in the electrical energy sector are not new; deceptively, they have existed as long as supply chains have, so why the recent explosion of attention? The economic significance of instabilities can be substantial; literature emphasises that the lack of control over the supply chain networks compromise the management of the supply chain interruptions (Snyder, Atan, Peng, Rong, Schmitt & Sinsoysal, 2016:89). The participants highlighted the fact that the supply chain is operating more reactively regarding the updated policies and procedures. These actions can cause postponements to the supply chain department regarding establishing contracts in light of solicitations from the business. The case company has, in instances, found itself competing with exportation quality, particularly as far as coal is concerned.

7.4.3 Conclusions to determine the strategies of mitigating supply chain risks in the electrical energy sector in South Africa

The third empirical objective was aimed at determining the strategies of mitigating supply chain risks in the electrical energy sector in South Africa. Risk mitigation seeks to diminish the risk to an acceptable level of efficiently; it applies both to the reduction of the probability of a risk occasion and to the significance (Fan & Stevenson, 2018:1). Mitigation strategies are suitable, but not limited to, operational risks with moderate to high probability and low impact. The selection

of a risk mitigation strategy also depends on the risk-type and the organisational budget over the risk period (most instances link to a financial year) (Chen, Sohal & Prajogo, 2016: 853). Due to the expanding level of supply risk, it is vital to acquire a better comprehension of the idea of risk, which is essential to evolving informed risk mitigation strategies. According to Zhao, Hwang and Phng (2014:27), risk-mitigating strategies are "strategic moves companies intentionally attempt to alleviate the vulnerabilities distinguished from the different risk sources." The observation amid the interviews and group sessions brought to light the supply chain risk categories in the case firm; namely, operational disturbance, tactical disruption and strategic uncertainty.

One of the mitigation factors will be the successful implementation of training programmes related to modern supply chain strategies. There are a plethora of training systems available; for example, intermediary and advanced training making use of the alert levels, conveying of load shedding data to employees, training videos, online courses as well as education from higher learning institutions. The focus groups further discussed contingency and continuity plans as part of the mitigation of risk in the electrical energy sector. The monitoring of the risk must not be based on judgemental assessments but also on formal processes. With a specific end goal to lessen vulnerability, an organisation may have methodologies to decrease the data dispensation needs and additionally the strategies to augment the information handling ability.

Variety in a supply chain incorporates all of processes influencing the flow of goods across the supply chain and the match between supply and demand (Rajesh & Ravi, 2015:343). These variations are raised mainly from three known sides: upstream (suppliers' performance), downstream (customers' demand), and internally from the production procedures of the case firm. Conflicting supply lead-time makes it capricious and subsequently increases the forecast error, notwithstanding the system used. Issues additionally occur at the point when suppliers cannot fulfil volume or blend prerequisites in the request. Since the case company depends on its suppliers to sustain capable production progressions, the incompetence of suppliers to deliver the required material, components or products will have prejudicial effects on the supply chain's capacity to serve its customers.

Firms monitor individual audit nodes within their supply chains to forecast the most vulnerable node to risks and empower them to utilise the most appropriate measures to maintain a strategic

distance from disturbances together with their accomplices (Blackhurst *et al.*, 2011:374). Furthermore, the continuous supplier monitoring generates the knowledge of external risks that are often concealed due to the insufficiency of control. Efficient supplier monitoring and auditing guarantees the control of suppliers' discrepancies in performance results and risky practices, consequently accomplishing risk management objectives (Aqlan & Lam, 2015:5640).

7.5 RECOMMENDATIONS

The conclusions of the study suggest that several challenges need to be addressed by the case firm about its supply chain risk management. The research is empirical. Qualitative data were collected to research the nature of non-theorised findings. It is, therefore, essential to suggest recommendations that could meet the identified challenges.

7.5.1 Recommendations based on identification of supply chain risks in the electrical energy sector

The impact of supply-chain risk management (SCRM) on the execution leaves room for further exploration. The research offers understandings into the circumstances that forcefulness can be considered an essential requirement to deal with supplier-side risks, while agility is necessary to deal with customer-side risks. The research further aims to provide clarity by empirically testing these hypotheses and scrutinising the findings using case studies. Informed from a reasonably diverse literature base on supply chain preparedness, moreover, with the expectation that the strategy may be necessary for improving the supply chain's customer value and business performance, this research offers strong support for this assumption.

Supply chain risk preparedness has a robust encouraging effect on the supply chain's customer value while mitigating its impact on commercial performance by the supply chain's customer value and, thus, is indirect only. The monitoring of external and internal customer service in the electrical energy sector is essential when combating risks. The case firm's supply chain must also consider a dynamic (robust) approach, which will be able to endure this ever-occurring unpredictability of risks. These findings will further encourage the managers to select the most suitable supply chain strategy established on risk-based setting factors, which will be able to profile a supply chain

proposal that prompts exceptional business performance, as well as enhanced customer value, and subsequently, societal benefits.

The hypothesis associated in Quantative Reseach. No quantative research is really designed for hypothesis testing. As an hypothesis can be formulated based on qualitative reaearch and can be tested later using qualitative research is that SCRM is essential for the reinforcement of both agility and robustness of a supply chain. The statement coincides with the descriptions of both the in-depth interviews and the focus groups as part of this study. Thus, the execution of SCRM, which entails the identification, valuation and monitoring of risks, will allow the case company to cope better with changes both proactively and reactively. Moreover, additional possible facilitators of agility and robustness, such as cooperation, insurance and postponement, for some reason unknown to SCRM are reliable drivers of understanding these two strategies. Importantly, companies who are continually searching for means to enhance the agility and forcefulness of their supply-chains find that the overview of SCRM can be a useful supplement to more conventional means, for example, excess capabilities and safety stocks.

7.5.2 Recommendations based on the effects of supply chain risk in the electrical energy sector

The disruptions experienced in the supply chain are not new to the international business. These disruptions have also started to affect the case company and are not unique to the electrical energy industry. While these occurrences have highlighted the significance of robust supply chains for separable companies and entire industry sectors, they prompt the author to suggest fast solutions intended to change the status quo. Through the patterns of globalisation and outsourcing, the unpredictability of supply chain structures is augmented. As opposed to a precise sequence of value-adding stages, dynamic system shapes become a reality.

This study reveals that supply chain visibility, supply chain flexibility and supplier development strategies positively affect supply chain effectiveness. Moreover, risk culture positively moderates the effects of supply chain visibility and supplier development on supply chain effectiveness. The majority of the participants in the study were all aware of the risk drivers embedded in their supply chain strategies. In some instances, these drivers either caused or intensified the reported supply

chain interruptions. The study further observed that the anticipation of the risks at an early stage still lacks the proactive approach.

The findings during the focus group and in-depth-interviews recommended that supply chain visibility, supply chain effectiveness and knowledge development have a useful and momentous effect on supply chain efficiency. This study exemplified several ramifications for the leadership of the case firm. The firm must embrace strategies to improve the ability to respond promptly and cost-effectively to capricious interruptions. It is vital for the leadership of the case firm to know and comprehend the risks engaged with supply chains as this will further ensure that the line department has a better understanding of the supply chain department.

The moderating effect of risk management culture on the impact of supply chain visibility and supplier development strategies on supply chain effectiveness was critical since the implementation of these strategies prerequisites continuous contribution of top management in risk decisions and participation of employees. It means sharing knowledge of core business processes with collaborators, communicating future strategy needs with partners and enhancing the incorporation of activities across the supply chain. From this perspective, the proper alignment between supply chain strategies' visibility, internal customers and supplier development strategies, and risk management culture can offer advantages to corporations expecting to accomplish a compelling supply chain objective. Therefore, supply chain managers should offer significance to risk management culture. Risk management culture can become a device to guide the legal path for risk decisions in a supply chain operation.

7.5.3 Recommendations based on determining mitigating supply chain risk strategies in the electrical energy sector in South Africa

This study recognises the connection between exposure mitigation strategies and the supply chain efficiency of a company in the electrical energy sector in South Africa and the effect of risk management on the relationships between vulnerability mitigation strategies and the supply chain adequacy. The findings propose that supply chain visibility and supply chain effectiveness have a positive and significant effect on supply chain effectiveness.

The supply chain strategy of the case company needs to consider a more robust approach to withstand the ever-occurring instability risks in South Africa and the global market. Supply chain certainty mirrors the impression of performance quality at each progression in the chain. As such, how much confidence do the different players in a supply chain have in the capacity of those "upstream" and "downstream" of themselves to do what they say they will do?

This research further characterised the leading causes of upstream complexity in the electrical energy sector in general and offered the use of a legitimate diagnostics apparatus, analysing and understanding prospective complexity around the case firm. The research similarly presented a scope of organisational capabilities in the supply chain function that act as an arbitrator of the relationship between upstream unpredictability and supply chain performance. The findings establish an expansion of supply chain integration solutions subsequently manipulating the firm's resources most efficiently and effectively.

Addressing the two essential - visibility and control - components of supply chain management, will reestablish supply chain certainty and break the risk meandering. The total end-to-end prominence will enable supply chains to be transparent, and the accurate data would be accessible to the correct adherent of the supply chain at the right time. Empowering sufficient control levers to be available to all the partners will equally enable prompt actions to be taken when information reveals such needs. Both visibility and control are fundamental for the re-establishing of the supply chain, inevitability, although, at times, one may take precedence over the other.

This study has identified the following as strategies to mitigate the identified risks at the electrical energy firm:

- *Information accurateness, visibility and approachability:* All through the supply chain as in the case company instance, essential operative measurements and status reports, for example, contracts available, open tenders, expiring contracts, abilities and backlogs should be readily available by key members of the supply chain. Such data ought to be accurate and timely, rendering it useful for all parties for development and growth tenacities. The management of critical indicators is essential as is the availability thereof.

The meticulousness of the information must be a source of confidence to the parties utilising the data.

- *Warnings on deviations:* Whenever deviations from the procedure have transpired, at that point the appropriate authorities in the supply chain must be informed. The expectation is to have controls in place to determine the ratio of the deviation and the type of action needed. A process control framework should be adequately sensitive to identify irrational conditions, yet not excessively complicated to make the context markedly anxious, with a considerable measure of pointless changes and redresses.
- *Approachable recuperative actions:* Recognition of wrong action and communication thereof to all members of the supply chain with alternate plans and tools to implement remedial action. An excellent example in the case company is the unavailability of an acceptable standard of coal. Remedial action requires that a panel of suppliers should be appointed based on the results of the tender; this would address the out of stock situation.

7.5.4 Recommendations on how managers or leaders can identify and find supply chain risks in the electrical energy sector in South Africa

The instruments recognised (Six Sigma, ABC analysis, Brainstorming, etc.) in this supply chain industry which can be utilised as part of a wide range of phases of SCRM, in risk identification and investigation, risk appraisal, choice and usage of risk management activities and risk monitoring. It is clear that the participants in this study are fully aware of the different tools available. The application of the risk management tools will elevate the risk burden to the case firm. Consistency is lacking in the way management communicates the risks to the practitioners in the company. The fact that there are not sufficient competitors in the electrical energy sector does not justify the slackness in the provision of data concerning the risks faced by the organisation. Other industries have descriptive methods on how to approach the various risks they are facing in the different intervals. The same should apply to the supply chain in the electrical energy sector. The relationships between the different functions relying on the supply chain must be examined and maintained or improved.

7.5.5 Recommendations on how risk strategies can help minimise or eliminate supply chain risks in the electrical energy sector in South Africa

The researcher found that uncomplicated strategies are appropriate to challenge risk in the electrical energy sector. These strategies were apparent amid the underlying exploratory study with interviews of the managers and the individuals of the focus groups; they also originate from the literature review.

Circumventing risk and decreasing risks as a strategy: The study found that few participants used risk evasion as a risk management strategy. Avoiding risk whenever conceivable and reasonable is a straightforward and proficient way of protecting the project from unnecessary damage and loss of financial assets. The findings of this research are sustained by preceding studies on risk management strategies, which propose that risk avoidance is a standout amongst the most widely recognised conducts that organisations use to mitigate risk (Fan *et al.*, 2017:63). Notwithstanding avoiding risks, whenever it is conceivable and proficient, the study also found that risk reduction was an essential strategy for mitigating risks. While numerous risks can be maintained efficiently, the electrical energy sector also employs strategies, for example, safety efforts, that enable them to decrease risks.

Risk transferring and sharing as a strategy: The study further found that risk transfer and risk sharing was also a common strategy used by electrical energy sector professionals in managing their risk. Risk transfer or sharing is the strategy of commissioning a third party in facilitating the company to take on some of the risks related to a given event in the project. The case firm employed this strategy with the big projects such as capital investment; typical in the study was the insurance taken out by the companies. The contracts used by the different suppliers ensure that either the case firm shares some of the insurance cost or it has no financial bearing on the case firm.

The case company should empower its practitioners to apply this strategy all the time or consider this strategy when contracting with suppliers. It was apparent during the interviews that the empowerment era has passed; all decisions are taken by management, which leaves the specialists to do only paperwork.

7.5.6 Recommendations on transferring of skills in the electrical energy sector in South Africa

The case firm has clauses in the used contract family (NEC, FIDIC, etc.), which also include the transferring of skills. The interviews with the participants fell short of addressing the issue of skills transfer explicitly. However, the topic was addressed by the participants that nobody is shadowing the consultants on projects. Reasons vary why projects are not completed or adequately handed over to the supply chain staff. When this occurs, they are expected to continue with the management of the project, whereby no skills transfer took place.

The lack of skills transfer has proved to be an expensive experience, seeing that the new person must be trained from the beginning. Skills transfer in the electrical sector is of great importance because large projects are not the norm. As much as the building of power stations does not often happen, the supply chain skills can be retained and applied to the case firm.

The current procedure and existing risk in the case firm of this study are transformed by the activity “mitigate supplier risks” into risk-mitigated methods. Constraints such as budgets, influential factors, policies and regulations are all part of the challenges the case firm experiences in the supply chain.

7.5.7 Recommendations on environmental matters

The interview participants expressed some common suppositions on how the case firm could best catalyse environmental improvements among their different suppliers. Possibly the furthestmost central incentive heard frequently from the participants was for the case company to integrate environmental performance into their ordinary supply chain pronouncements accurately. This study further recommends that the case firm looks into the possibility of increasing the incentives to the suppliers who demonstrate environmental leadership. Also, the company should emphasise the prominence of operative communication and collaborative methodologies for encouragement of environmental enhancements through the supply chain. The case firm is already applying a system allocating points for adhering to the environmental laws. The system seems to be outdated and should be updated to be in line with regulatory requirements.

7.5.8 Recommendations regarding transparency

The performance of the supply chain department is not available in a transparent manner. A performance matrix must be available to all in the case firm on a free basis. The supply chain practitioners can handle the sensitivity of the information. There are indicators, which will either encourage or discourage risk ignorance and financial mismanagement respectively in the supply chain department. It is to be noted that the case firm is reliant on taxpayers' money regarding receiving funding from the shareholder. This alone should count for transparency in the allocation of monetary value to projects as well as the approval by the bidding committees.

All the advertised bids must be addressed regarding results and value of the proposed contract. By applying this method the case firm will be perceived to be open and transparent to the public and all participants regarding the outsourcing of projects. The case firm must communicate the outcome to all the participating suppliers.

7.5.9 Recommendations on communications

Having predefined correspondence conventions and channels if there should be an occurrence of interruptions, it empowers firms to appropriate the vital data rapidly and successfully, without perplexity, and to keep any postponements in conveying relief strategies at bay. The development of communication for risks on an acceptable frequency is recommended; adding the risk register as part of the agenda has become best practice. It was apparent during the interviews that different managers in one department but in different sections performed meetings on an impromptu basis. The communication department should handle all the communication in the organisation, which would ensure the same message is transmitted to all affected and non-affected staff members

7.5.10 Recommendations on the political climate

There is almost nothing the board or executive level can do with all these changes. The political climate changes rapidly in the electrical energy sector and the country as a whole. It is out of the control of the daily management of the case firm. This can also not be an excuse for the case firm, as much as this is costly and time-consuming. The case firm should build a culture of tolerance to change and adherence to timelines, budgets and processes. It is recommended that the due

diligence of all transactions be done before contract awarding, which will ensure there are no political connections when outsourcing happens. A further recommendation is that bids should not be cancelled halfway through a process because of flimsy reasons, such as tender validity. The practitioners should stick to the projected timelines.

7.6 LIMITATIONS OF THE STUDY

All research studies have certain limitations, and this study is no exception. One of the real impediments of this research is that it only considered a limited number of types of risks that are applicable to supply chain management. A significant restriction of this study is that its scope was narrow because the research focused only on the electrical energy sector in South Africa. Despite the fact that the research has made every effort to limit the threats to validity, there were certain conditions which may have influenced the internal validity of the study. All participants were liable to superfluous factors, which were out of their control and the researcher could not change or influence these situations. For example, after the interviews scheduled for both the managers and the focus groups, the case company faced a significant restructuring process in the supply chain department. The move was disruptive to the participants, which resulted in the rescheduling of meetings and interviews on different occasions, and factors such as heat or coldness or other external factors might have given them distinct impressions and attitudes that they might not otherwise hold (Gladwin, Figner, Crone & Wiers, 2011:364). The researcher could not control the answers during the focus group sessions as participants made use of the opportunity to express their frustrations with the case company's management due to different scandals, which had emerged during meetings. Despite the fact that it is never an objective of qualitative methods to state goals, truths, a phenomenon, or to generalise the results, the findings reflect only the views of the case firm.

7.7 IMPLICATIONS FOR FURTHER RESEARCH

This study provided some useful understanding of the effect of supply chain risk mitigation in the electrical energy sector. Regardless of the endeavours made by the researcher to ensure that the study is without imperfections, several constraints are highlighted so that they can form part of future studies. Initially, the findings of this research allow for further development by conducting comparative studies along supply chain risks and the different collaborations with the private sector.

The scope could be expanded to incorporate different utilities in different industries operating nationwide with a global footprint. The information gathering for this study focused only on the electrical energy sector in South Africa, concentrating exclusively on the supply chain department within the head office of the case firm, based in the Gauteng province. The results could be more revealing if the research included both the perspectives of internal and external partners of the value chain as a correlation. The current study created an opportunity to conduct similar studies making use of perceptions of different stakeholders.

The current study was conducted using the qualitative methodology. The results of a mixed method approach, which incorporates both qualitative and quantitative methods, could be fascinating. The reliability of the findings in this study would be improved, and generalising would be limited. The applied methodology of this study was a more in-depth and more productive approach, which was the main research aim.

This study has substantiated the supplier chain risk characteristics as a critical component contributing to the improvement of the supply chain performance in the case firm. During this study, it emerged that numerous articles related to the topic discussed many strategies and systems to address the supply chain risk mitigation. The constraining initiatives include the financial appetite and the ownership of risk management by the leadership of the case firm. During the in-depth-interviews and focus group meetings an element of trust was expressed by both the managers and participants. It would be interesting to explore the trust issue and to understand the role it is playing in the supply chain risk and to what extent it influences the financial implications of the case firm. This could increase the involvement of management at all levels in the supply-chain risk mitigation factors.

7.8 FINAL REMARKS

This chapter concludes the study by reviewing the contributions made by the researcher. This research aimed to conduct a comparative study of the supply-chain risks mitigation strategies in the electrical energy sector in South Africa. It then answered the research questions and addressed the implications of the thesis for theory and practice. The study found that the supply chain department in the case firm lacks training to handle complex discussions; this was expressed by

participants during the meetings. Discussion on the limitations of the thesis and the identification of further research opportunities forms part of the chapter. The methodology was prescribed in Chapter five, and data successfully gathered and analysed. The limitation of the case study approach, interviews and focus groups is their validity, generalisability, and reliability. Training and continuous practice on the data collection tool, ATLAS.ti, is recommended, as it can be time-consuming during the analysis stages. The opportunity to improve on these three aspects of research is to make use of the proper context and methodology based on the research aims. The practitioners in the case firm need more knowledge regarding risk management. When companies perform poorly the focus shifts to the supply chain to combat risk and to save money; leadership must embrace these challenges and source from within the firm for experience to overcome constraints.

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APPENDIX A – INTERVIEW SCHEDULE

IN-DEPTH INTERVIEW SCHEDULE

- 1) How would you describe the performance of the South African electrical energy sector over the past few years?
- 2) What are the internal supply chain threats/risks faced by your organisation?
- 3) What are the external supply chain threats/risks faced by your organisation?
- 4) Which factors are actuating/driving the threats faced by the electrical energy sector?
- 5) What are some of the effects of these threats to the operations of the electrical energy sector in South Africa?
- 6) Do you feel that enough is being done to counter the effects of the supply chain threats/risks facing the electrical energy sector? Why do you think so?
- 7) Suppose you are the overall authority in the electrical energy industry in SA. What would you do to improve the situation?

Do you have any other recommendations on approaches that can be used to manage supply chain risks in the electrical energy sector?

APPENDIX B – FOCUS GROUP SCHEDULE

FOCUS GROUP INTERVIEW SCHEDULE

- 1) Would you mention some successes that your firm has enjoyed in the electrical energy supply chain over the past few years?
- 2) What are the main supply chain threats/risks facing the electrical energy industry in South Africa?
- 3) What has been the response of stakeholders to these threats/risks?
- 4) How can your organisation effectively manage supply chain risks it is currently facing?
- 5) What are the green (environmental) issues relevant to your supply chain risks and how does your organisation manage them?

APPENDIX C – LETTER OF CONSENT



Date:
10 March 2016
Enquiries:
Mr Len Turner
Telephone:
+27 11 800-5184

To: The Registrar
Vaal University of Technology

ETHICS CLEARANCE: CONFIRMATION OF ESKOM INTELLECTUAL PROPERTY RIGHTS AND SECURITY CLEARANCE FOR DOCTORAL RESEARCH – MR. ELLSWORTH JONATHAN

This memorandum serves as an ethics clearance; confirmation of Eskom intellectual property rights and security clearance for the continuation of Doctoral level research and write-up by Mr. E. Jonathan. The research topic is "Supply Chain Risk Mitigation Strategies in the Energy Sector in South Africa."

Mr. Jonathan has followed due internal processes in terms of gaining permission for this research.

It must be noted that this general clearance is for a limited period only, which will be for the rest of the financial year 2016 until end 2020 calendar year, and in no way waives Eskom's Intellectual Property Rights.

Yours sincerely



Len Turner
Senior Consultant
Skills Development: CoE





Vaal University of Technology

Your world to a better future

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Department of Logistics
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INFORMATION LETTER AND CONSENT FORM FOR INVITATION TO BE INTERVIEWED

Research Title: Supply Chain Risk Mitigation Strategies in the Electrical Energy Sector in South Africa

Promoter: Dr. C. Mafini – Head of Department: Logistics - Vaal University of Technology

Co-Promoter: Prof. J. Bhadury – Dean: School of Business Administration and Economics, State University New York-Brockport

Co-Promoter: Prof. M Dhurup - Executive Dean: Faculty of Management Sciences - Vaal University of Technology

Dear Chief Procurement Officer, Senior General Manager, General Manager, Senior Manager, Middle Manager, Sourcing Specialist, Senior Buyer and Buyer

My name is Ellsworth Jonathan. I am currently employed at Eskom Holdings Ltd in the Procurement and Supply Chain Department as a Middle Manager: Commercial. This letter is an invitation to consider participating in a study I am conducting as a major activity of my Doctoral degree in the Department of Logistics at the Vaal University of Technology under the Faculty Management Sciences. The purpose of this study is to investigate supply chain risk mitigation strategies in the electrical energy sector in South Africa.

Participation in this study is voluntary. It will involve an informal interview of approximately 30-45 minutes in length to take place in a mutually agreed upon location. You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher. With your permission, the interview will be tape-recorded to facilitate collection of information, and later transcribed for analysis. Shortly after the interview has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or clarify any points that you wish. All information you provide is considered completely confidential. Your name will not appear in any thesis or report resulting

from this study. However, with your permission, anonymous quotations may be used. Data collected during this study will be retained for 12 months in a locked office at the Vaal University of Technology where only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at +27 11 800 6377 or 082 407 7781 or by e-mail at ellsworth.jonathan@eskom.co.za. You can also contact my promoter, +27 16 950 9520 or e-mail chengedzaim@vut.ac.za.

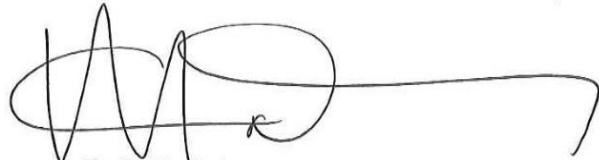
I would like to assure you that this study has been reviewed and received ethical clearance through the Research Ethics Review Board at Vaal University of Technology and Eskom Holdings Ltd. However, the final decision about participation is yours. I hope that the results of my study will be of benefit to Eskom Holdings Ltd, as well as to the broader research community.

I very much look forward to speaking with you and thank you in advance for your assistance in this project.

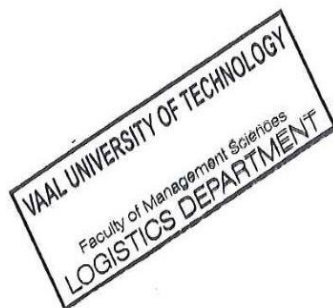
Sincerely,



Ellsworth C. Jonathan
Doctoral Candidate



Dr C. Mafini
Head of Department: Logistics
Vaal University of Technology



CONSENT FORM

I have read the information presented in the information letter about a study being conducted by **Ellsworth Jonathan** of the Department of Logistics at Vaal University of Technology. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be tape recorded to ensure an accurate recording of my responses.

I am also aware that excerpts from the interview may be included in the dissertation and/or publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project had been reviewed by, and received ethics clearance through, the Head of the Research Directorate at Vaal University of Technology and Eskom Holdings Ltd. I was informed that if I have any comments or concerns resulting from my participation in his study, I may contact the Head of the Research Directorate.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

☐ YES ☐ NO

I agree to have my interview tape recorded.

☐ YES ☐ NO

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

☐ YES ☐ NO

Participant's Name (please print) _____

Participant's Signature _____ Date _____

Researcher's Signature _____ Date _____

Researcher's Title _____ Department _____

Research Promoter Signature _____ Date _____

Research Promoter Title and Name _____ Department _____