AN INTEGRATED APPROACH TO RISK MANAGEMENT FOR A BULK COAL EXPORT LOGISTIC CHAIN

by

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DECLARATION

STUDENT NUMBER: 32748477

I declare that **AN INTEGRATED APPROACH TO RISK MANAGEMENT FOR A BULK COAL EXPORT LOGISTIC CHAIN** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

30/11/2016

Mr Andre Botha

Date

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My first and foremost thanks is to my Heavenly Father for the ability and opportunity to be able to undertake such a research project. It is by His grace that we are who we are and through His mercy we achieve what we do. Therefore let all the glory be to Him.

Then my wife, Annatjie, and my family, Armand and Anzel. To be student, husband and father does not come without its challenges. Thank you for bearing with me through the process. My family is the wind beneath my wings, and without them, my flight is not possible. Also I would like to thank Elder Le Roux for his support during the last two years and the constant reminder, “Is it handed in?”

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There are people that I should also recognise, but there are not enough pages to thank everybody. Although not on paper, please do not feel neglected or offended, but thank you from the bottom of my heart.

ABSTRACT

In an ever-changing world where economic growth is inter-alia dependent on the export of bulk minerals, the risk and the severity of risk incidences in the bulk mineral supply chain should be minimised. In South Africa the export of coal is a large contributor to the GDP and any risk to this supply chain will directly affect its contribution to the GDP. Although all the stakeholders in the bulk coal export logistic chain manage the risk in their own domain, the bulk export logistic chain represents a supply chain structure where the risk of one stakeholder influences the risk of another stakeholder. Therefore, to reduce the total risk, an integrated risk management framework for the bulk coal export logistic chain is required.

This study investigated the risks and the risk management processes in the bulk coal export supply chain. This logistic chain was chosen based on the monetary value the chain represents and the contribution to the GDP. A qualitative research design was used with one-on-one interviews and content analysis of risk management policies and procedures to obtain the data. The study revealed that there are risks that could not be managed on an individual stakeholder level and therefore an integrated risk management approach that considers the total bulk coal logistics export chain is required.

Key words: Supply chain; Risk; Risk management; Logistics; Logistics risk management; Qualitative research; Triangulation; Bulk coal; Export, Bulk coal export.

LIST OF ACRONYMS AND ABBREVIATIONS

CEP	Coal Exporting Party
COSO	Committee of Sponsoring Organisations of the Treadway Commission
COT	Coal Oversight Team
ERM	Enterprise Risk Management
FEL	Front End Loader
GDP	Gross domestic product
PUTLS	Precision Unit Train Loading System
PWC	PricewaterhouseCoopers
RBCT	Richards Bay Coal Terminal
SCRM	Supply chain risk management
TFR	Transnet Freight Rail

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CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

The risk of natural disaster has increased over the past decade (Bereriche and Ait-Kadi, 2015:31). There is also a higher risk from man-made disasters, such as terrorism, which occurs more frequently nowadays (Sodhi and Tang, 2012:72). Supply chain integration and complexity further add to increased risks in supply chains (Sodhi and Tang, 2012:65).

Logistics has an influence on the economic development of a country and has a direct effect on the economy by facilitating and making trade possible (Fawcett, Waller and Bowersox, 2011:115-116). Many developing countries, such as Brazil, Peru, Chilli and South Africa, depend on the export of bulk minerals as a foreign earner of revenue to maintain and govern the country's economy (Oyinlola, 2007:5; Roe and Haglund, 2012:3). These countries export to the global market and are subjected to all the variables as encountered by global logistics networks.

A recent series of disasters, such as Hurricane Katrina, the terrorist attacks of 9/11, the SARS epidemic in South East Asia, the case of the fire at Ericsson's supplier in Albuquerque, New Mexico in the USA and many more, depict the vulnerability of the logistic chains (Stecke and Kumar, 2009:200). Companies that operate in the absence of risk management are exposed to the risk of increased losses in the event of disruptions (Christopher, Mena, Khan and Yurt, 2011:68).

This study will focus on the risk management practices in the bulk coal export logistic chain. This logistic chain was chosen due to the economic contribution it makes to the South African economy, and due to the recent increase in the frequency of disruptions it is exposed to. This study reviews the risk and the risk management practices the various stakeholders in this logistic chain apply and the efforts these stakeholders make to mitigate the losses caused by disruptions.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

This section discuss the background to the research problem, specifically focusing on the role of minerals, the economy and the logistic chain, and the bulk coal export logistic chain.

1.2.1 The role of minerals, the economy and the logistic chain

Minerals and mineral mining play an important role in the economy of a country, particularly in less developed countries. Minerals and mining often produce important resources for the development of most products, and in less-developed countries the export minerals form an important part of the foreign revenue earnings for the country (Roe and Haglund, 2012).

South Africa is built on the back of mining, and the mining sector cumulatively contributes 18% to the GDP of South Africa (Smit, 2013). The mining sector's income in South Africa is more than R330 billion per annum and accounts for 20% of all investments in South Africa (Bandaly, Satir, Kahyaoglu and Shanker, 2012:249). Kantor (2013) added that due to the contribution to exports, mining also influences the value of the rand and interest rates. The South African economy is very dependent on the exports of minerals, and metals account for as much as 50% of South Africa's export revenue (Smit, 2013).

Statistics from The South African Chamber of Mines for 2012, showed that coal as a commodity is by far the most important mining commodity, followed by gold and then platinum. In 2012, the total sales revenue for coal was R96.1bn, where R52.2bn of this revenue was derived from the export of coal (Ryan, 2014). Coal mining and coal exports, therefore, have the potential to be a major contributor to the National Development Plan. The export of coal is a future driver of the economic growth of South Africa (National Planning Commission, 2012).

Coal export is not possible without proper logistics infrastructure. Logistics is increasingly relevant to the rapid economic growth of emerging economies (Hirschinger, Spickermann, Hartmann, von der Gracht and Darkow, 2015:74). A direct correlation can be seen between the logistics capability of the country and the volume of trade. Developing countries, with better logistic chains, will fare better in the global market and hence, will develop their economy (Hausman, Lee and Subramanian, 2013:237). Efficient logistics could attract foreign investment that could in turn, create economic growth (Devlin and Yee, 2005:436). There is a correlation between the economic relevance of a country in a region and the logistics capability of that country (Memedovic, Ojala, Rodrique and Naula, 2008:372). This implies that through improved logistics the economy of that country could grow.

1.2.2 The bulk coal export logistic chain

Logistics is the work required to move and position the product throughout the supply chain. Logistics is primarily the conduit of product and service flows within a supply chain (Bowersox, Closs, Cooper and Bowersox, 2013). The purpose of logistics is to move and geographically position inventory (Bowersox *et al.*, 2013:5). The objectives of logistics is thus to have 1) the right material, 2) in the right quantity, 3) at the right time, 4) at the right place, and then within the right cost (Fuchs and Wohinz, 2009:234; Wee, Blos and Yang, 2012:286). This study focuses on the management of the movement or logistics of bulk coal from source to export harbour. For the purposes of this study, bulk is defined as *"A commodity which is shipped in large, unpackaged amounts"* (Investopedia US, 2014). Logistics management, as depicted in Figure 1.1, entails:

> *" that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption to meet the customer's requirements"* (Council of Supply Chain Management Professionals, 2015).

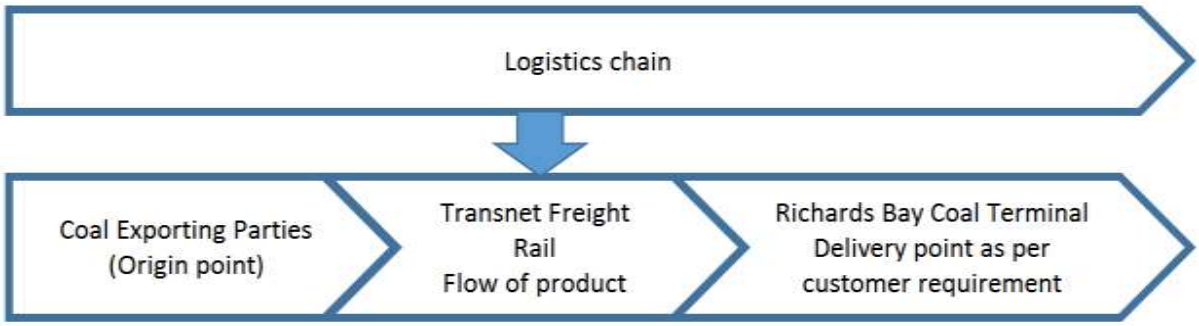

Figure 1.1: The bulk coal export logistic chain

Source: Developed by author (2015)

The nodes in the bulk coal export logistic chain are the coal exporting parties (CEPs), Transnet Freight Rail (TFR) and Richards Bay Coal Terminal (RBCT).

According to Bowersox *et al.* (2013:357), there are four flows that will take place to form a supply chain. These flows are:

- Product/Service value flow
- Information flow

- Cash flow
- Market accommodation flow

This study will focus on the product/service flow and the information flow. Figure 1.2 depicts the information flow and the elements contained in the information flow. It also elaborates on the product/service flow.

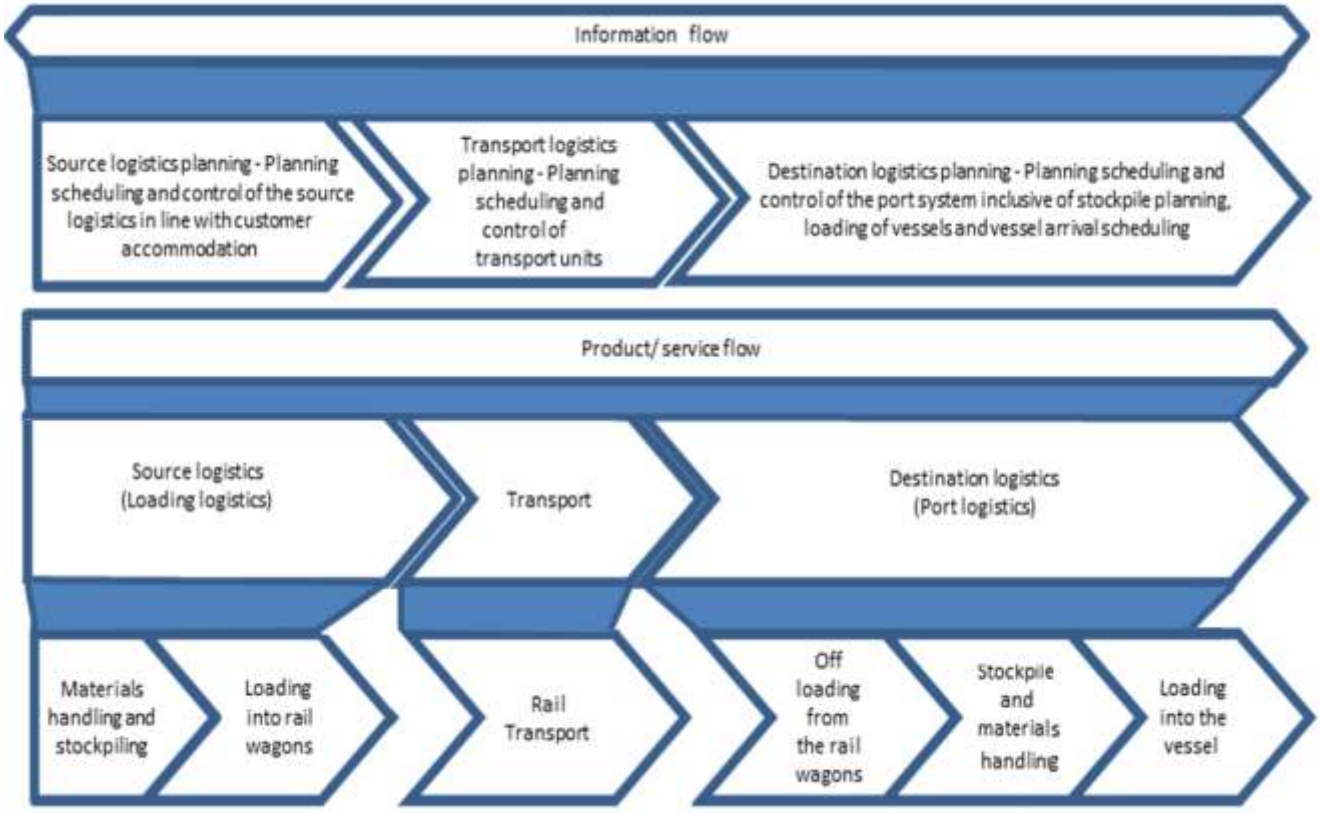

Figure 1.2: The elements in the bulk export coal logistics system

Source: Developed by the author (2015)

1.3 RISK MANAGEMENT AND DISRUPTIONS IN A LOGISTIC CHAIN

All human endeavour and operations related to human endeavour involve risk and uncertainty (Olson and Dash Wu, 2010:694). Although risk cannot be avoided, the effect needs to be understood and managed (Latif, Gohar, Hussain and Kashif, 2013:20). Risk can be defined as the effect of uncertainty on objects. The effect may be positive, negative or a deviation from the expected. Risk is often described by an event, a change in circumstances or a consequence (The Association of Insurance and Risk Managers in Industry and Commerce (AIRMIC); The Institute of Risk Management (IRM), 2010:4). Risk management is the set of activities, within an

organisation, undertaken to deliver the most favourable outcome and reduce the volatility or variability of that outcome (Hopkin, 2012:38).

Husdal (2011) divided risk management into two areas: proactive risk management and reactive risk management. While proactive risk management refers to activities taking place before a risk incident, reactive risk management refers to planned actions to be executed after a risk incident has occurred (it can also be referred to as disruption management). As seen in the list below, the South African media have reported about various risk incidences that influenced the operations of the bulk coal export logistic chain and the economy.

- *Mail and Guardian* - 12 October 2012 - Transnet strike hangs in balance – Labour dispute to be resolved between labour and management (De Wet, 2012).
- *Financial Times* - 13 March 2013 - Strike hits Anglo Coal Mine in South Africa – Mining labour strike in anticipation of wage increase (England, 2013).
- *Fin24* - 21 Jul 2010 - RBCT workers end wage strike – Labour strike (I-Net-Bridge, 2010).
- *Engineering News* - 27 Jan 2011 - Recent rail disruptions could lop a further 2Mt off SA coal exports – Abnormal rainfall in the geographical area caused rail infrastructure disruptions (Creamer, 2011).
- *Mining Weekly* - 27 March 2009 - South African coal exports expected to rise in 2009, but rail will determine by how much – Political policy plays on the declaring of steam coal as a strategic commodity (Faurie, 2009).
- *Mail and Guardian* - 12 May 2010 - Sabotage suspected after Transnet train derailment – Sabotage suspected in the derailment of a train and this manifested as a form of homebound terrorism (Staff Reporter, 2010).
- *Mineweb* - 1 April 2011 - SA's Transnet shuts two coal lines after derailment – Derailment as a result of infrastructure exertion (Flak, 2012).
- *Zululand Observer* - 10 February 2014 - Shipshape for RBCT – Power supply failure that resulted in a nine day disruption was restored (Savides, 2014).

Although not an exhaustive list, the above risk incidences indicate a need to review the bulk export logistic chain in search of an improved risk management solution.

1.3.1 Risk management and mitigating strategies

According to Kouvelis, Dong, Boyabatli and Li (2011:4), risk management is a two-stage action plan that consists of planning and execution. The planning stage should provide for proactive actions to ensure sustainability and profitability in the event of an undesirable event or disruption. This stage of the risk management process consists of the identification of possible risks, determining the probability and severity of the risk, and the mitigating actions needed to reduce the disruption. The execution stage should contain risk-detecting mechanisms to detect risks, signs of risk and then trigger responses and recovery plans (Kouvelis *et al.*, 2011:4).

An effective risk management programme comprises of risk identification, assessment, response planning and ongoing monitoring and control. Managing disruption risks, falls mostly in the response planning category (Tomlin and Wang, 2011:82).

The bulk coal export logistic chain consists of more than 20 stakeholders (there are 19 Coal Exporting Parties (CEPs), Transnet Freight Rail and Richards Bay Coal Terminal (RBCT) that constitute the full chain activities. Based on company statements in the public domain, it is evident that these stakeholders do have a risk management focus.

The bulk coal export chain stakeholders' focus on risk management is summarised in Table 1.1. The table lists the company and the source of the information on the particular company's risk focus. These public statements do not indicate whether the risk management focus is directed towards the bulk coal export logistic chain. To ensure adequate risk mitigating, the relevant companies should have a focused, implemented and operational risk management strategy towards the bulk export logistic chain (Tomlin and Wang, 2011:80).

Table 1.1: Public statements regarding the risk management focus of companies in the bulk coal export logistic chain

Company	Risk management focus	Source of public statement
Transnet Freight Rail	TFR will strive to achieve the highest state of Risk Management, i.e. being a Risk Intelligent Organisation. This will be achieved by: ▪ Establishing common risk methodologies, terminology, and metrics to ensure consistent risk management and reporting across the enterprise. ▪ An inclusive risk scenario process designed to quickly assess risks and produce actionable cross-department risk mitigation plans. ▪ Increasing adoption of a corporate-wide perspective on the part of risk managers while they maintain a thorough understanding of departmental agendas, TFR will better manage its risks by adopting the principles of "Risk Intelligence," in which the goal of extraordinary growth is achieved through proactive risk taking, not managed risk avoidance. The competitive benefits of Risk Intelligence include: ▪ Improved ability to identify, assess, and act on risks by facilitating enterprise-wide collaborative risk management ▪ Use of risk assessments to better inform strategic decision making ▪ Reduced cost of risk management and burden on business operations ▪ Renewed confidence and reassurance for stakeholders through more robust procedures for risk identification, analysis, and management. In short, "the goal of an enterprise-wide risk management initiative is to create, protect, and enhance shareholder value by managing the uncertainties that could positively/negatively influence achieving the organisation's set objectives." ERM also creates value by developing, implementing and monitoring the right management strategies.	http://www.transnetfreightrail-tfr.net/SS/RM/Pages/Overview.aspx

Company	Risk management focus	Source of public statement
Richards Bay Coal Terminal	**Risk Management** **Risk Management and Corporate Governance** The RBCT Board of Directors subscribes to the King Code of Corporate Governance (King 2 and 3). To further their commitment to the code, the Board established an Audit Committee in 2001. A reconstituted Finance Committee (Finco) superseded this committee on 20 June 2003. RBCT expects all employees to share its commitment to high moral, ethical and legal standards. The responsibilities and authorities are extensive, but are basically divided into three main areas: Internal Audit, Risk Management and Corporate Governance. **Internal Audit** The directors recognise their responsibility for internal, financial and operating controls and the monitoring of their effectiveness. RBCT has a co-sourced internal audit function together with PricewaterhouseCoopers (PWC). This function reports on a quarterly basis to the Finance Committee, which is a subcommittee of the Board of Directors and also carries out the duties of the Audit Committee. **Risk Management** In support of the Audit/Finance Committee requirements, the RBCT Risk Management objective is to protect the organisation, its people, assets and resources, against the physical and adverse financial consequences of event risk. It involves planning, coordinating and directing the risk-control and risk-financing activities of the organisation. **Corporate Governance** The RBCT Board of Directors and Finco require that RBCT complies with the provisions of the King Code of Corporate Governance (King II) “in all material respects”.	http://www.rbct.co.za/sustainability-6/risk-management/

Company	Risk management focus	Source of public statement
Exxaro Resources	**Risk management** **Framework** In 2011, Exxaro implemented a revised enterprise risk management framework and process, based on international best practice and the principles of King III, to ensure alignment with all regulatory frameworks, standardised risk management practices across all functions and disciplines in the group, and to achieve integrated enterprise risk management governance by coordinating and integrating all risk management activities. Only an integrated approach will assist each component of the business to understand and mitigate critical risks. In 2012 the new framework was further embedded. This included support through appropriate technological enablement. **Philosophy** Effective risk management remains central to maintaining and enhancing a competitive advantage and adapting to changes in the internal and external business environment. As such, risk management is fundamental to every aspect of strategic and operational activity in Exxaro and risk assessments are done with the understanding that risks, and opportunities, are intimately linked to achieving strategic and operational objectives at all levels. The outcome of the continuous risk management process forms the foundation of the combined assurance framework and programme at all levels in the group.	http://www.exxaro.com/index.php/sustainability/risk-management/

Source: Compiled by the author (2015).

As indicated earlier, the logistic chain forms the ‘movement’ part of the supply chain. Literature presents various mitigating strategies that could be applied in a supply chain environment (including logistics) (Tomlin and Wang, 2011:81). Some of these mitigating strategies can be applied by a stakeholder in the supply chain and this will provide a direct risk-mitigating benefit to the particular stakeholder, and an added benefit to the supply chain as a network of organisations (Tang, 2006:34). Some risk mitigating strategies will only release the benefit if it is applied in an integrated manner in the logistic chain. For example, increased rail capacity reduces risk that will benefit the logistic chain first and then the service supplier (Boland and Savelsbergh, 2012:286). Figure 1.3 illustrates the suggested integrated risk management approach.

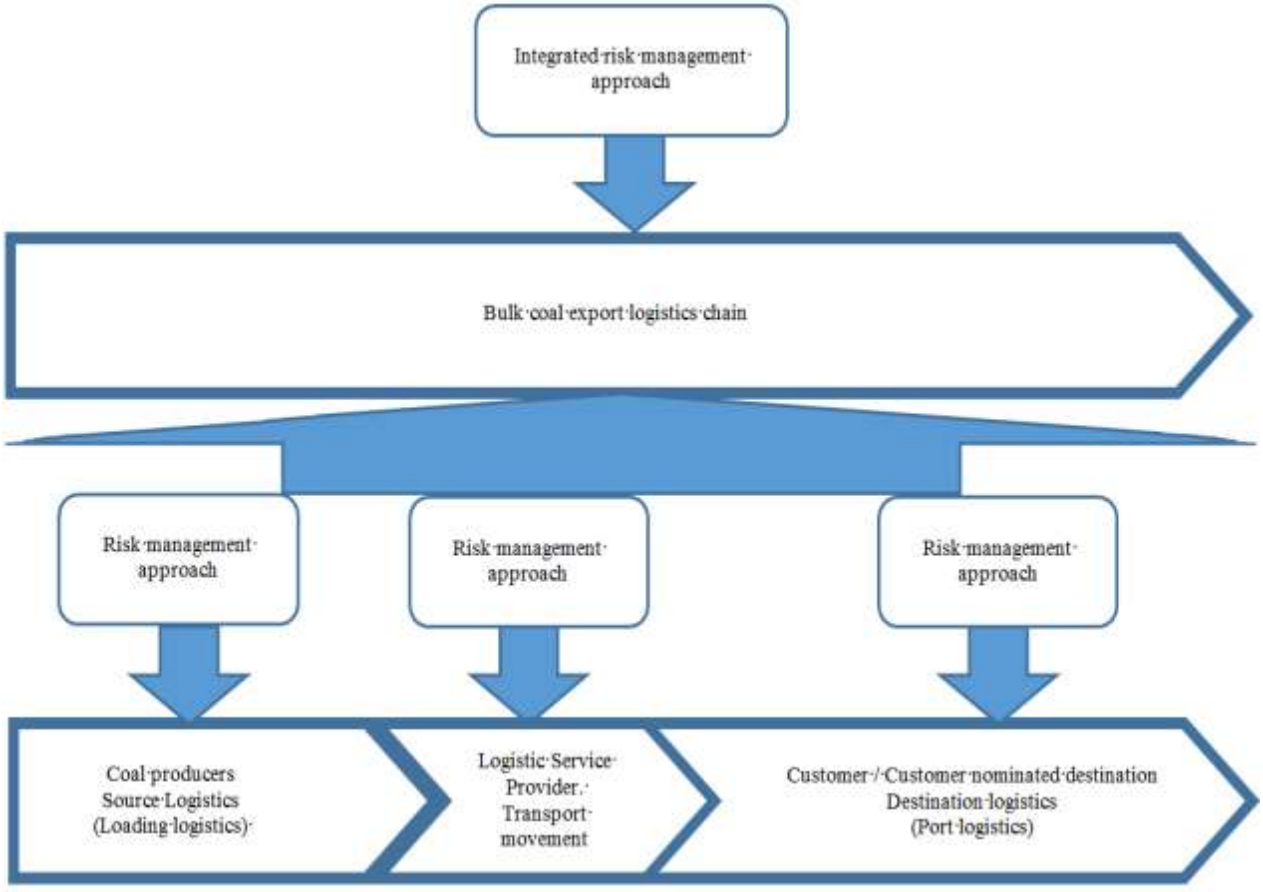

Figure 1.3: Structure of an integrated risk management approach

Source: Developed by author (2015)

Due to the fact that supply chain management has broader scope, although it includes logistics management, the risk-mitigating strategies of the supply chain differs from the logistic chain (Wilson, 2007:295). The supply chain risk-mitigating

strategy includes product supply risk, which is not part of logistics risk management. Table 1.2 presents a list of possible mitigating strategies focusing on the bulk coal export logistic chain.

Table 1.2: Possible risk-mitigating strategies

Possible risk mitigating strategies implemented by stakeholders
▪ Aggressive preventative maintenance programmes. ▪ Reliable component-sourcing strategies. ▪ Optimisation and planning tools and systems with better data integrity and data management
Possible risk mitigating strategies implemented by the logistics network
▪ Collaboration in terms of information flow. ▪ Agreement to set standard operation processes and procedures that govern the execution of operations. ▪ Adding surge capacity to the system to absorb the flow effects of disruptions

Source: Boland and Savelsbergh, 2012:286

In conclusion, from the discussions above it becomes clear that:

1. Stakeholders in the bulk coal export logistic chain have risk management strategies, but it could not be ascertained if these risk management strategies are adequately focused towards risk mitigation in the bulk coal export logistic chain, possibly because the coal export market is not their only market.
2. There is no evidence that an integrated risk management strategy for the total bulk export coal logistic network exists. This proposition is based on the current premise that the operational processes and planning of the bulk coal export chain is fragmented.

Further research in the strategies, policies and procedures of the stakeholders' risk and mitigation management are required to explore the possibility of establishing an integrated risk management approach towards the bulk coal export logistic chain.

1.4 RESEARCH QUESTION

In 2008, Henke (p 179) pointed out that risk management in a supply chain was an emerging field and risk management was incorporated into enterprise risk management. However, the implementation of supply chain management and collaboration between supply chain partners has grown since 2008. Collaboration in supply chains creates more risk (Breuer, Siestrup, Haasis and Wildebrand, 2013:335). As a result of this increasing risk in supply chains, it has become a growing field of research and practice (Bandaly *et al.*, 2012:254).

Risk incidences, in the recent past in South Africa, have cost the country and the stakeholders in the bulk coal export chain a loss in revenue (Brendan, 2014). It therefore makes sense to review the bulk export logistic chain to obtain an integrated risk management approach.

The main research question in the study is:

> *What are the current risk management approaches in the bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain?*

1.4.1 Research objectives

The main aim or objective of this study is to develop a framework for an integrated approach to risk management in a bulk coal export logistic chain.

The secondary objectives are:

- To conduct a literature study on risk management in supply and logistic chains (that will form the basis for the research instrument for the empirical study).
- To identify and explore the risks and risk management practices of the stakeholders in the bulk coal export logistic chain (by means of interviews).
- To explore the current policies and procedures of the different stakeholders (by means of a content analysis).
- To explore the possibility of an integrated risk management approach that can reduce the risk in the bulk coal export logistic chain (content analysis and interviews).

1.5 RESEARCH METHODOLOGY

A qualitative research approach was followed in this study to answer the research question. The research process included a literature review to assist with the understanding of the phenomena and to formulate the interview questions. These interview questions were used in the semi-structured one on one interviews with the participants in this study. The study followed the research process as depicted in Figure 1.4

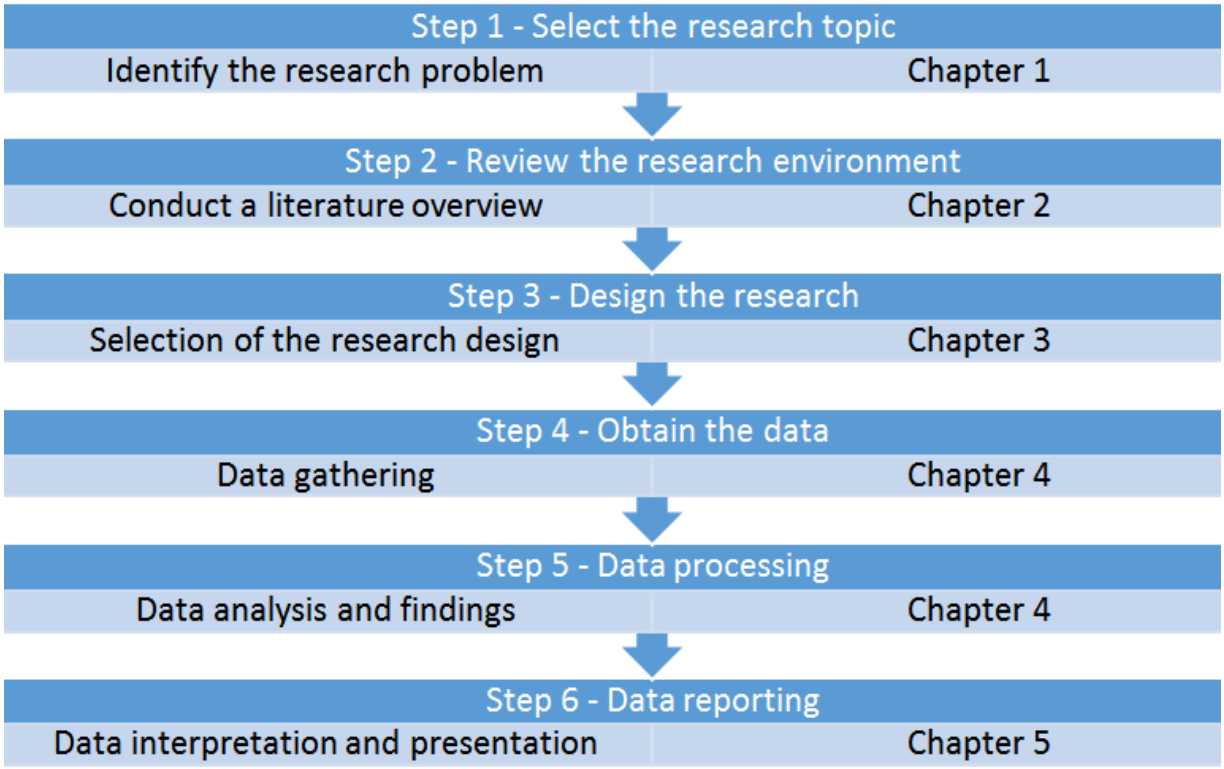

Figure 1.4: The research process

Source: Adapted from (De Vos, Strydom, Fouche, Delport, 2011:70)

1.5.1 Research design and approach

Research by Da Mota Pedrosa, Näslund and Jasmand (2012:276) indicated that the field of logistics and supply chain required more qualitative research. Therefore, and due to the explorative nature of the study, a qualitative exploratory research design was used in this research. Rich information and deep insight could be obtained on how the current stakeholders view the risks in the bulk coal export logistic chain and what current risk management actions are applied in the bulk coal export logistic

chain. The qualitative research approach did provide the researcher with a deeper understanding of the relevant phenomena (Gammelgaard and Flint, 2012).

1.5.2 Sample and collection of data

1.5.2.1 Sample

The sample of participants in this study was taken from members of the Channel Oversite Team (COT). The COT represents different areas in the bulk coal export logistic chain and consists of various members and stakeholders. A sample that represented a multiple perspective was thus included in the study. (Refer to Figure 1.5). Specific participants included in this study were representatives of the Coal Exporting Parties, Transnet Freight Rail, Richards Bay Coal Terminal and a consultant that worked extensively for various stakeholders in this Logistic chain.

Figure 1.5: Research sample

Source: Developed by author (2015)

The participants were selected by means of the purposive sampling method. The advantage of this sampling method lies in the depth of understanding of the phenomena and abundance of phenomena-specific information that can be obtained (Patton, 2015:599). Section 3.6.3.1 will elaborate more on the sampling for the study.

1.5.2.2 Data collection

The research used of two types of data, namely, primary and secondary data. Secondary data was obtained through a literature review regarding risk management in logistics and supply chain management. Primary data was obtained through semi-structured interviews. This method allowed the researcher an in-depth exploration of the phenomena through the use of prompting questions until data saturation was reached (De Vos, Strydom, Fouche and Delport, 2011:345-346). In addition, data was obtained through a document analysis (content analysis) of the risk management and policies (inclusive of the risk registers) applicable to the participants' companies (Trautrims, Grant, Cunliffe and Wong, 2012:838). The data collection will be discussed in more detail in Section 3.6.3.2.

1.5.3 Data analysis

A thematic data analysis method was applied in this study. (Refer to Section 3.8). Primary data, obtained from the interviews, was transcribed into written data (Merriam, 2015:110). This written data was then broken up in to codes, themes and patterns, which was subsequently evaluated.

The thematic analysis process that was followed included the following actions (Boyd, 2013):

- Read through the transcribed data
- Identify the themes and patterns
- Identify codes and categorise the codes
- Capture all the data that reflects the codes
- Combine the findings

The document analysis mentioned in Section 1.5.2.2 was conducted through a two-step thematic analysis. An *inductive content analysis* (with an open mind) was done on the risk management policies and procedures (inclusive of the relevant risk registers) to identify themes and codes. In addition, the thematic codes from the interviews were used in a *deductive content analysis* on the risk management processes and policies. (Refer to Sections 3.8.2.1 and 3.8.2.3 for a detailed

discussion). The codes and themes identified in this content analysis were used for triangulation of the primary data, to ensure trustworthiness.

1.5.4 Findings and recommendations

The findings showed the following:

- The risks, as perceived by the participants, in the bulk coal export logistic chain were: infrastructure, the macro economy, uncontrollable events of nature, disruptions and risk that occur in operations and management, and people skills, labour and social impact.
- The risk-mitigating actions applied by stakeholders in the bulk coal export logistic chain were: capital-spend review, cost containment, water recycling and conservation, incident management, investigation and risk register capture, long-term wage negotiation and community management.
- From the findings, an integrated risk management approach (framework) that could be applied in the chain to reduce the risk incident effect could be proposed.

The above findings are discussed in full in Chapter 4. The recommended integrated risk management approach, based on the findings, will be discussed in Chapter 5.

1.6 MEASURE OF TRUSTWORTHINESS

This study reviewed credibility (Merriam, 2015:234), transferability, dependability and conformability to establish trustworthiness (De Vos *et al.*, 2011:420).

- Credibility is the process that establishes that the findings that were made were verified (Goffin, Raja, Claes, Szwejczewski and Martinez, 2012:806). Multiple data sources were used through the purposive sampling of participants, interviews were audiotaped and after transcribing, the transcribed documents were compared to the audio tape, checked and verified.
- Transferability refers to the ability to transfer the knowledge and results from this study forward to another phenomenon of the same nature through generalisation. In this study the research method, data collection and analysis were discussed in full detail to ensure transferability to such other research phenomena (De Vos *et al.*, 2011:420). The research methods, data collection and data analysis processes were based on literature and are well established.

- In evaluating dependability, all the stages of the research process are under review (Goffin *et al.*, 2012:806). In qualitative studies, a dependable audit should be kept that outlines transparency and traceability. To increase the dependability of this study the researcher will keep a record of all the decision-making events that were undertaken in the field work and the research process. This record-keeping would provide an auditable trail and transparency that will increase the dependability of the research process (Patton, 2015:1472).
- Conformability refers to the fact that the interpretations of the data are not merely figments of the imagination, but that these interpretations are drawn from logic, are non-prejudiced and free of researcher bias (Goffin *et al.*, 2012:806). Through triangulation, record-keeping and recording of data and documents, the conformability of the research was established (Patton, 2015:1472).

Furthermore, the researcher used triangulation to increase the validity of the study (Hastings, 2010:1538). Triangulation is the process of using multiple sources of data and / or multiple sources of approaches to analyse the data to enhance the credibility of the research (Hastings, 2010:1538). In this study, the interview data was triangulated with the risk management policies and procedures (inclusive of the risk register) to increase the validity and trustworthiness.

Interviews were recorded with the permission of the participants and an external, independent transcriber was used to transcribe the data. The trustworthiness of the methods employed is further discussed in Section 3.7 of Chapter 3.

1.7 LIMITATIONS AND ASSUMPTIONS OF THE STUDY

Based on the fact that the research was qualitative in nature and purposive sampling was used, there are limitations to the study and the study cannot be generalised to all bulk coal export logistic chains.

The study was based on the following assumptions:

- Through the application of the qualitative techniques, sufficient information was obtained to answer the research objectives of the study.
- By using the semi-structured interview process with prompting questions, the researcher could answer the research question.

- Through the chosen methodological approach and research design the researcher could obtain a thorough understanding of the risk and risk management approaches in the bulk coal export logistic chain.

1.8 SIGNIFICANCE OF THE STUDY

This study focused on the risk and the risk management processes in the bulk export logistic chain. There is little research into the bulk export environment in South Africa and this research aims to contribute to the body of knowledge in the field of risk management in logistics.

Furthermore, the study aims to provide guidance and direction to the Channel Oversite Team to develop an integrated risk management approach for the bulk coal export logistic chain to actively manage and reduce the severity of risk incidents.

The study furthermore, contributes to encouraging the use of a qualitative research methodology by other researchers in the logistics and supply chain management domain.

1.9 OUTLINE OF THE STUDY

Chapter 1 introduces the background to the research problem, and the concepts of risk and risk management in the logistic chain. The important role of coal as a commodity in the economy and the influence of the logistic chain on the economy are discussed. The bulk coal export logistic chain is defined. The impact of risk incidences on a logistic chain was highlighted and the chapter includes a non-exhaustive list of incidences that occurred in the recent past. The research problem and objectives were stated and the chapter continues with an explanation of the methodology. The limitations of the study were stated and the significance of the study is provided. The chapter concludes with a summary of the outline of the study in Figure 1.6.

Chapter 2 consists of a literature review dealing with the concepts of risk and risk management, and risk in the supply chain. The bulk coal export logistic chain was defined. The chapter will cover the following topics:

- Risk: The risk definitions, components of risk enterprise, risk management and the cost of risk.

- Supply chain risk management: The supply chain risk is defined, the sources and drivers of risk are tabled and the literature risk-mitigating strategies are reviewed.
- Logistics risk management: Definitions, logistics risk sources, drivers and the mitigating strategies found in literature for logistics risk management are provided.
- Bulk coal export logistic chain: The bulk coal export logistic chain is defined and the activities and stakeholders are outlined and discussed.

The purpose of the chapter was to review the literature and strengthen the researcher's knowledge base to extract the appropriate questions for the semi-structured interview. This enabled the researcher in the interview, to prompt the participants until data saturation was found without research bias. The chapter concluded with a summary and the proposed questions for a semi-structured interview.

Chapter 3 covers the methodology of the research. This chapter reviewed the research questions and objectives. The chapter links the research approach and design, and elaborates on the research method. The researcher explains the role of literature, the questions, reduction in questions, and the sampling method that was applied. The trustworthiness of the study is reviewed in terms of credibility, transferability, reliability/dependability and conformity. Triangulation as a validation method is discussed. The full process of data analysis is discussed under the headings of data preparation and reducing data. The chapter end with a summary and conclusion.

Chapter 4 starts with an introduction and then provides the interview and policy content analysis findings in detail. The findings were depicted according to the identified themes from the thematic analysis. The themes are: Infrastructure, Macro economy, Uncontrollable events of nature, Disruptions and risk that occur in operation management and People. The chapter ended with the information obtained from the interviews and a reflection on possible changes that will reduce the risk in the bulk coal export logistic chain.

Chapter 5 started with an introduction, draws conclusions and made recommendations. This was done by reflecting on the research question and objectives and illustrates how the research question was answered and objectives

attained. The chapter continued to elaborate on the proposed risk-mitigating approaches that could be included to form the basis for an integrated bulk coal export logistics risk management framework. The chapter concluded with the limitations of the study and possible areas of future research.

Figure 1.6 displays the layout of the research study.

Figure 1.6: Outline of the research study

Source: Developed by author (2015).

CHAPTER 2: RISK, RISK MANAGEMENT AND THE BULK EXPORT LOGISTIC CHAIN

2.1 INTRODUCTION

Company survival in the modern business environment is no longer an issue of one firm competing against another firm, but has become an issue of one supply chain (including logistic chains) competing against another supply chain (Craighead, Blackhurst, Rungtusanatham and Handfield, 2007:149). With the development of complex supply chains as a result of globalisation, a higher degree of risk has been introduced into the management of supply chains (Fischbacher-Smith and Smith, 2015:180). Risk management in supply chains has remained a critical component of business continuity (Ojha, Gianiodis and Manuj, 2013:180), and thus also supply chain continuity.

Broadly, this chapter will focus on risks and risk management, supply chain risk management, the bulk coal export logistic chain and logistic risk management.

This chapter started with a definition of risk, and then provides the history and evolution of risk and risk management. This chapter also reviewed the management of risk in isolation, to where risk management became an integrated enterprise model. The cost of risk will also be discussed.

The chapter further focused on risk management in the supply chain, identifies the sources of risk, risk drivers and mitigating strategies that are relevant in the supply chain. The bulk coal export logistic chain is defined and components are outlined.

Lastly, the chapter continued with a focus on logistics risk management and the sources of risk, risk drivers and absorbers of risk and logistics risk mitigating strategies.

The chapter concluded with a summary of risk management and proposed questions for the research interviews.

2.2 THE CONCEPT OF RISK

2.2.1 Definition of risk

All human endeavour and operations carry some risk and uncertainty (Olson and Dash Wu, 2010:694). Because risk is unavoidable, the effect of risk requires understanding and insightful management, and therefore, in modern strategic business planning, a risk management plan is essential (Latif, Gohar, Hussain, Kashif, 2013:20). Risk and risk management have become an important topic in the business world. Many authors have written reports and articles about risk, and many discussions in company boardrooms revolve around risk. Therefore, the mitigation of risk has been assigned to top management for the management and execution thereof (Lemmer, 2014:175). Furthermore, risk is being studied in various areas such as finance, corporate and business risk and also in the area of supply chains.

Risk can be defined as the effect of uncertainty on objects, whether positive or negative, or a deviation from the expected. Risk is also often described by an event, a change in circumstances or a consequence (The Association of Insurance and Risk Managers in Industry and Commerce (AIRMIC); The Institute of Risk Management (IRM), 2010:4). In this definition, ‘an object’ can be an organisation or a set of integrated processes, such as a supply chain or logistic chain.

2.2.2 Components of risk

Risk can also be defined in terms of **three dimensions**: uncertainty, probability and effect (or consequence) (Breakwell, 2014:3). McLaughlin (2015:39) defines probability as a frequency of events, and consequence as the effect of the event. These two dimensions (frequency and consequence/effect) of risk require intervention (mitigation), as studies show that frequency and consequences in the modern times are elevated (Son and Orchard, 2013:684).

These three dimensions are described in the section below.

2.2.2.1 Uncertainty

As the term implies, uncertainty is something that is doubtful or unknown (Merriam-Webster, 2012). There is a distinction between uncertainty related to a known event,

and uncertainty related to an unknown event; the prior is called risk and the latter is called pure uncertainty (Kumar and Gregory, 2013:275). Due to the effect of uncertainty in risk, risk cannot be eradicated, but only mitigated with risk-reducing actions, referred to as risk management strategies (Lockamy, 2014:757).

2.2.2.2 Probability

Probability is the chance that something will happen or that has a chance of happening (Merriam-Webster, 2012). Data from history in conjunction with modelling are used to measure probability. Often these models involve various statistical measures that entail correlations (strength of association between two variables) and dependencies (the quality or state of being dependent; especially the quality or state of being influenced or determined by, or subject to another) (Merriam-Webster, 2012). Probability is the quantifying measure on which risk assessment can be based (McLaughlin, 2015:40).

2.2.2.3 Effect/Consequence

Uncertainty in terms of risk exerts an effect or consequence on the object (Hopkin, 2012:34). This consequence can further be postulated to be positive or negative (AIRMIC; IRM, 2002:2). Elahi (2013:128) defines this effect/consequence as a 'business outcome' that has an effect on the organisation.

Therefore, risk can be explained by the following formula of McLaughlin (2015:39):

$$Risk\ (uncertainty) = Probability\ (chance\ of\ happening) x Consequence\ (effect)$$

This means that:

- Risk cannot be avoided because of the term 'uncertainty' and risk will always exist (Lockamy, 2014:757);
- Risk can be quantified as a result of probability (the chance of happening) and the consequence/effect and this consequence/effect can have a value attached to it (McLaughlin, 2015:40).

2.3 HISTORY OF RISK AND RISK MANAGEMENT

The purpose of risk management is to improve the future and not explain the past (Borge, 2001:6). The earliest examples of risk management are found in the

disciplines of finance. Risk management, as a profession, was first recognised in 1956 from an article in the Harvard Business Review. It was, in essence, an extension of the position of the insurance manager (Bredell, 2004:109).

Traditionally, companies regarded risk management as an extra source of cost. However, in research reported by Elahi (2013:118), it is noted that two-thirds of a sample group of 271 executives indicated that risk management is important. As supply chains and supply chain risks gained more prominence, it was included in the enterprise risk management strategies (Henke, 2008:179).

Collaboration in supply chains does not only offer opportunities but creates more risk (Breuer *et al.*, 2013:332). Consequently, risk and risk management in supply chains has become a growing field of research and practice (Bandaly *et al.*, 2012:254).

2.4 ENTERPRISE RISK MANAGEMENT (ERM)

ERM is a discipline under the more general field of risk management. DeLoach (2000) suggested that ERM is the evolution of operational risk management into a strategic process which aligns strategy, process, people and technology at the organisational level. The Committee of Sponsoring Organisations of the Treadway Commission (COSO) defines ERM as *"... a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives,"* (Fraser and Simkins, 2010:3).

ERM is part of the evolutionary process of risk management, and is part of various disciplines in the organisation (Choi, Ye, Zhao and Luo, 2016:282). Due to various scandals, such as the Enron case and other developments in the global trade, ERM has become a core part of business (Personnel Today, 2002).

2.4.1 Components of ERM

ERM consists of eight components that should be aligned with the objectives of the organisation. The implementation of ERM should happen at every level and in every part of the organisation (PricewaterhouseCoopers (a), 2004:5; Moeller, 2011:256-286):

- **Internal environment** – The internal environment encompasses the tone of an organisation, and sets the basis for how risk is viewed and addressed by an entity's people, including the risk management philosophy and risk appetite, integrity and ethical values, and the environment in which they operate.
- **Objective setting** – Objectives must exist before management can identify potential events affecting their achievement. ERM ensures that management has a process in place to set objectives, and that the chosen objectives support and are aligned with the entity's mission and are consistent with its risk appetite. The risk appetite is the level and magnitude of risk accepted by the organisation's management.
- **Event identification** – Internal and external events affecting the achievement of an entity's objectives must be identified, and there must be a clear distinction between risks and opportunities. Opportunities are channelled back to management's strategy or objective-setting processes.
- **Risk assessment** – Risks are analysed, and their likelihood and impact are considered as a basis for determining how they should be managed.
- **Risk response** – Management selects risk responses – avoiding, accepting, reducing, or sharing risk – developing a set of actions to align risks with the entity's predetermined acceptable level of risk-taking and risk appetite.
- **Control activities** – Policies and procedures are established and implemented to help ensure the risk responses are effectively carried out.
- **Information and communication** – Relevant information is identified, captured, and communicated in a form and timeframe that enable people to carry out their responsibilities. Effective communication also occurs in a broader sense, flowing horizontally and vertically through the entity.
- **Monitoring** – The entirety of ERM is monitored and modifications are made as required. Monitoring is accomplished through ongoing management activities, separate evaluations, or both.

2.4.2 Benefits of ERM

ERM is a value-creating activity that is vital to the proper functioning of the organisation. The implementation of ERM provides the following benefits to the

organisation (PricewaterhouseCoopers, 2004:1; Moeller, 2011:27; Lam, 2014:53-57):

- **Alignment of risk and strategy:** Executives consider the risk appetite of the organisation by assessing strategic alternatives and by developing mechanisms towards the control of the risks. The focus is now no longer merely on company bottom-line financials, but also on the value that risk mitigation provides, and ERM provides the platform for management to maximise the risk mitigation value.
- **Improved risk-based decisions:** ERM provides alternatives in the case where a risk is detected – whether it is risk avoidance, acceptance, reduction or sharing. This allows management more flexibility in making decisions according to the organisation's risk appetite.
- **Reduction in surprises and losses in the business environment:** Organisations improve their ability to recognise possible events and initiate counteractive measures, as well as to reduce surprises and the expenses or losses involved with them.
- **Identification and management of multiple and cross-organisation risks:** Every organisation faces a huge number of risks which involves several divisions. Parallel to this, organisation-wide risk management allows effective reactions, dependent on each other, as well as on general measures with multiple risks.
- **Identification of opportunities:** ERM considers all possible events, including opportunities, hence allowing management to recognise and proactively capitalise on these opportunities.

The execution of the ERM guidelines, specifications and the operational monitoring combined with risk management, are intended to serve as an integrative approach for designing and implementing Supply Risk Management for firms today and in the future (Henke, 2008:184)

The purpose of including supply and supply chain risk into ERM is to create a focus on the integrative approach of managing this risk (Henke, 2008:184).

2.5 COST OF RISK

The consequence (effect) of risk can be quantified in more than a financial cost (Hendricks and Singhal, 2008:780). Although the direct impact cost is the foremost quantifiable, there are other additional costs.

Reputational risk is one risk that cannot be quantified in full, however, the impact of this risk will result in a tangible financial value (Lemke and Petersen, 2013:414).

After disruptions, the cost associated with expediting, premium freight, obsolete inventory, additional transactions, overtime, storage and moving, selling, and penalties paid to customers, increases (Hendricks and Singhal, 2008:780).

Based on the premise that risk has a cost, the steps in the risk-mitigating process are 1) to evaluate the cost of risk, and 2) introduce a risk-mitigating option that will potentially result in a lower cost (Olson and Dash Wu, 2010:697).

The cost of risk has further evolved to become a potential competitive advantage. Dual sourcing, as part of the Nokia risk-mitigating process, created a competitive advantage for them when the Philips microchip plant in Albuquerque had disruptions caused by a fire. That plant supplied chips to both Nokia and Ericsson. Nokia learned of the impending chip shortage within just three days and took advantage of their multi-tiered supplier strategy to obtain chips from other sources. Ericsson, however, could not avoid a production shutdown because it was sourcing from only the Albuquerque plant (Lu, Huang and Shen, 2011:1251).

2.6 SUPPLY CHAIN RISK MANAGEMENT (SCRM)

2.6.1 What is supply chain risk management?

As there are various definitions for the supply chain, there are various definitions for supply chain risk management (Bredell, 2004:28). Bandaly *et al.* (2012:250) define the supply chain risk management as the process that manages the risks that hinder the performance of the supply chain.

Supply chain risk management (SCRM) can also be defined as "*The practice of managing the risk of any factor or event that can materially disrupt a supply chain, either within a single company or spread across multiple companies,*" (Kessinger and

Macmorrow, 2012:517). Figure 2.1 provides an illustration of the scope of the supply chain risk environment.

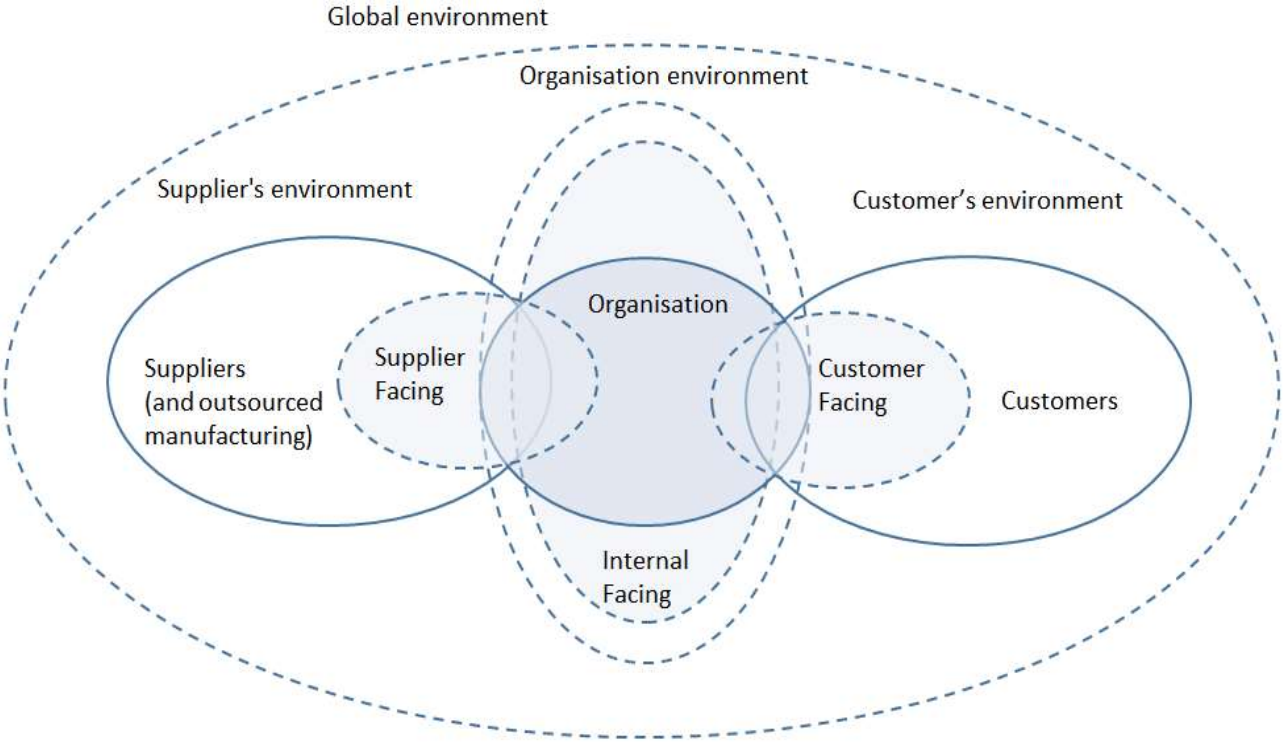

Figure 2.1: Scope of the supply chain environment

Source: (Council of Supply Chain Management Professionals, 2015)

One of the most critical aspects of SCRM is to have visibility beyond the borders of your own organisation, and to be able to influence the supply chain (Kessinger and Macmorrow, 2012:516). The ultimate purpose of SCRM is to enable cost avoidance, to continue customer service and to maintain market position (Kern, Moser, Hartmann and Moder, 2012:517).

It appears that supply chain risk can be addressed along two dimensions (Tang, 2006:453):

- Supply chain risk – Operational risk or disruption risk. Both of these risks have inherent uncertainties and cannot be avoided. The impact might be reduced through managing the risk.
- Mitigation approach – Mitigation strategies can be employed to reduce the impact of the risk event.

Husdal (2011:31) divided the risk management in supply chain management into two areas: proactive versus reactive management. Figure 2.2 illustrates the risk

mitigating and the contingency strategies. The contingency strategies are purposefully developed to contain the impact of the disruption in the supply chain.

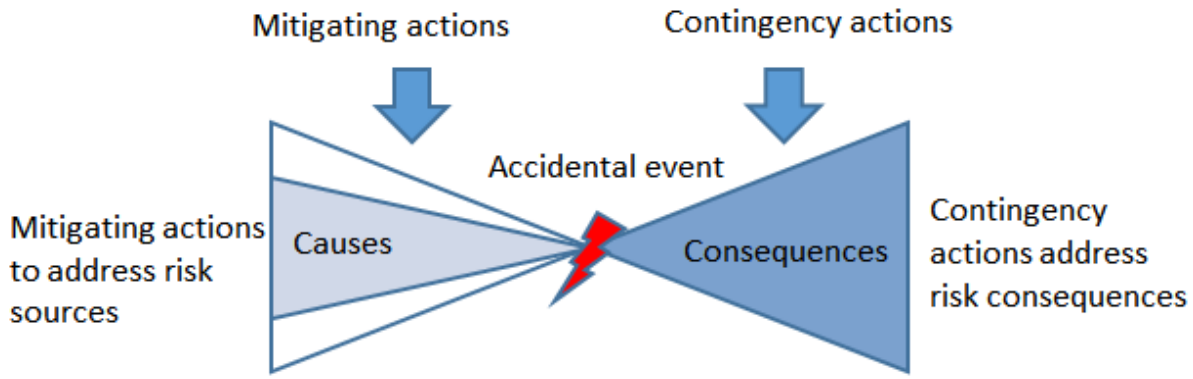

Figure 2.2: Risk mitigating and contingency strategies

Source: Husdal, 2011:31

A supply chain disruption, as defined by Wagner and Bode (2008:307), is the combination of (1) an unintended, anomalous triggering event that materialises somewhere in the supply chain or its environment, and (2) a consequential situation which significantly threatens normal business operations of the firms in the supply chain. A disruption (i) causes (something) to be unable to continue in the normal way, or (ii) interrupts the normal progress or activity of (something) (Merriam-Webster, 2012). According to Craighead *et al.* (2007:132), *"Supply chain disruptions are unplanned and unanticipated events that disrupt the normal flow of goods and materials within a supply chain and, as a consequence, expose firms within the supply chain to operational and financial risks"*.

Disruption risk has received more attention in the last few years due to the fact that supply chains became longer and their delivery time requirements are reduced, hence the supply chains are prone to more opportunities for disruptions (Kleindorfer and Saad, 2009:53). The goal of risk management in a supply chain is to recover as soon as possible after the disruption with minimal losses. The speed with which decisions are made by the supply chain managers is of vital importance (Macdonald and Corsi, 2013:271). These decisions are a continuation of the risk management process which starts with a supply chain risk assessment and mitigating plans, and ends in a recovery plan.

Husdal (2011) approached SCRM with a fourfold construct. This construct consisted of risk sources, risk drivers, strategies (mitigative actions) and consequences (contingent actions). Figure 2.3 illustrates Husdal's approach.

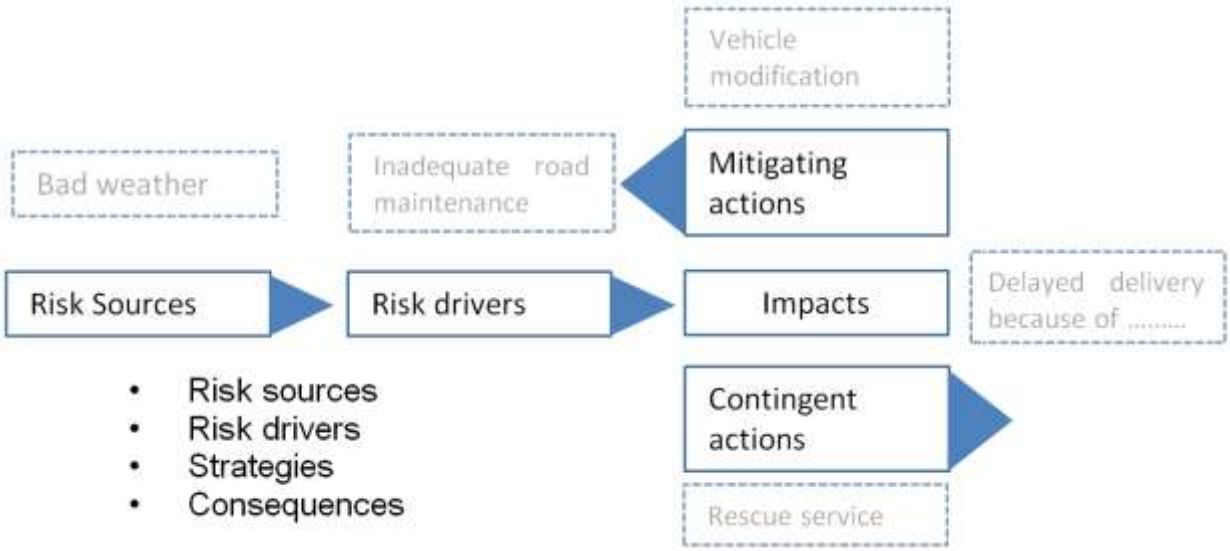

Figure 2.3: Husdal's fourfold construct of SCRM

Source: (Husdal, 2011:30)

In the process of SCRM, the supply chain risk manager should identify the possible risk sources, risk drivers and the develop the associated risk-mitigation plans (Husdal, 2011:30)

2.6.2 Sources of risk

The source of risk can be defined as a grouping of risk in a risk domain, such as uncertainty in demand for the product (Bandaly *et al.*, 2012:262). Wagner and Bode (2008:310) identified five risk sources in the supply chain, based on the definition that any negative deviation from the expected standard in the supply chain, when resulting in a disruption, is a risk source. The five types of risk sources are: 1) demand side, 2) supply side, 3) regulatory, legal and bureaucratic, 4) infrastructure and 5) catastrophic. These sources can further be grouped into either internal to the supply chain or external to the supply chain.

The risk sources are the originating point of risk. The risk source has the element of probability, and therefore the risk source can be influenced by frequency (Colicchia and Strozzi, 2012:412).

2.6.3 Risk drivers

Colicchia and Strozzi (2012:412) refer to the risk drivers as risk management influencers. Outsourcing of manufacturing, logistics, and basic operational activities such as procurement, have left firms with little appreciation for the complexity and vulnerabilities that have been introduced into their supply chain (Kessinger and Macmorrow, 2012:515). Modern supply chains have become more complex due to the extension of the supply chain rendering more risk nodes, also resulting in less visibility due to the length of the chain. Hence, the extended relationships that are required, and the implementation of a 'short term or quick fix' will likely create a disruption in another part of the supply chain due to its integrative nature (Sodhi, Son and Tang, 2012:7).

Craighead *et al.*, (2007:140-143) identified the risk drivers in the supply chain as: supply chain density, complexity and node criticality.

A supply chain comprises of a network of nodes that represent the entities and activities in the network. The entities perform logistic chain activities, such as warehousing and transport, or selling of materials by a supplier to a customer lower down in the chain. This continues until it is depicted from the source to the destination (Craighead *et al.*, 2007:134). Figure 2.4 depicts a diagram of the supply chain structure with reference to **density, complexity and node criticality.**

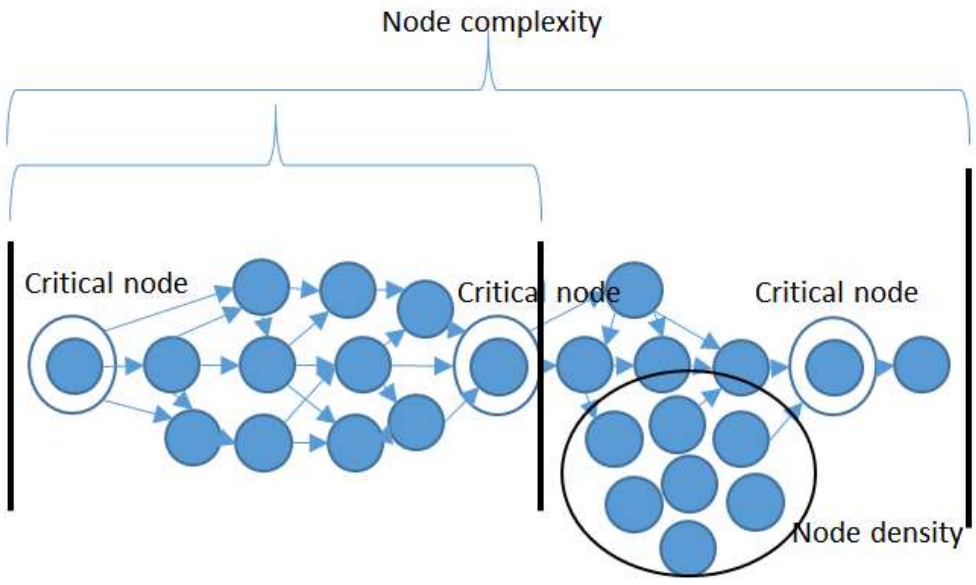

Figure 2.4: Risk drivers in the supply chain - density, complexity and node criticality

Source: Developed by author (2015)

These nodes represent entities that form part of a supply chain's structural characteristics. These nodes have their own behaviour, which can influence the behaviour of the nodes adjacent to it, which in its turn can also influence the behaviour of those nodes adjacent it. Therefore the behaviour of the supply chain will comprise of the behaviour of the number of nodes and how the interrelationship between these nodes is established and executed (Craighead *et al.*, 2007:135).

Supply chain density is defined as the number of dense areas in a chain. Geographic density invariable leads to more unplanned events and hence increases the risk (Craighead *et al.*, 2007:140).

Supply chain complexity is defined as the number of nodes in the supply chain. The more complex the supply chain is perceived to be the more the risk increases (Craighead *et al*., 2007:141).

Node criticality is defined as the importance of a node in the supply chain. In a single source supply chain the source node is seen as critical and if this node experiences a disruption this will affect the total supply chain. Hence, the more critical a node in a supply chain, the more severe the risk (Craighead *et al.*, 2007:142; Breuer, 2013:332).

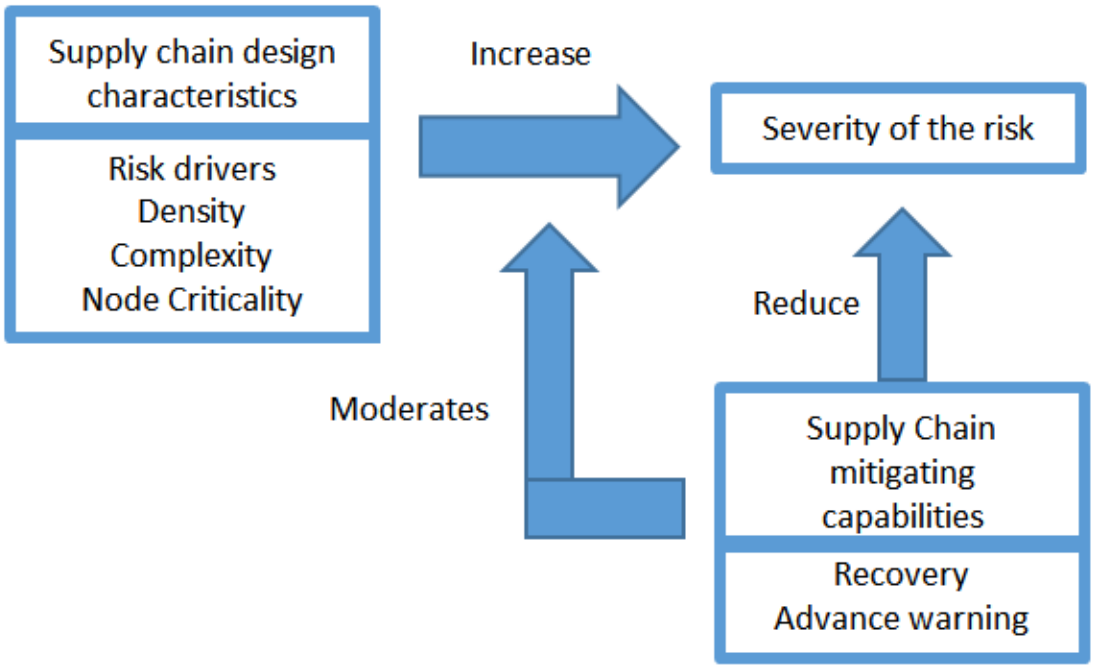

Figure 2.5: Risk driver interaction towards consequence

Source: (Craighead *et al.*, 2007:148)

Figure 2.5 indicates the effect of risk drivers on the severity of the consequence of risk. A risk driver, such as communication of an advance warning system, can reduce the severity of the risk. Supply chain complexity can, in the absence of an advance warning system, increase the severity of the risk (Craighead *et al.*, 2007:148)

2.6.4 Risk-mitigating strategies

Due to the difference in circumstances, changes in controllable and uncontrollable factors, the risk and risk-mitigating strategies of one logistics supply chain will differ from another, and the unique design and over-arching strategy of the particular logistics supply chain will dictate the preferred risk-mitigating strategy (Tomlin and Wang, 2011:98).

Risk-mitigating strategies are required to be investigated in conjunction with the risk sources and risk drivers, and from these parameters a strategy could be developed (Juttner, 2003:207).

There are various mitigating strategies recorded in literature that are practised and are able to address some of the supply chain risks. Table 2.2 indicates some of the strategies found in literature to address the mitigation of logistics and supply chain risks.

Table 2.1: Supply risk and disruption mitigating strategies

Author	Mitigating strategy
Marley, Ward and Hill, 2014:143	Increase inventory, capacity, responsiveness, flexibility, and capabilities;
	Acquire redundant suppliers
	Pool demand
Kouvelis, Dong, Boyabatli and Li, 2011:8	Buffering - Maintaining excess resources of safety stock, idling capacity, safety lead times
	Pooling or sharing of resources, flexible technology, common components, trans-shipment, postponement
	Contingency planning, 'Virtual buffering'' established by a pre-set course of action, backup supply, multi-sourcing/supplier portfolio.

Author	Mitigating strategy
Son and Orchard, 2013:701	Policy framework change to keep strategic stock over and above safety stock
Tomlin and Wang, 2011	Stockpile inventory - Hold inventory that can be used to fill customer demand even if supply is interrupted.
	Diversify supply - Source product from multiple vendors/facilities so that a problem at one vendor/facility doesn't affect the entire supply.
	Back up supply - Have an emergency vendor, facility or logistics provider that is not normally used but that can be activated in the event of a supply problem.
	Manage demand - Influence demand to better match the actual supply by, for example, adjusting prices or offering incentives to encourage customers to purchase products that are less supply-constrained.
	Strengthen the logistic chain - Work with suppliers to reduce the frequency and/or severity of supply problems.

Source: Compiled by author (2015)

It is not practical and feasible to develop a mitigating strategy for every risk identified. There are operational adjustments and management that can address some of the risks. These daily operational management processes can include the use of information technology to manage supplier and customer relationships (for example, through collaboration) (Tummala and Schoenherr, 2011:479).

All mitigating strategies represent a trade-off, such as a trade-off in terms of cost versus revenue loss, for example, the cost to implement and maintain a mitigating strategy versus the revenue loss from a disruption incident (Wee *et al.*, 2012:298). Another trade-off is the strategy choose to follow and the risk versus the strategic objective goals, i.e JIT strategy and performance against risk of failure (Juttner, 2003:208). These trade-offs do not only represent the cost and value of profit at first line off site, but in the end reflect in an economic value. The final, important supply chain trade-off decision is between 'managing risk and delivering value'. This is the trade-off between the extra costs related to most of the mitigating strategies and the total costs of supply as a main principle of contemporary supply chain management.

This concludes the section on SCRM. Logistics in the supply chain is responsible for the movement of materials from the supplier to the customer (Waters, 2011:16). The next section focuses on logistics risk management.

2.7 LOGISTICS RISK MANAGEMENT

2.7.1 What is logistics risk management?

Logistics is the work required to move and position the product throughout the supply chain. Logistics is primarily the conduit of product and service flow within a supply chain (Bowersox *et al.*, 2013:4). The purpose of logistics is to move and geographically position inventory (Bowersox *et al.*, 2013:5). The objective of logistics is thus to have 1) the right material, 2) in the right quantity, 3) at the right time, 4) at the right place and then within the right cost (Fuchs and Wohinz, 2009:234; Wee *et.al.,* 2012:286). Logistics risk can be regarded as the unexpected, unwanted event that causes the inventory not to be at the right place, at the right time in the right quantity or quality, at the right cost (Fuchs and Wohinz, 2009:234).

2.7.2 Logistics risk management model

From the SCRM we recognise that the following elements play a role in the management of risk:

- The logistic chain design (Craighead *et al.*, 2007:148);
- The physical flow of operations (the execution of the service/product flow and the communications) (Wagner and Bode, 2008:317), and
- Performance feedback for optimisation and redesign (Macdonald and Corsi, 2013:271).

Fuchs and Wohinz (2009:238) developed a logistics risk management model as depicted in Figure 2.6

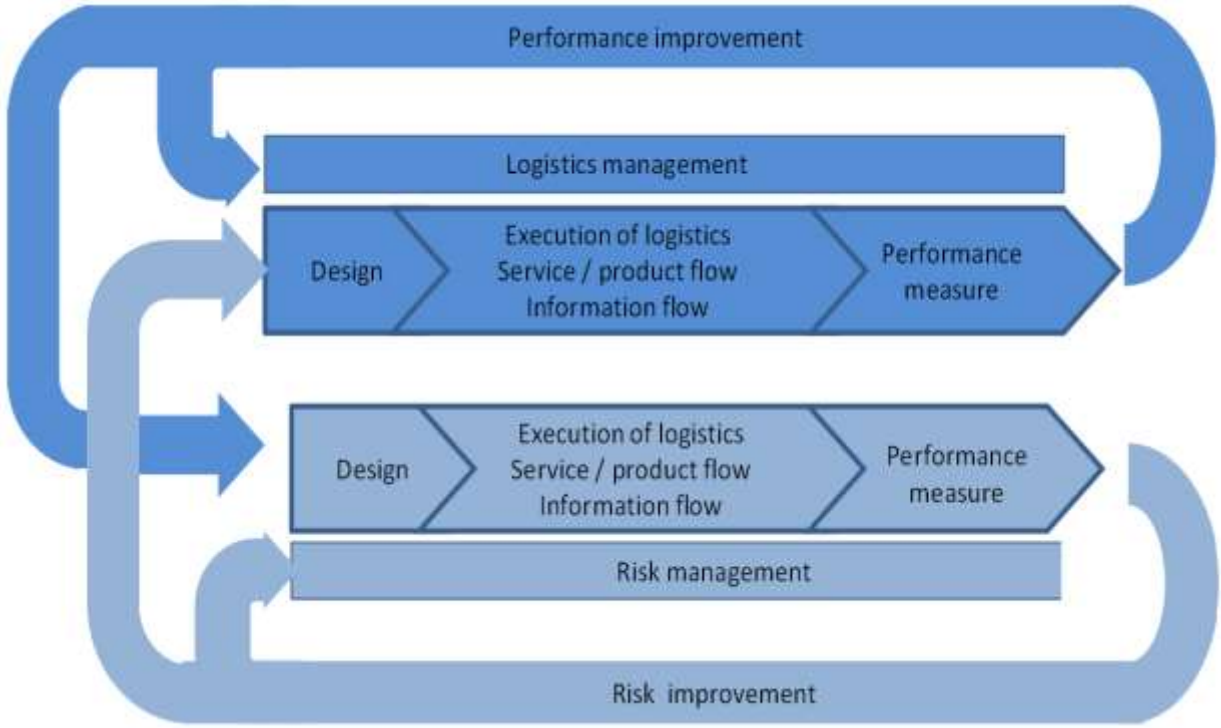

Figure 2.6: Logistics risk model

Source: Adapted from Fuchs and Wohinz, 2009:238

The Fuchs and Wohinz risk model consists of the design of the logistics supply chain, the execution of the logistic chain and the performance management.

From this model we know that each element in this model (design, execution and performance) could contain risk and when risk assessment in the logistic chain is reviewed, each of these areas requires review.

2.7.2.1 Design of the logistics supply chain

The logistics design contains the design parameters of the network and total chain. This design contains inherent risk (Hosseini and Dullaert, 2011:359) which can be internal or external risks. The internal risk is the risk that is acknowledged at the design of the system, for example, complexities of the logistic chain. The internal design stems from strategy but also includes the physical, tangible inventory that requires movement. As an example, a lean logistic chain with optimised resource utilisation will attract a greater risk of disruption should the resource quality not be of a high standard (Christopher and Towill, 2000:208). Logistics trade-offs to achieve the total lowest cost of the supply chain (Bowersox *et al.*, 2013:32) can be one of the inherent and design risks (Craighead *et al.*, 2007:148). The product attributes can

contribute to the risk, such as fuel that is a hazardous cargo. The following product attributes play a role in the design of the chain, and consequently they influence design risk: value, volume, weight and requirements for special treatment (Fuchs and Wohinz, 2009:236).

The external design risk includes the environment under which the logistic chain must operate. These risks include those associated with legislation, government processes and restrictions (Klosa, 2013:50).

2.7.2.2 The execution of logistics

The execution of logistics is the movement of the product or material from the source to the destination, and includes the flow of information (Bowersox *et al.*, 2013:357). This physical execution of logistics contains risks attached to information and material or product flows from the original supplier to the delivery of the final product to the end-user (Juttner, 2003:200). There are risks attached to disruptions caused by equipment failure (Gurning and Cahoon, 2009:7), infrastructure disruptions (Transnet Corporate Communication, 2013:58) and many other disruptions. Risk in the service/product flow is also subjected to the network complexity (the length of the chain and number of intermediaries), the integration with reference to physical distribution and handling, the product attributes and the risk associated with the product.

2.7.2.3 Information flow

Risks in information stem from system integration and the visibility across the logistic chain. The key to improved logistics visibility is shared information among logistic chain members (Christopher and Lee, 2004:391). Other areas in the information flow that carry risk include technology usage, the strategy regarding information sharing, accuracy and time frame of sharing information. The rapid pace at which information management advances information management can exert risk or reduce risk.

2.7.2.4 Performance management

The purpose of performance management is to measure the performance of execution compared to the design of the logistics system, and further to identify the risk probability and occurrence thereof (Fuchs and Wohinz, 2009:240). This information is then processed to optimise and improve the effectiveness and

efficiency of the measured executed performance (Macdonald and Corsi, 2013:271). The identification of new risks and the evaluation of identified risks remains a continued process in performance and logistics risk management (Jereb, Cvahte and Rosi, 2012:273; Manuj and Mentzer, 2008:202; Fuchs and Wohinz, 2009:238).

2.7.3 Risk sources

As in the case of risk management and SCRM, logistics risk management invariably has the same risk sources due to the fact that the scope of logistics management crosses various other functional management areas across the supply chain (Peck, 2006:139-140).

Various authors have identified and classified risk in different ways. However, there is a large extent of overlap in the sources and classification (Sodhi, Son and Tang, 2012:11). For example, König and Spinler (2016:128) classified their risk sources as **operational risks** contained in the execution of logistics and refer to process risk (production yield and equipment failure), control risk (wrong planning and execution of production), supply risk (delayed deliveries out of stock) and demand risk (volatility in the market demand). Natural risks (weather and storms) and man-made risk (labour strikes and socio-political crises) are classified under **disruption risks** (König and Spinler, 2016:128)

For this study, the risk sources will be categorised as depicted in Figure 2.7.

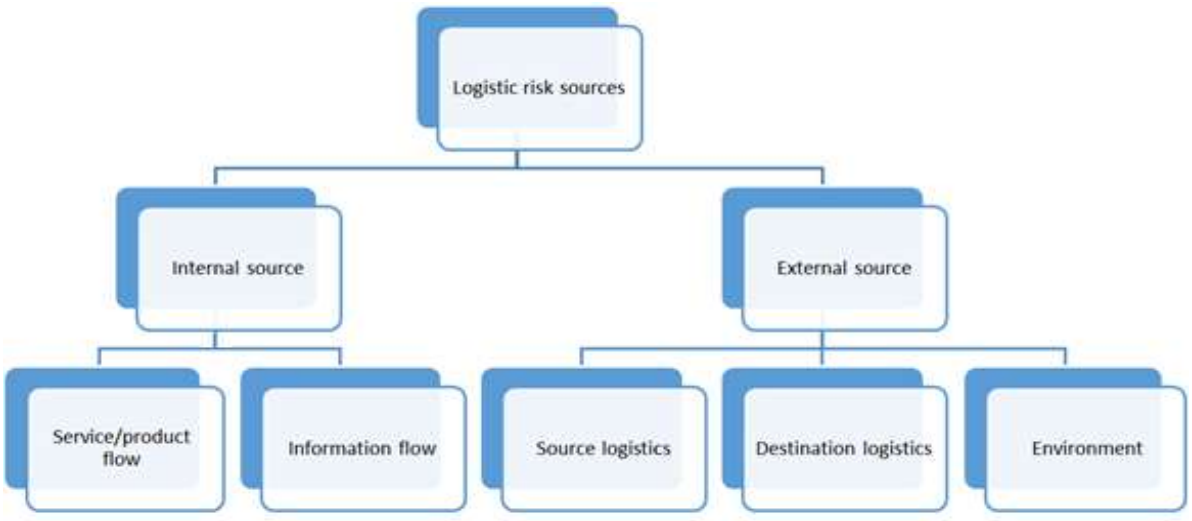

Figure 2.7: Logistics risk sources

Source: Adapted from Fuchs and Wohinz, 2009:235.

Table 2.2 contains a list of the logistics risk sources of bulk coal logistic chains mentioned in literature.

Table 2.2: List of risk sources

Service / product flow	Information flow	Source logistics	Destination logistics	Environment
Coal spillage on track must be cleared prior to rail commencement. (Boland and Savelsbergh, 2012:287)	Lack of collaboration between role-players in the supply chain (Boland and Savelsbergh, 2012:278)	Production delays at the source (Ernst, Krishnamoorthy, Sier and Marquez, 2008:178)	Technological accidents. (Rose and Wei, 2013:212)	Increased demand and fluctuations in demand (Boland and Savelsbergh, 2012:278)
Theft of signal cables results in service disruptions. (Transnet Corporate, 2013:56)		Loading disruptions at the source, inventory depletion Machine equipment failure (Sivhaga, 2012:18)	Electrical outages. Equipment breakdown. (Gurning and Cahoon, 2009)	Political events (Gurning and Cahoon, 2009)
			Recovery of rail-related disruptions manifest later at the port in terms of demand scheduling and queuing disruptions. (Boland and Savelsbergh, 2012:285)	

Source: Compiled by author (2015)

2.7.4 Logistic risk drivers

Logistic risk drivers either amplify or reduce the risk (Colicchia and Strozzi, 2012:412). Some authors refer to these risk drivers as the vulnerability of the supply chain (Wee *et al.*, 2012:295; Fuchs and Wohinz, 2009:235). Fuchs and Wohinz (2009:235) categorised four drivers, as illustrated in Figure 2.8.

Figure 2.8: Logistics risk drivers

Source: Fuchs and Wohinz, 2009:235

Examples of risk drivers in the four categories for a logistic chain are provided in Table 2.3.

Table 2.3: Logistics risk drivers

Human failure	Technical failure	Organisational failure	*Force Majeure*
Labour unrest. (Rose and Wei, 2013:212)	Equipment breakdown. (Gurning and Cahoon, 2009)	Infrastructure disruptions. (Transnet Corporate Communication, 2013:58)	Severe weather condition (Gurning and Cahoon, 2009)
	Mechanical failures of equipment, rail wagons. The major disruptions result from locomotive failures. (Boland and Savelsbergh, 2012:287)		

Source: Compiled by author (2015)

2.8 DEFINING THE BULK COAL EXPORT LOGISTIC CHAIN

To understand the areas of risk in the bulk export logistic chain the scope of the logistic chain should be defined. The scope of logistics includes the identification of the nodes and the four flows; i) service/product flow, ii) information flow, iii) cash flow, iv) market accommodation flow (Bowersox *et al.*, 2013:357).

In the study, bulk is defined as "*A commodity which is shipped in large, unpackaged amounts"* (Investopedia, 2014).

To define the scope of the bulk coal export logistic chain the study will apply the following definition of logistics:

> *"Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption to meet the customer's requirements"* (Council of Supply Chain Management Professionals, 2015).

Figure 2.9 depicts the bulk coal export logistic supply chain.

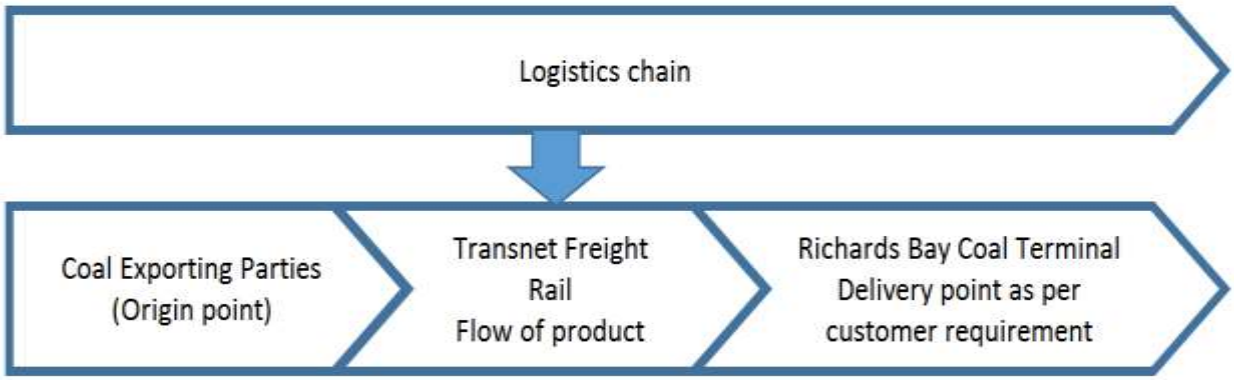

Figure 2.9: The bulk coal export logistic chain

Source: Developed by author (2015)

2.8.1 The nodes in the bulk coal export logistic chain

2.8.1.1 The coal exporting parties

The coal exporting parties are coal producers that produce the product for movement in line with supply agreements. Over 80% of South African coal is produced by five leading international natural resources companies, namely, BHP Billiton, Anglo Coal, Xstrata, Exxaro and Sasol. The rest of the coal is produced by smaller companies, mainly owned by black empowerment groups that are also affiliated to the main role-players in the industry (Mathu and Chinomona, 2013:347).

2.8.1.2 Transnet Freight Rail

Transnet Freight Rail (TFR), a business unit in Transnet, is responsible for rail freight. As such, TFR is the logistics rail transport service provider that is responsible for receiving the coal and transporting it to the customer/destination. Transnet is a South African government-owned corporation which is the operator and custodian of

South Africa's major transport infrastructure (rail, harbours and pipelines). Transnet is featured as one of the most important logistics companies in the South African coal industry (Mathu and Chinomona, 2013:355). The rail transport service is used to transport export coal to the Richards Bay Coal Terminal. The main focus of TFR is transporting bulk and containerised freight.

2.8.1.3 Richards Bay Coal Terminal

Richards Bay Coal Terminal (RBCT) is the receiving point where the customer will receive the coal sold on free-on-board sales term. The RBCT is a bulk coal terminal that receives, stacks and stores the coal until the customer's nominated vessel arrives to receive the coal. RBCT represents the customer's nominated destination (Smit, 2013:22-25).

2.8.2 The four logistics flows

As outlined by Bowersox *et al* (2013:357), the four logistics flows are:

i) service/product flow,
ii) information flow,
iii) cash flow,
iv) market accommodation flow

For the purposes of this study, just the first two flows will be discussed.

2.8.2.1 The service / product flow

The product or service flow comprises of activities that ensure the movement or storage of the coal. Figure 2.10 depicts the activities involved in the product flow.

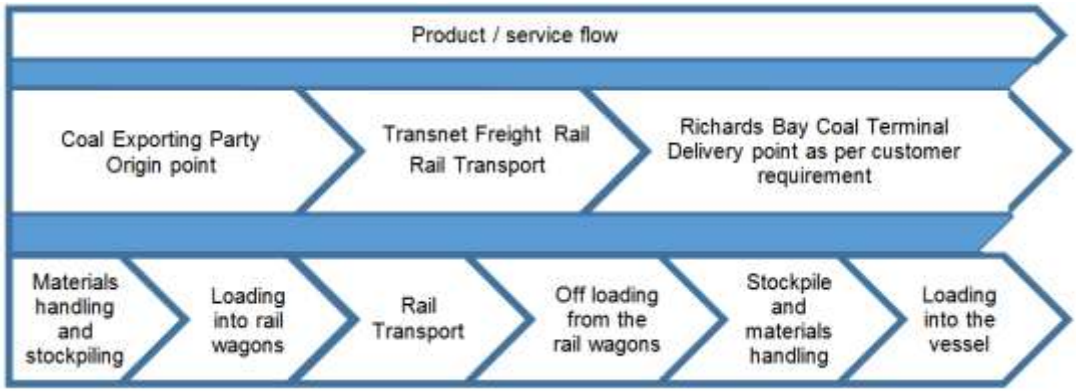

Figure 2.10: The product flow activities in the bulk coal export logistic chain

Source: Developed by author (2015)

Coal Exporting Party - Origin

Various operational methods can be applied during the loading of coal at the coal producer. However, the most common method applied in this industry is the conveyor belt and stacker-reclaim equipment. The equipment is primarily conveyor belt orientated with a spout to stack and a bucket scoop for reclaiming. The bucket digs into the stockpile and drops the material onto the conveyor belt. This belt system directly feeds it into the loading equipment bin or acts as the loading equipment.

Some of the supply sources (coal producers) stack and reclaim by means of front end loader (FEL) equipment methodology. This entails a wheel-based motorised operation that relies on human manoeuvring and speed. This action is executed by digging into the stockpile with the FEL's scoop bucket and then loading onto a conveyer system to load into the rail wagon.

Loading into rail wagons

According to Sivhaga (2012:4), Precision Train Loading Systems were constructed in the early 1980s, and are mostly still in operation today. The design of the Precision Unit-Train Loading System (PUTLS) differs in terms of design and is constructed in accordance with the loading requirements. It generally consists of a 250- to 300-ton surge bin positioned above a 100- to 130-ton weigh bin. Four bi-parting gates usually control the transfer of coal from the surge bin into the weigh bin. Today, loading coal trains involves more than simply placing coal into the rail wagon. After some coal mines had been built, it became necessary to retrofit high capacity precision-loading systems to the originally designed volumetric loading systems. These systems are costly and purpose-fit designed. Typically, when a new mine is established a high capacity loading system will be part of the mine design.

Loading by means of FEL operation implies that after material is scooped it is dropped into a rail wagon. Due to the mobility this type of system is flexible in terms of adding or reducing capacity. However, the operating cost and the flexibility on the longer term might outweigh a shorter term advantage (Sivhaga, 2012).

Transnet Freight Rail - Rail transport

Bulk coal is transported by means of rail over long distances. The reason for this preferred option is that the operational cost seems to be lower. The main mode of transport into RBCT is undoubtedly the CoalLink rail line, running from Blackhill, Mpumalanga, through KwaZulu-Natal, into Richards Bay, across a total distance of 580 km. This line is capable of transporting approximately 72 MTPA. In 2009, Transnet Freight Rail announced that the capacity would be upgraded to 81 MTPA by June 2010 through the introduction of additional equipment and increased functionality (Crickmay, 2009:21). In a public statement released by Transnet on 14 July 2016, Transnet state that the expansion program is in progress and will be completed over next seven years (Likhethe, 2016).

Rail transport consists of a system of activities and equipment. This system is not only limited to rolling stock (locomotives, rail wagons) but includes infrastructure (rail tracks, signalling systems, electric overhead cables) and operational systems (IT scheduling systems for planning, plan execution, train drivers and operational management personnel) (Luger, 2008:219).

Richards Bay Coal Terminal – Delivery point as per customer request

Activities at Richards Bay Coal Terminal consist of receiving coal, storage and the handling of coal (Yan-liang, 2013:3716).

Dry bulk port terminals are classified in two groups, namely, major bulk product and minor bulk product. Coal and iron ore are classified in the group of major bulk product. Due to the increase in bulk-product movement during the last decade, new bulk-handling systems had to be designed (Christopher and Lee, 2004:388). Dry bulk port further consists of three activities: Entrance activity (unloading of the rail wagons), the stockyard system (stockpile and materials handling) and an exit system (loading into a bulk vessel) (Christopher and Lee, 2004:390).

2.8.2.2 Information flow

The information flow supports the product/service flow and acts as an initiator and controller of the movement of the material. The information flow accuracy is extremely important as this governs the inventory and the movement of inventory.

Incorrect information flow can result in inventory shortages that can result in additional cost (Bowersox *et al.*, 2013:34).

The information flow consists of three separate planning and control elements. The output of one element is the input of the next element. The planning and scheduling horizon of this information flow spans an execution period (for example, next day, minutes and hours), tactical period (three months or a year) and a strategic period of 10 years (Boland and Savelsbergh, 2012:278).

Figure 2.11 depicts the information flow in the bulk coal export logistic chain.

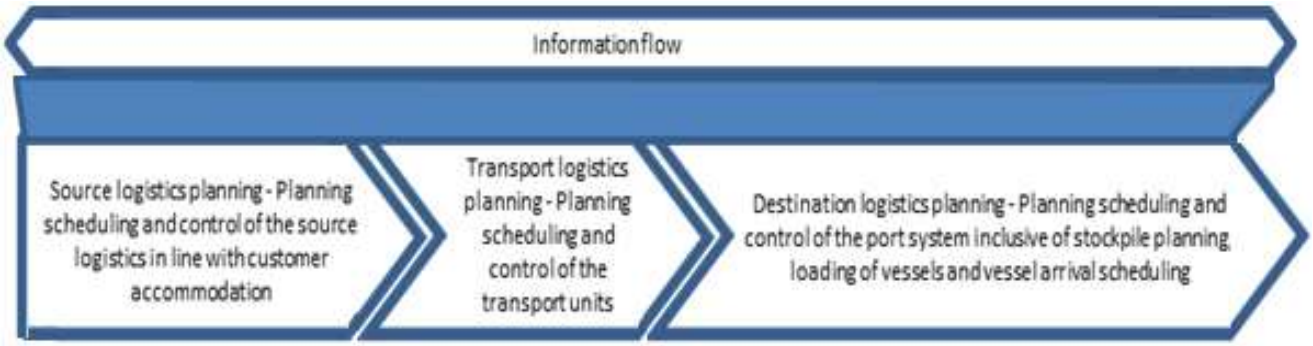

Figure 2.11: Information flow in the bulk coal export supply chain

Source: Developed by author (2015)

2.9 SUMMARY

Due to the effect of uncertainty in risk, risk cannot be eradicated, but can only be mitigated with risk-reducing actions, referred to as risk management strategies. Based on the components of risk, probability and consequence (effect) risk can be quantified. The severity of the loss can be reduced with risk management. Without any risk management, companies and the economy are prone to suffer increased losses. The increased complexity of the integration of supply and logistic chains increases risk from one node to another. In the bulk export logistic chain, as indicated above, there are various nodes that are integrated in the logistic chain. To effectively manage the risk over the whole chain a holistic or an integrated risk management process for the bulk export logistic chain is suggested. Figure 2.12 proposes the structure of an integrated risk management system that can potentially assist to reduce the total risk in the bulk coal export logistic chain.

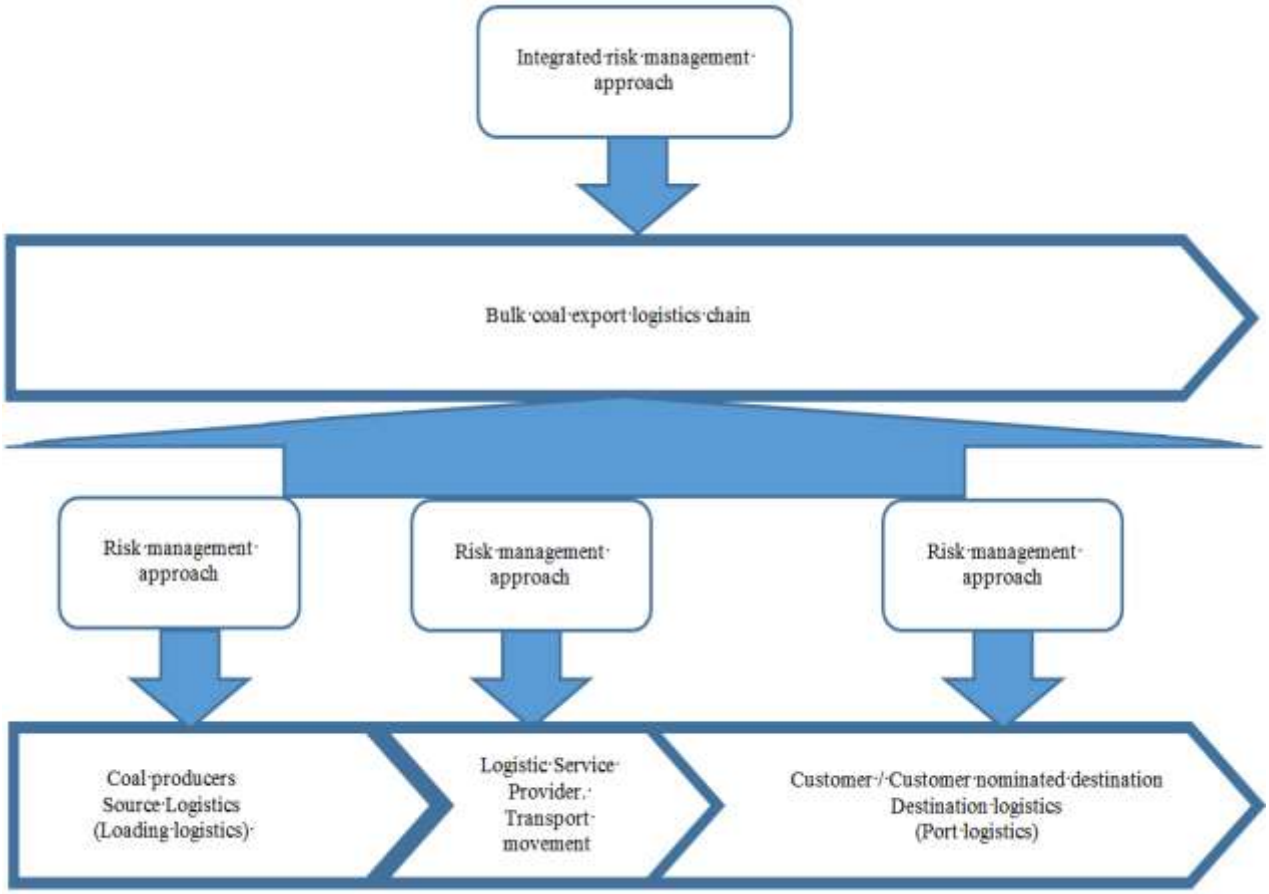

Figure 2.12: Structure of an integrated risk management approach

Source: Developed by author (2015)

2.10 PROPOSED QUESTIONS FOR THE SEMI-STRUCTURED INTERVIEW

The research investigates the possibility of an integrated risk management strategy for the whole bulk coal export logistic chain. The main research question is: *What are the risk management approaches in the current bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain?*

In Chapter 1 it was indicated that the empirical study will be conducted by means of semi-structured interviews with various key persons in the different parts of the bulk coal export logistic chain.

The proposed questions for the semi-structured interviews were identified from the literature study in Chapter 2. The proposed questions have undergone a double

review process to ensure that the questions will be in a position to answer the research question and meet the objectives.

Questions for the interviews

Question 1: What do you think are the risks in the bulk coal export logistic chain?

Prompting question (if not indicated by participant in main question):

Explain your reason for identifying those risks.

Is the identified risk a root cause or a symptom?

Question 2: How do you/your company manage these risks in the logistics export chain?

Prompting question:

Is the risk management a general strategy or focused?

How does each of these strategies add value?

Question 3: What changes, if any, would you recommend to stakeholders in the export logistic chain to reduce the risk?

Prompting question:

Why would you recommend these changes?

How will these changes add value to all stakeholders or only certain stakeholders?

Question 4: Do you have any other ideas related to risk that were not covered or explored to add to the discussion?

2.11 CONCLUSION

This chapter focused on risk, risk management, logistics risk management and the bulk coal export logistic chain. The next chapter will focus on the methodology of the study.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The previous chapter presented the concepts of risk, risk management, logistics risk management, and defined the bulk coal export logistic chain. The chapter provided an oversight of the risk in all the facets that could be applicable to risk management in the bulk coal logistic chain. The purpose of Chapter 2 was to review the applicable literature in preparation for the data-gathering process. The chapter ended with questions for the semi-structured interview.

Chapter 3 focuses on the research design and methodology. The chapter begins by revisiting the research question and objectives. The research approach and design are assessed, followed by a detailed discussion of the instruments that were used for the research. The sampling design, methods and the data collection processes are outlined, followed by the analysis techniques and procedures, including the processes that were followed to ensure the validity and reliability of the research. Figure 3.1 provides an oversight of the focal points in Chapter 3.

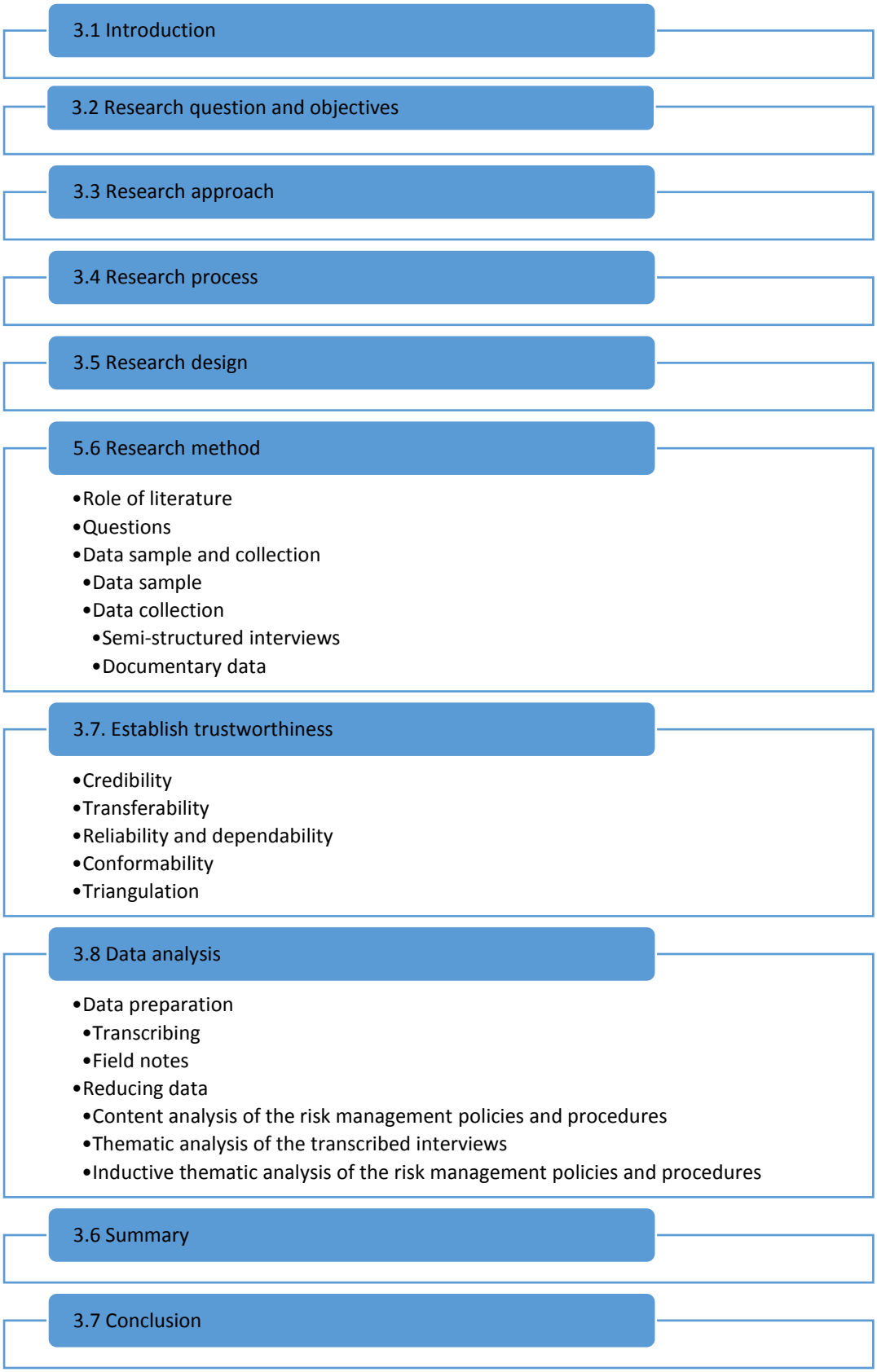

Figure 3.1: Overview of Chapter 3

Source: Developed by author (2016)

3.2 RESEARCH QUESTION AND OBJECTIVES

3.2.1 The main research question

The main research question in the study is:

> *What are the current risk management approaches in the bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain?*

3.2.2 The objectives

The main aim or objective of this study is to develop a framework for an integrated approach to risk management in a bulk coal export logistic chain.

The secondary objectives are:

- To conduct a literature study on risk management in supply and logistic chain (that will form the basis for the research instrument for the empirical study)
- To identify and explore the risks and risk management practices of the stakeholders in the bulk coal export logistic chain (by means of interviews;
- To explore the current policies and procedures of the different stakeholders (by means of a content analysis)
- To explore the possibility of an integrated risk management approach that can reduce the risk in the bulk coal export logistic chain (content analysis and interviews).

This study will follow the interpretive phenomenological (content and thematic) research design (Visagie 2014 (a); Evans, 2007:182-184).

The following section provides a discussion of the research approach, research process and research design that were followed by the researcher in order to meet the research objectives. Figure 3.2 indicates the relationship between the research approach, research design and the research methodology.

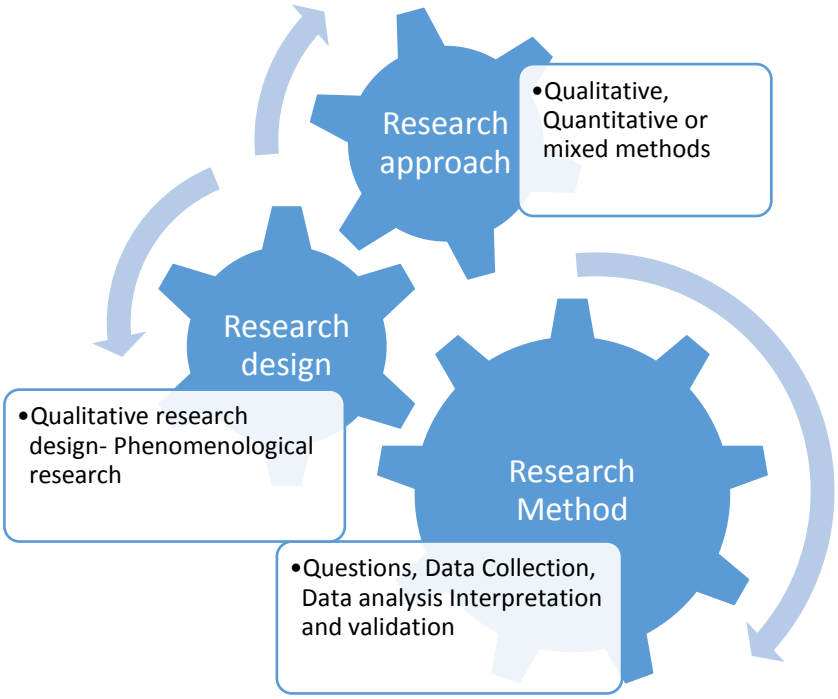

Figure 3.2: Relationship between research approach, research design and research method

Source: Compiled by author and adapted from Creswell (2013:36)

The three components illustrated in Figure 3.2 are discussed below.

3.3 THE RESEARCH APPROACH

The research approach is the broad plan on how the research will be conducted, and in this broad plan there are various components that play a role (Creswell (a), 2013:35).

The research approach is commonly grouped into qualitative and quantitative analysis (van Zyl, 2014:11; De Vos *et al.*, 2011:63), while a combination of the two can be viewed as another grouping (Creswell (a), 2013:36). These approaches have distinct characteristics. Table 3.1 indicates the characteristics of the two main approaches.

Table 3.1: Characteristics of research approaches

	Qualitative research	Quantitative research
Focus of the research	Quality (nature, essence)	Quantity (How much, how many)
Goal of the investigation	Understanding, descriptive, discovery and meaning	Prediction, control and confirmation
Design characteristics	Flexible, evolving and emerging	Predetermined and structured
Sample	Small, non-random and purposeful	Large, random and representative
Data collection	The primary instrument, interviews, observation and documents	Inanimate instruments (Scales, tests etc.), questionnaires and computers
Findings	Comprehensive, holistic and richly descriptive	Precise and numerical

Source: Compiled by author adapted from Merriam, 2015:18

Derived from the research question, this study followed a qualitative approach to explore the phenomena, to understand and obtain a holistic and richly descriptive finding of the phenomena (Merriam, 2015:18).

Research by Da Mota Pedrosa *et al.* (2011:276) indicates that the field of logistics and supply chain requires more qualitative research. Gammelgaard and Flint (2012) pointed out that more and richer development of understanding in the field can be obtained by going beyond the conventional approach and using a qualitative approach. For micro processes in the logistics and supply chain research field the qualitative approach can yield a deeper and richer understanding.

This study drew on the expert knowledge of the Channel Oversite Team (COT) members, who represented the bulk coal export logistic chain. In-depth interviews with these expert participants would lead to the answering of the research question.

3.4 RESEARCH PROCESS

Research is a process through which knowledge is gathered and the research process is a scientific method that results in a reasonable and sound answer, and follows certain steps to reach the answer (Van Zyl, 2014).

The research process for this study is depicted in Figure 3.3.

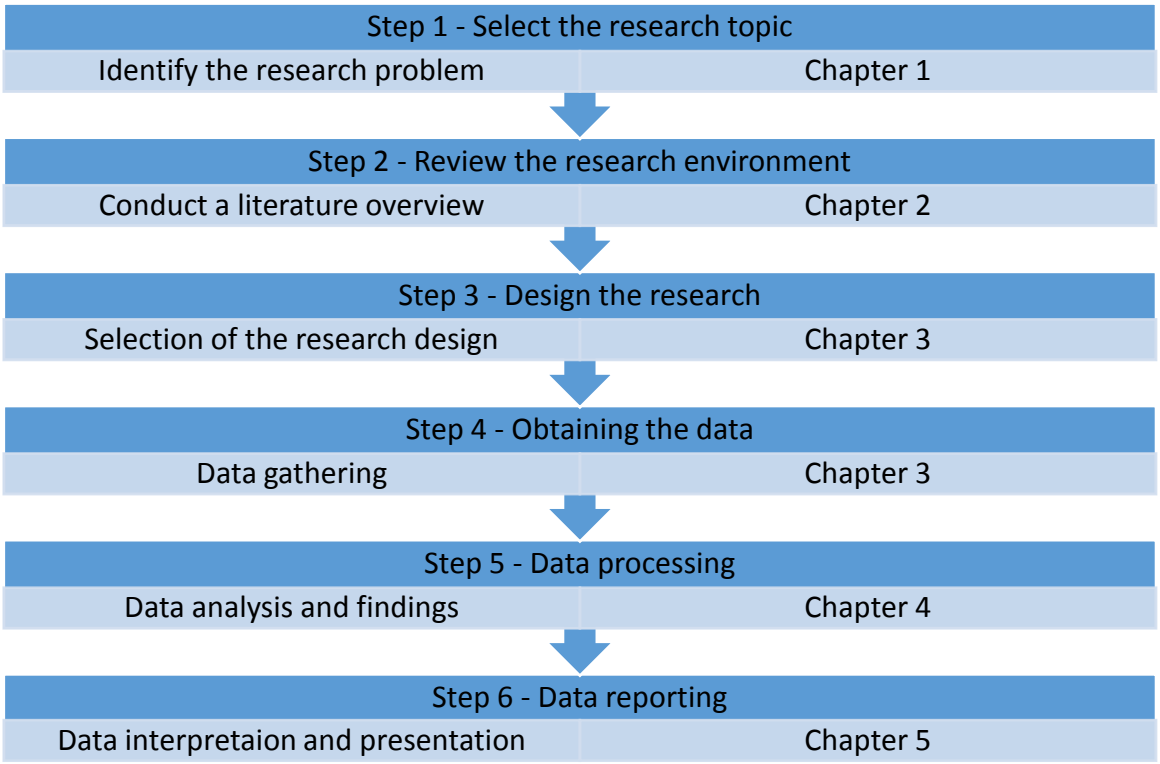

Figure 3.3: The research process

Source: Adapted from De Vos *et al.*, (2011:70)

The research process started with the identification of the research problem (Chapter 1, Section 1.7). In step 1, a research question was identified to resolve the research problem and to make recommendations. In order to fully resolve the research problem, the researcher gathered information through an exploratory literature review in step 2 (Chapter 2). Then the research design, step 3, was conducted (Chapter 3), followed by step 4, data gathering (Chapter 3). Step 5 consisted of data processing and findings (Chapter 4) and lastly, step 6, included data interpretation and presentation of the findings (Chapter 5).

3.5 RESEARCH DESIGN

A research design should lead the researcher to answer the research question (Patton, 2015). There are various research designs.

Qualitative research encompasses generic research designs (descriptive, contextual and exploratory) with certain characteristics that guide the research design. Table 3.2 summarises the generic research designs and constructs a research design for this study.

Table 3.2: Generic research designs

Dimension	Exploratory	Descriptive	Contextual
Focus	Exploring a situation, phenomenon, community or individual – "what?" May be the first stage in a sequence of studies	Describing the specific details of a situation, setting, participant(s) or phenomenon – "how" and "why"	Understanding events, actions and processes in terms of its immediate context
Data collection	Text or image data Interviews/observations Relatively small sample size	Text or image data Interviews/observations Relatively small sample size	Text or image data
Data analysis	Thematic analysis; open inductive / deductive coding	Thematic analysis; involves developing descriptions	Thematic analysis; open inductive coding
Product of the study	Increased insight and understanding in a relatively unknown research area; provides a general picture of conditions and determines meaningful data patterns	Presentation of a picture of the details of the research phenomenon based on deeper meanings, thus leading to thick descriptions; theory	Increased insight into a phenomenon with reference to the environment and circumstances in which the study took place – holistic picture

Source: Visagie, 2014 (a)

The study of the bulk coal export supply chain is exploratory in nature. The study explored the "what" question to determine what the risks were, and what the current risk-mitigating actions applied to the bulk coal export chain were. The balance of the characteristics of the exploratory research design w covered from Section 3.6 onwards.

3.6 RESEARCH METHOD

3.6.1 Role of literature

A literature review was conducted in Chapter 2. The literature review assisted in establishing the research question (Van Zyl, 2014:46) and assisted in establishing the theoretical framework of the study (Merriam, 2015:83).

In qualitative research, one can conduct open-ended interviews and make observations without reading treatises on the phenomenon, but this could potentially lead to an unstructured approach that would not answer the research question (Patton, 2015:371). The literature review can present a quandary in qualitative research, as it can influence bias in the researcher and limit openness for new and emerging data. However, at the same time it can assist in creating interplay to ensure that a saturation point can be reached in interviews with open-ended questions (Patton, 2015:581-582).

In order to avoid bias, the researcher drafted questions for semi-structured interviews (refer to Sections 2.10 and 5.6.2). These questions were tested with an independent qualitative research expert who had no knowledge of the phenomena under investigation. Through a revision of the questions from a non-literature point of view the most important research area did reveal itself (Hallberg, 2010:5387). The role of the literature in this study was not to show that the risk management in the bulk coal export logistic chain is wrong, but to obtain more insight into the SCRM to enable the researcher to ask the appropriate questions (De Vos *et al.*, 2011:301).

3.6.2 Questions

The questions for the semi-structured interview were prepared to obtain knowledge and understanding regarding the risk and risk management processes in the bulk coal export logistic chain (De Vos *et al.*, 2011:308). As an instrument of the data gathering method, the role of these questions was to enter the world of the participant to extract the data for the research (Merriam, 2015:88). The questions in the semi-structured interview were constructed in a broad sense to address the research question (Creswell, 2013 (a):160). Figure 3.4 depicts the question-review process that was followed to ensure that the research data is non-biased and fulfils the requirements for questions that will answer the research question, in depth.

Figure 3.4: Question review process

Source: Developed by author (2016)

3.6.3 Data sample and collection

The type of research would dictate the type of data and sample size required (Van Zyl, 2014:268). To explore and obtain rich information and deep insight into the risks and risk-mitigating strategies of the bulk coal export logistic chain, saturation is required (Beitin, 2012:245). Data saturation means the point is reached when there is enough information to replicate the study, when the ability to obtain additional new information has been attained, and when further coding is no longer feasible (Fusch, P.I. and Ness, L.R, 2015:1408). The sample taken from the Channel Oversite Team (COT) assures different perspectives and insight from different positions or parts of the bulk export chain, thus taking all perspectives into account before saturation was reached (De Vos *et al.*, 2011:350).

There are various instruments that can be used for qualitative data collection. The instruments range from open-ended narratives, check lists, field guides to interviews (De Vos *et al.*, 2011:335). Merriam (2015:18) includes documentary data and observation into the qualitative data-collection method. In this study, two of the data-collection instruments were utilised. Primary data was collected through semi-structured interviews and the data for triangulation was obtained from a two-step thematic content analysis of the risk management policies and procedures (inclusive of the risk register) of the companies that participated in the study.

3.6.3.1 Sample for data collection

The sample of interviewees or participants was selected from the COT that represents the bulk coal export logistic chain. The sample should in all relevance represent the world of the phenomena in study (Beitin, 2012:249). The COT represents sources from different positions in the bulk export chain, including Coal Exporting Parties, Transnet Freight Rail, Transnet Commercial, RBCT an a consultant. The group of participants included senior managers, general managers and operational managers with 5 to 20 years' experience. For this study, the number of participants was a minor concern, but the ability of the participant to contribute to the body of knowledge was a major concern (Merriam, 2015:105).

A multi-perspective approach to contribute to the richness of the data (Beitin, 2012:249) combined with a purposive sampling approach (Patton, 2015:598) was followed to ensure the theoretical saturation.

For this sample, (i) three participants from the CEPs (junior miner, international mining company and one black-owned mining company) were selected; (ii) two representatives from Transnet Freight Rail; (iii) two representatives from RBCT; and (iv) an external consultant who worked with the mining houses on the Richard Bay Coal Line to manage the coal exports. The advantage of this purposive sampling from the COT lies in the potential for information richness (Patton, 2015:599).

Figure 3.5 depicts the purposive sampling methodology in terms of the integrated bulk coal export logistic chain.

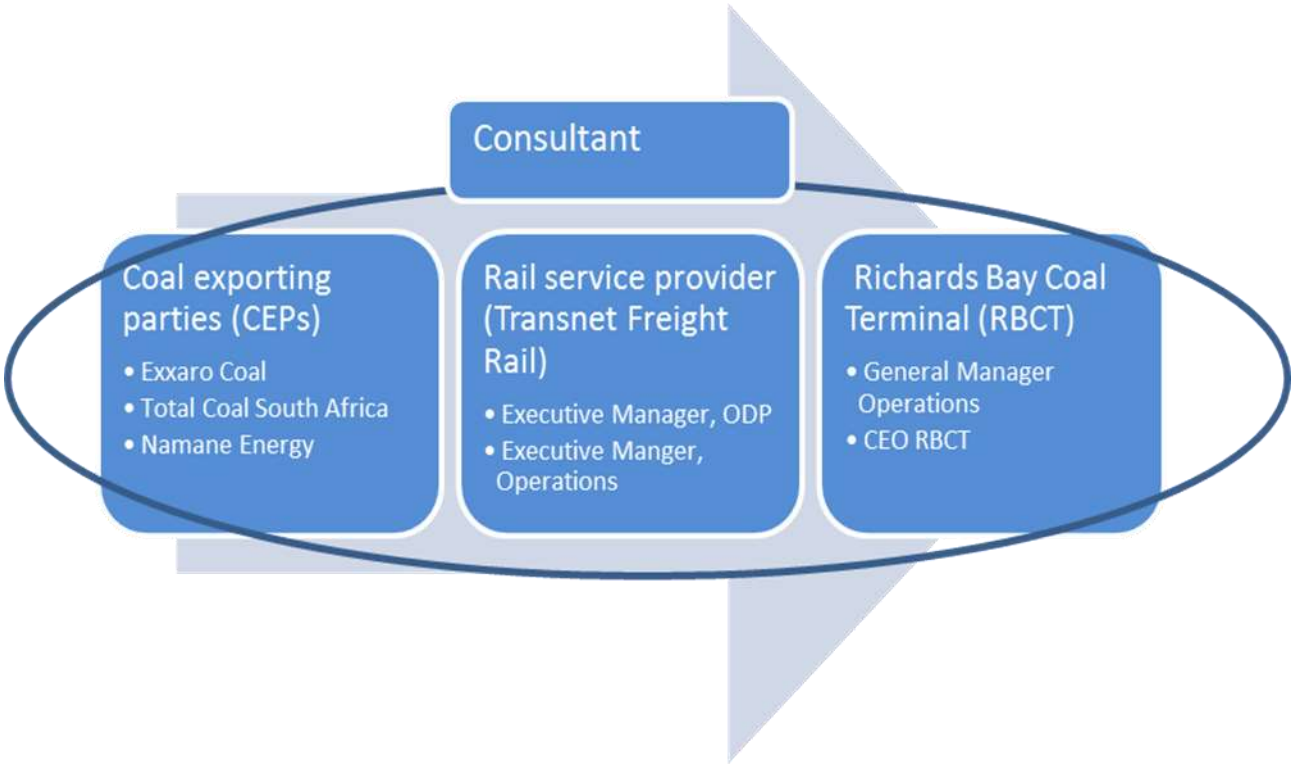

Figure 3.5: Purposive sample selection

Source: Developed by author (2015)

3.6.3.2 Data collection

Semi-structure interviews

Primary data was collected through a semi-structured interview with participants from the sample group (De Vos *et al.*, 2011:342). A semi-structured interview was chosen to explore and understand the complexities of the risks and risk management processes in practice in the bulk coal export logistic chain (Merriam, 2015:17). The semi-structured interview also provided the opportunity to obtain first-hand

information and obtain a broader response by following up with prompting questions (Van Zyl, 2014:199). Although an effort was made to keep interviews to less than an hour each, no time restriction was placed on the interview, and the participants were consequently granted the opportunity to elaborate on the questions without any restriction (De Vos *et al.*, 2011:345-346).

The interviews were recorded for later transcribing and thematic content analysis (Van Zyl, 2014:200). Field notes were made for later review, data verification and clean-up and to supplement the interview process (Corbin and Strauss, 2014:218).

Documentary data

A two-step *content analysis* was done on the risk management policies and procedures of the participating companies. Firstly, the policies and procedures were inductively analysed (with an open mind) to identify codes and themes. Secondly, a deductive content analysis (with themes identified through the analysis of the interviews) was done. The data extracted from the policies and procedures (document source) was used in establishing the trustworthiness of the data (Section 3.7 onwards).

3.7 ESTABLISH TRUSTWORTHINESS

This section reviewed the 'Truth Value', a concept and construct relevant to a qualitative study, to establish the quality of the research study (De Vos *et al.*, 2011:419). Various researchers have reviewed the concept of quality assessment and the concept of trustworthiness (rigour and authenticity) within the research process, and transferability is hailed as the prominent criteria for quality testing (De Vos *et al.*, 2011:420). Sousa (2014:213) focuses on the trustworthiness of the process, and in line with De Vos *et al.* (2011:420) argues that the research process that was followed, should be described to the reader to establish the quality of the study. De Vos *et al.* (2011:422) concluded by recommending that great care should be taken to describe in detail the data analysis and the steps taken in data analysis to establish trustworthiness. To establish trustworthiness this study reviewed credibility (Merriam, 2015:234), transferability, dependability and conformability (De Vos *et al.*, 2011:420)

3.7.1 Credibility

Credibility is the process that establishes that the findings that were made were verified and the realities of the findings cannot be interpreted in multiple ways (Goffin *et al.*, 2012:806). Credibility can further be increased by using multiple sources to verify the data. This is done through triangulation (Patton, 2015:1446).

During the interview an interview guide was used to ensure that the relevant data was obtained from the participant. An audio recording was used to capture the full detail of the interview and this recording was transcribed verbatim by an external specialist in the field (Appendix F). To ensure that the interview process conforms to the relevant quality required by qualitative measures, the first interview audio recording was send to a qualitative research expert to review and provide quality approval (Appendix G) (Creswell, 2013(b):274).

After the transcription of the interviews by the transcription specialist, the transcribed manuscript was reviewed by comparing the written data to the audio recording, in order to ensure that the transcription was done correctly. The mistakes in the transcriptions were corrected prior to data analysis. The transcribed data was reviewed against the field notes to supplement and ensure that the interpretation was correct. Triangulation was introduced to increase the credibility of the data in the research (Patton, 2015:264). Section 3.7.5 will elaborate on the process.

The data analysis process uses statements with verbatim quotes from the participants.

3.7.2 Transferability

Transferability refers to the ability to transfer the knowledge and results from a study to another phenomenon of the same nature through generalisation. Although the context of two phenomena cannot be identical, the understanding of the context will justify the transferability (Goffin *et al.*, 2012:806). The research method, data collection and analysis of this study are discussed in full detail to ensure transferability to such other research phenomena. The research methods, data collection and data analysis processes are founded on literature and are well established. To ensure further transferability, all the interviews are recorded, and the

transcribed documents of the interviews and the analysis documents and processes are available to create an audit trail.

The questions used in this study are derived from literature as reflected in Sections 2.10 and 3.6.2 and these questions build on the relevant literature (Rubin and Rubin, 2011:69).

3.7.3 Reliability and dependability

Reliability refers to consistency in results (Merriam, 2015:220), rendered by the processes and procedures that were followed. In evaluating reliability, all the stages of the research process are under review (Goffin *et al.*, 2012:806). In qualitative studies a dependable audit should be kept that outlines transparency and traceability.

To increase the dependability of this study, the researcher kept a record of all the decision-making events that were undertaken in the field work and the research process. This included recordings of interviews, field notes and all the relevant documentation of the study. This record keeping will provide an auditable trail and transparency that will increase the dependability of the research process (Patton, 2015:1472).

3.7.4 Conformability

Conformability assures that interpretations of the data are not merely figments of imagination, but are drawn from logic, non-prejudiced and are free of researcher bias (Goffin *et al.*, 2012:806).

Through triangulation and record keeping the conformability of the research was established (Patton, 2015:1472).

3.7.5 Triangulation

Triangulation is the process of using multiple sources of data and/or multiple sources of approaches to analyse the data to enhance the credibility of the research (Hastings, 2010:1538). Triangulation can be done in various manners and includes triangulation of data, of investigators, of methods and of theory (Torrance, 2012:113).

The researcher used triangulation as an approach to evaluate the outcome of the study and to increase the validity of the study (Sousa, 2014:212). Data triangulation in this study was done through the analysis of the interviews with the participants and the documentary analysis of the participants' company risk management policies and procedures. Through triangulating the two sets of data, the researcher could obtain a complete overview of the phenomenon (Merriam, 2015:216). (The inductive thematic analysis and deductive analysis were outlined in section 3.6.6.2 above). Figure 3.6 depicts the data triangulation process that was used in the study to increase credibility.

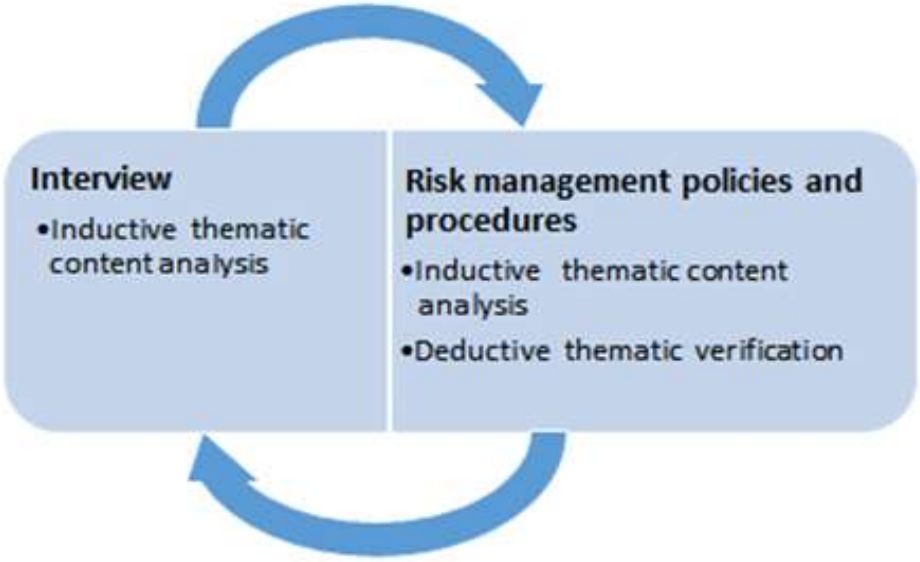

Figure 3.6: Triangulation process

Source: Compiled by author (2016)

3.8 DATA ANALYSIS

The purpose of qualitative data analysis transforms data into findings (De Vos *et al.*, 2011:397). A volume of raw data is reduced through a process and a search for patterns and trends to bring order and structure to a mass of collected data (Merriam, 2015:29). There are multiple methods to analyse data (De Vos *et al.*, 2011:400). A thematic content analysis was used in this study to understand the phenomena and to answer the research question (Visagie and Maritz, 2013:9). The data analysis for this study followed the process as depicted in Figure 3.7

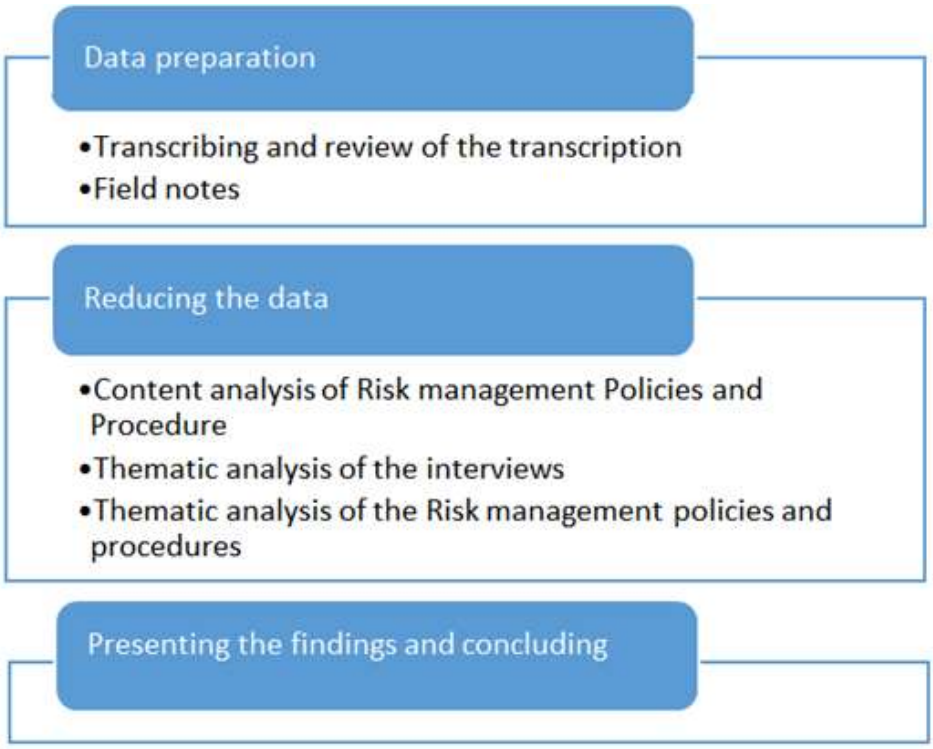

Figure 3.7: Data analysis process

Source: Compiled by author and adapted from De Vos *et al.*, (2011:403-404)

3.8.1 Data preparation

Data preparation was important and reprented the start of the learning nuance (Smith and Firth, 2011:56). A well-prepared and thorough data-preparation process did further contribute to the validity of the research (Elo *et al.*, 2014:2).

3.8.1.1 Transcribing the audio recordings and reviewing the transcripts

The data was transcribed from the recorded interviews. Transcribing is the process where the recorded audio tape is transformed to written data. A recorded interview possesses the advantage that all the detail that could have been conveyed was captured and a verbatim transcript will provide the full and richness of the information (Merriam, 2015:110). For this study, the transcribing process was outsourced to a professional transcriber (see Appendix F). By outsourcing the transcription, researcher bias is avoided and a peer check is accomplished to increase the trustworthiness of the data (Elo *et al.*, 2014:4). To ensure correctness of the transcriptions the researcher listened to the interviews and compared the transcriptions. Any errors were corrected.

3.8.1.2 Field notes

The researcher took field notes which were used to supplement the data. The field notes included observations about the participants' demeanour and were seen as additional data for analysing the transcripts (Patton, 2015:858-859). After reviewing the transcriptions, the field noted were reviewed to supplement the transcribed data where important data was revealed (Merriam, 2015:131). The field notes assisted in identifying possible coding (Patton, 2015:78).

3.8.2 Reducing the data

The reduction in data in this study was established in three process steps.

- An inductive content analysis was done of the risk management policies and procedures of the participants' companies. Themes were extracted through the content analysis (De Vos *et al.*, 2011:384).
- A thematic analysis was done of the transcribed interviews. An inductive approach (with an open mind) was taken whereby the data was split into phrases and sentences (Schulz, 2012).
- A deductive content analysis was performed on the policies and procedures by using the themes, categories and codes identified during the thematic analysis of the interviews. The data of this process was used to ensure trustworthiness through data triangulation (Schulz, 2012).

3.8.2.1 Content analysis of the risk management policies and procedures

The participants in the interviews provided copies of the risk management policies and procedures (inclusive of the risk register) of their respective companies for content analysis. The data was thematically analysed through an open coding system. An inductive approach was followed where the main aim was concerned with generating new theory, with the use of the research question to narrow the scope of the investigation and research (Gabriel, D.2013). Figure 3.8 indicates the inductive open coding system that was used.

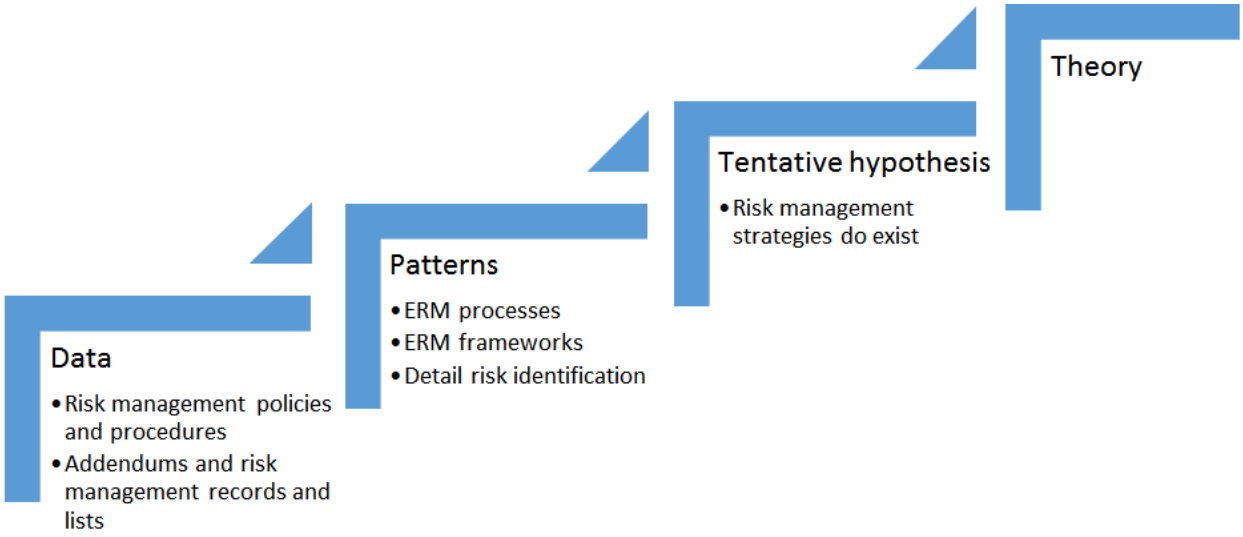

Figure 3.8: Inductive content analysis of risk management policies and procedures

Source: Adapted from (Schulz, 2012).

3.8.2.2 Thematic analysis of the transcribed interview data

From the transcribed interviews a thematic analysis was done. Thematic analysis is the process whereby data is used to identify and reporting patterns and themes in data (Boyd, 2013). The analysis required the recognition of codes for the patterns and themes (Patton, 2015:1178). Codes can be described as features that were identified and appeared interesting to the researcher (Boyd, 2013). The sentences and paragraphs were extracted and explored, to link meaning to the data (Visagie(b), 2014). These meanings were categorised to form later themes.

Table 3.3 reflects the thematic map that was established from the transcribed interviews.

Table 3.3: Thematic map of the interviews

Theme	Category	Code
Theme 1 **Infrastructure (Section 4.2.1)**	4.2.1.1 Infrastructure investment – Growth	capital, infrastructure, growth, investment
	4.2.1.2 Infrastructure investment – Maintenance	capital, infrastructure, maintenance
	4.2.1.3 Infrastructure – Ageing	infrastructure, ageing
	4.2.1.4 Technology	Technology
	4.2.1.5 Overvaal tunnel	Tunnel

Theme 2 **Macro-economy (Section 4.2.2)**	4.2.2.1 Macro-economy of coal commodity	economy, commodity, market, price, future of coal
Theme 3 **Uncontrollable events of nature (Section 4.2.3)**	4.2.3.1 Nature	weather, water
Theme 4 **Disruptions and risk that occur in operations and management (Section 4.2.4)**	4.2.4.1 Aligned vision amongst stakeholders in chain	Alignment
	4.2.4.2 Communication	communication, information, transparency, sharing
	4.2.4.3 Electricity supply	Eskom power
	4.2.4.4 Operational Management	operations, equipment,
Theme 5 **People skills, labour and social impact (Section 4.2.5)**	4.2.5.1 People skills	skill/s, knowledge, expertise, people, succession, transfer, old, groom
	4.2.5.2. Labour and social impact	community, political, labour, strikes

Source: Compiled by author (2016)

Chapter 4 elaborates in detail on the data analysis and the findings of the thematic analysis based on the thematic map.

To introduce rigour to the thematic analysis, cross-referenced codes from the field notes were introduced (Fereday and Muir-Cochrane, 2006:83).

3.8.2.3 Deductive thematic analysis of the risk management policies and procedures

The data from the risk management policies and procedures can be grouped into two different levels of information. The one level is strategic in nature with holistic themes, and the other level is detailed and operationally inclined (policy and procedures versus the detail annexures and risk management registers). To ensure rigour in the triangulation process, a deductive analysis was done on the policies and procedures (Fereday and Muir-Cochrane, 2006:84). The deductive process was

used in the thematic analysis of the policies and procedures to test the theory that was derived from the interview data (Gabriel, D, 2013). The deductive process used in the thematic analysis of the policies and procedures is depicted in Figure 3.9.

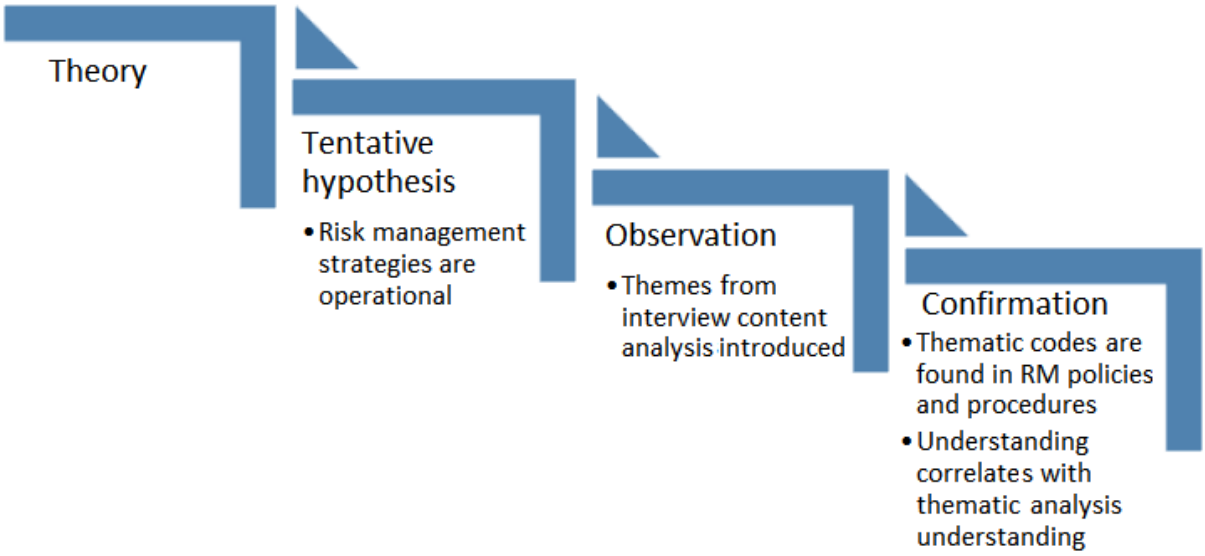

Figure 3.9: Deductive thematic analysis of risk management policies and procedures

Source: Adapted from (Schulz, 2012).

3.9 SUMMARY

The researcher used a qualitative approach to answer the research question of the study: *What are the current risk management approaches in the bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain?*

The researcher used interviewing with a thematic analysis to obtain the primary data for the study. A second set of data was obtained from a content analysis of the risk management policies and procedures (including annexures and risk management registers), in addition to the theory from the literature study. The purposive sampling method ensured that the information from the data is rich, insightful and pertinent to answer the research question.

The research design was developed to offer the researcher the opportunity to uncover the risks and the risk-mitigating practices in the bulk coal export logistic chain and to develop an integrated approach to risk management.

3.10 CONCLUSION

This concludes the discussion on the methodology that was used in the study to answer the main research question. In Chapter 4 the data analysis and findings will be discussed.

CHAPTER 4: DATA FINDINGS AND ANALYSIS

4.1 INTRODUCTION

The objective of this study was to explore and describe the current risk management approaches of the stakeholders in the bulk coal export logistic chain that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain. Chapters 1 and 2 of this study covered the research question, the study objectives and reviewed the literature to explore risk and risk management in supply and logistic chains in general and the bulk logistic chain in particular. Chapter 3 described the methodology that was followed to conduct the research, the sample population and how the data was analysed. In this chapter the data findings and overall data analysis of the study will be discussed.

Semi-structured interviews were conducted with stakeholders in the bulk coal export logistic chain. The participants interviewed were mainly operational managers in a bulk logistic chain and constituted service providers as well as coal exporting parties. A total number of eight participants were interviewed, with six of the participants being male and two female. All the participants are current members of the Channel Oversight Team (COT).

The data was collected by means of semi-structured interviews. A total time of 356 minutes was spent on conducting the interviews with an average of 45 minutes per interview. All of the participants contributed and shared their knowledge with enthusiasm. Field notes were taken during the interviews to ensure the correctness of the interpretation during the transcription, and the transcriptions were reviewed for inconsistencies and corrected.

4.2 FINDINGS

This section present the findings according to the thematic analysis of the interviews and the content analysis of risk management policies and procedures.

The participants all reflected a broad-based knowledge of risk management and the risks in their environment. The data from the interviews ranged from strategic risk management inputs to tactical and functional risk inputs. The data gathered from participants on certain themes did not differ significantly from participant to

participant, but it was found that the participants from the service industries (Transnet and Richards Bay Coal Terminal) were more concise in identifying the risks, mitigating actions and proposed solutions than the participants representing the coal exporting parties (CEPs).

Data obtained from the content analysis of the documents of the various companies (of the participants), ranged from broad encompassing policy statements up to detailed risk matrixes that are managed on a tactical level. The data derived from the risk policies and procedures was used to triangulate the thematic findings of the interview data.

Table 4.1 summarises the thematic data analysis of the interviews in the form of a thematic map comprised of themes, categories and codes, and these themes, categories and codes are discussed in more detail in the sections that follow.

Table 4.1: Thematic map (themes, categories and codes)

Theme	Category	Code
Theme 1 **Infrastructure (Section 4.2.1)**	4.2.1.1 Infrastructure investment – Growth	capital, infrastructure, growth, investment
	4.2.1.2 Infrastructure investment – Maintenance	capital, infrastructure, maintenance
	4.2.1.3 Infrastructure – Ageing	infrastructure, ageing
	4.2.1.4 Technology	Technology
	4.2.1.5 Overvaal tunnel	Tunnel
Theme 2 **Macro-economy (Section 4.2.2)**	4.2.2.1 Macro-economy of coal commodity	economy, commodity, market, price, future of coal
Theme 3 **Uncontrollable events of nature (Section 4.2.3)**	4.2.3.1 Nature	weather, water
Theme 4 **Disruptions and risk that occur in operations and management (Section 4.2.4)**	4.2.4.1 Aligned vision amongst stakeholders in chain	Alignment
	4.2.4.2 Communication	communication, information, transparency, sharing
	4.2.4.3 Electricity supply	Eskom power
	4.2.4.4 Operational	operations, equipment,

	Management	
Theme 5 **People skills, labour and social impact (Section 4.2.5)**	4.2.5.1 People skills	skill/s, knowledge, expertise, people, succession, transfer, old, groom
	4.2.5.2. Labour and social impact	community, political, labour, strikes

Source: Compiled by author (2016)

4.2.1 Theme 1 - Infrastructure

Theme 1 reflects infrastructure and the concern the participants displayed regarding the infrastructure. Although the infrastructure was the most predominant theme, the infrastructure theme had categories that featured very predominantly. Table 4.2 reflects on infrastructure as a theme and the categories in the theme. Infrastructure risk is a source of risk that can materialise from a disruption in the infrastructure that the firm maintains for their supply chain (Wagner and Bode, 2008:310).

Table 4.2: Theme 1 – Infrastructure

Theme	Category	Code
Theme 1 Infrastructure (Section 4.2.1)	4.2.1.1 Infrastructure investment – Growth	capital, infrastructure, growth, investment
	4.2.1.2 Infrastructure investment – Maintenance	capital, infrastructure, maintenance
	4.2.1.3 Infrastructure – Ageing	infrastructure, ageing
	4.2.1.4 Technology	Technology
	4.2.1.5 Overvaal tunnel	Tunnel

Source: Compiled by author (2016)

The analysis of the policies and procedures indicated that infrastructure is a risk and forms part of the risk management process. There are noticeable differences in the data obtained from the service suppliers' policies and procedures and the CEPs' policies and procedures. Infrastructure, as a theme in the service supplier policy, tended to have a more general focus. The risk register matrix of one of the stakeholders in the bulk coal export logistic chain indicates that there is a focus on

the management of infrastructure risk. The infrastructure risk categories (and codes) are further discussed below.

4.2.1.1 Infrastructure investment – Growth

a. **Infrastructure** – Growth requires the extension of infrastructure in terms of creating capacity for transport volume or adding additional product volume to exports. A lack of infrastructure extension was a concern for half of the participants and this was more prominent from the CEPs' perspective than from the service providers. Capital spend in infrastructure is required to ensure future growth, without which the future of the total system is at risk:

"And I was unfortunate to pick up one of those cycles where there was no money to reinvest in the operation, which naturally then puts the whole system at risk, not only the operations but the future of the whole system. And you know really, I think at the point in time we sit right now, there's a huge, huge problem that they're going to halt investment or not invest either in a new expansion, expansion in capital which they've already made those kind of noises that it's not going to happen."

The growth sub-theme reflected the concern that capital might be

- **misspent:**

"If I summarise that, the long term planning and communication poses a risk as the preparation and planning for infrastructure might not be aligned."

- **not spend at all:**

"So I do believe there is going to be a major crunch on capital which is a risk, which means then that if we could develop infrastructure, remember it is in dollars, it does not matter what anybody says, the company is doing the project work, the equipment that is being used etcetera, everything is actually dollar denominated. They won't be able to spend that capital, which will press back or push back the infrastructure programme of a lot of companies."

"I mean the future of South African coal lies in the Waterberg and obviously that line needs to be capitalised but that's also back to who is going to invest in South Africa."

- **not aligned to the growth strategies of the commodity:**

"So once again, if we're going to increase the traffic, in a pace, yes from a strategic point of view I know they want to move GFB [general freight business] traffic away from the coal line, but the risk for me in this is if our timing is not going to be spot on with regards to export traffic increasing and the timing that they want to move the GFB traffic away…because I know from a capital perspective they are moving our capital projects on, it is going to bite us and that is a concern for me as well."

b. **Mitigation** − One of the proposed mitigating remedies from the data is that through engagement between CEPs, and obtaining the support to consolidate infrastructure use from TFR, RBCT and the Government, efficiency and optimisation can reduce the pressure to expand the current inefficient infrastructure in order to accommodate growth:

"And it cannot, it's not sustainable in the way that it's sitting right now. You need to change the whole landscape and people need to open their minds and literally welcome the support and the input from the other places and recognise that there are some best of breeds, and best of expertise in each one of the parties. And by doing that you'll find you'll be able to reduce, significantly I believe, on the expansionary capital, or you know, effectively manage it. So now is the time that they should be investing in latest technology and making assets, making the system as efficient as possible, which may mean that ultimately that you don't need expansionary capital, but you need sustaining capital and you obviously need maintenance."

"It is capital, but it is all about how well you move a product, say from a new mine, I think there is a lack of cooperation in the industry to consolidate infrastructure and I think it's the only way that we will see the coal industry being able to move forward if there is some consolidation because at the moment it is so hard to consolidate anything and that to me poses a great risk."

Conclusion − The conclusion with regard to this section is that growth is required, but should be done in a coordinated balance with the coal commodity (price and demand) cycle and coal mining capital investments in mind. Further the

infrastructure-growth risk can be alleviated by technology, infrastructure efficiency and sharing of un-optimised infrastructure.

4.2.1.2 Infrastructure investment – maintenance

a. **Infrastructure – maintenance**: The data obtained from the participants displays that the service providers, as well as the coal exporting parties, viewed infrastructure investment in the form of maintaining the infrastructure as a risk. Capital investment towards maintaining infrastructure is required.

> *"As well as then sustaining capital, which is the more critical component and then on a day to day basis of the maintenance, so you're going to find them starting to try and save money which will then naturally put the whole system into jeopardy".*

The category infrastructure investment – maintenance is closely related to the category infrastructure – ageing. From the data one will find that maintenance (replacing TFR rolling stock and RBCT operating equipment) and ageing are almost used interchangeably, and infrastructure maintenance (replacing components) is used as a "risk mitigating" solution.

> *"Just to recap, ageing infrastructure, the actual railway line, and RBCT's equipment in terms of their stackers, re-claimers, tippers, these are huge, huge machineries that requires a huge amount of capital expenditure to replace."*

> *"Um I would hazard a guess, one of the biggest risks I see in, in the South African coal value chain is probably the rail infrastructure and I mean here the fixed lines and the overhead electrification and the long distances between mining operations and port um I think the number of bridges that we have along this value chain is, is probably one of the concerns to me specifically bearing in mind this coal value chain has been going since the early nineteen seventies.". "So my view would be although infrastructure and rolling stock being a big part of that infrastructure it, it's my view that that has been fairly well mitigated from a risk point of view where we sit at this stage."*

b. **Mitigation** − To manage this risk, the research study data indicated that a review of the capital-spend and alignment between where and when it should be spent can contribute to the reduction in risk.

"Then also this is now the risks that I didn't want to mention, but maybe I should, but on the next question I can mention that, but also for me you know is that we will start having…you have a focused view you know and we can also reverse that then back to our strategic department to say, hey you know what? … stop that capital or stop that, because our demand is not going come for the next two or three years we can do without the capital and that will help the business from not spending unnecessary capital now."

"….which may mean that ultimately that you don't need expansionary capital, but you need sustaining capital and you obviously need maintenance."

This infrastructure – maintenance category codes, are also related to the category of technology and operations and management.

Conclusion − In summary, the conclusion can be made that in the infrastructure investment category – *maintenance*, there is a risk if no capital investment is acquired to maintain or replace infrastructure (capital equipment, rail line upgrade and TFR locomotives).

4.2.1.3 Infrastructure – Ageing

a. **Age and ageing infrastructure** − as a risk, was reflected by most of the participants in the study. The extent of age and ageing was not stated explicitly by all the participants. However, some participants acknowledged ageing as a minor risk, while others regarded it as a major risk.

"The biggest risk that I identify at the moment is ageing infrastructure."

"Um and you know the nature of the terminal, the nature of the terminal being used as a, as a stock piling area, um you obviously got the risk associated with the availability of that plant and whether or not that plant is in operation what the up-time is, etcetera, together with again similar to the rail infrastructure, that the terminal where its, it's almost forty years old, um I think the risk to a large extent is being mitigated currently in the sense that there are very key um replacement plans in place for ageing infrastructure, um again linked to legislative reporting, less fact of requirement, statutory obligations, and one would have to assume that from most of the infrastructural requirements,

whether it would be at mine, rail side or terminal that all of those have to comply with road statutory type inspections."

b. **Mitigation** − The risk of ageing infrastructure can be mitigated and managed through capital replacement.

"… um I think the risk to a large extent is being mitigated currently in the sense that there are very key um replacement plans in place for ageing infrastructure,

It is noted that this category - *ageing* was shared amongst service providers and coal exporting parties on an equal base.

Conclusion − In summary, the category infrastructure – ageing was identified as a data code that has a moderate impact but can be mitigated through re-capitalisation.

4.2.1.4 Infrastructure − Technology

Technology risk refers to the changes in technology that should support the flow in the supply, and increase efficiency and caution disruption (Wagner and Bode, 2008:310). Furthermore, the technology risk also refers to the information technology (IT) processes and systems that support the operational execution on a day-to-day basis that could be at risk of malfunctioning (Macdonald and Corsi, 2013:270).

a. **Technology** − was identified by three participants from the service industry and two from the coal exporting parties. The manner in which the data was presented indicates that technology infrastructure poses a perceptual lucrative advantage on a strategic level:

"So now is the time that they should be investing in latest technology and making assets, making the system as efficient as possible, which may mean that ultimately that you don't need expansionary capital, but you need sustaining capital and you obviously need maintenance. But just reading journals and listening to what the other systems are doing, the other heavy haul systems around the world, everything is moving to a far more automated environment, with technology being the underpin. And you know, with seriously significant intelligence in this technology."

Technology poses a risk-mitigating advantage but also has a risk-elevating property.

Technology as a risk-mitigating advantage:

“So that we can pick up specific hot spots and you know, become less dependent on manpower and more dependent on technology to manage whatever risks or dangers there are with our ability to run the service.”

Technology's risk elevating properties:

“It is typically your new technology where if the technology is here and that strategy work and we invested money and we bought these locos, now they are here, but where we haven’t done enough homework from an operational perspective.”

“I am concerned ...[laughing] about TFR spending so much capital when we look at what happened in Prasa, I sincerely hope they are not buying the wrong locos, whether they are too tall or too wide. I am concerned.”

“I am not sure if you have got the background that in 2010 we attempted to upgrade it as part of the expansion, you know after a couple of months we had to revert back to the old system, so we have been nursing the old system until now.”

b. **Mitigation** – Tested and tried technology should be used to manage risk.

"…everything is moving to a far more automated environment, with technology being the underpin.”

Conclusion − The summary data from the category reflects that there is the perception that technology is a positive risk management tool on a strategic and tactical level, but in reality, on an operational execution level technology has a contrasting effect, and the result of the effect depends on a secure approach and implementation.

4.2.1.5 Infrastructure − Overvaal tunnel

a. **Overvaal tunnel** − The Overvaal tunnel was recorded as a category of concern by five of the eight participants. These concerns reflect a high risk of total disruption:

"Look, it's a known fact that one of the risks that we have on the coal line is to offload after the tunnel, you know? That seems to be the bottom line of our operation and obviously it impacts, you know, the coal exporter, TFR, RBCT, so definitely you know, I personally think that we should have some plan to sort of bypass the Overvaal tunnel."

The Overvaal tunnel also seems to be a capacity constraint in the system:

"So our timing with regards to increasing the export and moving GFB [general freight business] should be spot on, otherwise we are going to sit with a capacity issue at the Overvaal tunnel."

"The issue is still in terms of risk that if there is more coal, in other words 91 million tons, how are we going to get that through the Overvaal Tunnel?"

b. **Mitigation** − Data suggests that there are risk management actions in progress.

"The Overvaal tunnel from a strategic point of view, they are looking at a second Overvaal tunnel and like I mentioned they are looking at the Swazi link where they are also going to take the traffic away from the coal line, but I think the timing should just be spot on so that we don't increase in such a manner on the export side, while the GFB traffic is still running."

"… because it's the infrastructure and again the higher risk area is the tunnel [Overvaal tunnel], that is the high risk area and the industry try and open the second line although that has been put on hold because of the conditions, the coal economic conditions at this stage."

Conclusion − The Overvaal tunnel presents a major risk as it is the primary feed to Richards Bay. It is also a capacity constraint but there are risk management actions allocated to the category.

4.2.2 Theme 2 – Macro-economy

4.2.2.1 Macro-economy

The data shows that all the participants in this research study elaborated more than once on the influence of the macro-economy of coal as a commodity. The macro-economy of coal also influences the theme of infrastructure in all its categories.

Table 4.3 reflects on the macro-economy of the coal commodity as a theme and the categories in the theme.

Table 4.3: Theme 2 - Macro-economy

Theme	Category	Code
Theme 2 **Macro-economy (Section 4.2.2)**	4.2.2.1 Macro-economy of coal commodity	Economy, commodity, market, price, future of coal

Source: Compiled by author (2016)

The analysis of the policies and procedures indicated that the macro-economy is a risk as far as the coal exporting parties are concerned, and it is relevant and directly described in the risk management policies and procedures. However, the macro-economy of coal is indicated in the policy and procedures of the service suppliers as 'market risk' and is part of the risk management process. The 'market risk' is also a focus of the risk strategy contained in the more tactical risk matrixes (annexures to the risk policy and procedures).

a. **Macro-economy** − From the interview data it is found that the macro-economy theme is the root cause of other themes and risks. Other themes can be referenced as:

Infrastructure

"So when you look at infrastructure if you look at the cost of a siding these days, my goodness you cannot believe how that has increased so massive capital that needs to be spent. Now in a, in an economic and commodity downturn, that we are seeing now, that's a major risk".

"There's one primary risk that dominates now, and that's to do with the future of the coal industry, and the assessment of the service providers, in this case the TFR, around the future of the industry and their level of investment on commitment. So what you find is that at the moment, and this is the second or third cycle that they've been through, where there's been a lack of investment because of the view that they've taken on the market and the players in the market."

Operations

"Theft and vandalism is obviously a result of the economy; you know the root cause is unemployment as a result obviously of various issues."

People

"So root cause not enough skilled resources, and the sub-risk to that as a root, is skills transfer and then obviously risks that are flowing from, which is not a root cause but it is as a result of what is happening in the economy."

b. **Mitigation** − The research data suggested that there should be long-term agreements in place to stabilise the macro-economy on infrastructure, and that ensures revenue and related capital.

" Okay, I would still say long-term agreements to create stability and to mitigate the risk involved in the fluctuating commodity price as well as the fluctuating exchange rates; but also it creates a sense of stability in the mines where they know for a set period they have a dedicated customer that is bound to accept their product. So it makes things easier for them in terms of long-term plans, in terms of capital investments. ".

The short-term macro-economy risk can be mitigated by reducing cost:

"Obviously we manage our cost by reduction of overtime. We also have what we call a variation agreement where we don't allow people to go over eighty hours of overtime a month or work more than twelve hours a day. That is how we manage our costs and then obviously the import control in terms of expenditure, like travel and accommodation, consultancy fees and such things as that, we have specific initiatives that we manage those things and reduce our cost base."

Conclusion − In summary, the theme macro-economy is found to influence various other themes such as infrastructure, people, operations and management.

4.2.3 Theme 3 – Uncontrollable events of nature

4.2.3.1 Uncontrollable events of nature

From the data, it is seen that five participants shared the concern about the theme uncontrollable events of nature, and specifically, droughts and the availability of water. The participants acknowledge the uncontrollable nature of this data element.

Weather and weather conditions, as such, are an external risk factor that should be considered and managed (Schmidt and Raman, 2012:10).

Table 4.4: Theme 3 - Nature

Theme	Category	Code
Theme 3 **Uncontrollable events of nature** **(Section 4.2.3)**	4.2.3.1 Nature	weather, water

Source: Compiled by author (2016)

The analysis of the policies and procedures indicate that uncontrollable events, such as natural disasters, are encapsulated in the risk management policies and procedures on a strategic level. The risk refers to natural disasters and *force majeure* events. There were no specific focused risk management processes to address the natural or environmental risk.

a. Uncontrollable events of nature

"And I think as we go on from now, we are here in 2015, in the next 5, 10 years it could be challenging because weather patterns we identified as a risk, and our – I mean here, and the world, is just like heating up and you know, the drought."

"Look in terms of integrated risks at this stage I think probably you know one of the critical failures or one of the critical risks facing industry throughout the country is really water. I think just to, just to note that from an environmental management point of view. Um but no, I think that's pretty much it."

"So, you need water to wash your coal, so to get the coal specifications right for the end user, you need to wash the coal, and you need water, and the thing is, how do mining operations or even RBCT for that matter, manage the water available to them?"

b. **Mitigation** - The research data indicates that the water risk is managed and mitigated by operational risk-mitigating measures.

"So yes we manage the dams, we manage the ponds, we manage you know, the tap water. And we need to think about where, as mining operations going

forward, we recycle that water many times, but mining operations do manage that risk."

Conclusion − In summary, water as a derivative of uncontrollable events of nature and weather patterns pose a risk to the coal mining industry in terms of their production. Without product (coal) moving the bulk coal export logistic chain becomes obsolete and with the increasing weather changes (droughts) the risk is becoming a reality. Currently, the risk is managed by a water recycling process. However, the extent to which this mitigates the full extent of the risk is unknown.

4.2.4 Theme 4 - Disruptions and risk that occur in operations and management

All the participants in this research study elaborated in more than one data description on the operational and management theme. From the data, the theme is affected by other themes and displays in certain data as a symptom of another theme in the research. The theme presented various categories as indicated in Table 6.5. Risk that stems from demand or supply and cost factors which are always present in the logistic chain can be defined as operational risks (Mandal, 2011:70).

Table 4.5: Theme 4 – Operations and management

Theme	Category	Code
Theme 4 **Disruptions and risk that occur in operations and management** **(Section 4.2.4)**	4.2.4.1 Aligned vision amongst stakeholders in chain	alignment, process knowledge, objectives, goals
	4.2.4.2 Communication	communication, information, transparency, sharing
	4.2.4.3 Electricity supply	Eskom power
	4.2.4.4 Operational Management	operations, equipment, operational risk

Source: Compiled by author (2016)

The analysis of the policies and procedures of the various stakeholders that participated reveals that operational and managerial risk is present on strategic and tactical levels. The policy and procedure analysis further provided evidence that daily operational and managerial risks are recorded. The analysis indicated that communication in terms of risk management systems, reports, committees and

scheduled meetings are part of the risk management processes. Data indicated that operational risk management tends to focus more on the specific stakeholder and not the integrated value chain.

4.2.4.1 Aligned vision amongst stakeholders in the chain

a. The data in this category revealed that no alignment exists in the objectives and goals of the different stakeholders and this divergence in the chain contributes to risk. Half of the participants view this as a risk.

> *"But because of the way again, it gets back to the fact of there's divergent, I think there's divergent views at the moment, around where, generally, where the industry is going, so I think at those levels the operational risks are probably raised and are probably understood, but I don't think those current processes and governance structures effectively deal with what comes out or what is input by the various people."*

> *"Um so you know looking at it from an integrated point of view and the risks, I, I do, I do think one of the biggest risks that we face in this industry is misalignment of ultimate objectives." Um however even, even with all those good intentions from an industry point of view we, we ran into a complete misalignment where Transnet was from a port point of view the, the money was spent the infrastructure was put in place. From a terminal point of view in CEPs and private sector it was put in place, mines were built, mines were canned, but that critical link in between the rail, that just ground to a grinding halt, in fact it, it detracted and deteriorated in terms of performance."*

> *"So I think one of the big risks that the value chain faces is um a common understanding and a common objective of what the goals, and the principles are in terms of optimal utilisation of infrastructure from a mine point of view through to your rolling stock point of view um and again that filtering back into the coal terminal. So you know if the alignment in terms of that process, in terms of how those resources need to utilised and basically the effectiveness of that".*

b. **Mitigation** - From the data presented, it became clear that an acknowledgment of all stakeholders' positions in the bulk coal export chain, including the

'sensitive' and critical nodes or drivers of the processes, can assist in the mitigating of risk.

"Um not, not necessarily again, and I come back to the fact that Transnet cannot manage the mine's business, Transnet cannot manage the terminal's business, but Transnet needs to understand the levers in each of the various cycles, just like the CEP's need to understand the levers within the Transnet cycle and RBCT needs to understand those levers as well, so that we have a clear appreciation for the impact that our actions or lack of actions can have on the total value chain."

The data reflects that alignment is required at various levels of interaction, but misalignment was found on both strategic and tactical levels. The risk of misalignment results in the deterioration of performance and capacity reduction. However, understanding the total bulk coal export chain, including the relevant drivers, can assist in mitigating the risk.

4.2.4.2 Communication

a. In the research six of the eight participants reported that a lack of communication is a source of risk. The code – 'communication' includes information that is not shared or the lack of transparency. The category 'communication' is often found in relationship with other themes and can be the root cause of risk that manifests in other themes. From the data relevant to this category, 'communication' can be regarded as an operational tool to reduce risk:

   "So if I can summarise that, information communication flow can be improved between those parties. Exactly, and that will prompt quick decisions. Critical decisions."

   "If I summarise that, the long term planning and communication poses a risk as the preparation and planning for infrastructure might not be aligned"

b. **Mitigation** - Aligning the process goal and mitigating risk:

   "I think like everything if there is more communication, you will understand why I need a train at a certain time wherever and the job can run meaning we close the gaps of not supplying rolling stock when we need it."

“um and you know you could, you can argue, you can sit there and say well maybe it's just timing, but the reality is the relationships and the enhancement of the relationships um CEP lines of communication, common agenda, common understanding, have probably been the biggest wins in the value chain.”

Transparency can assist in knowledge sharing in risk management:

“And also if there is, if there is communication or the sharing of the information, it also provokes someone else then to say that risk might be a risk to myself as well, let me go and check how exposed I am.”

In summary the data reflects that communication is a facilitator that can avoid or contribute to risk.

“Um, I don't think there are two organisations that have got an exact system, I don't think there is an exact or a perfect system, but I think, I think an integrated approach, to me those that are, are not there in terms of their risk management process would probably benefit more from this sort of integrated strategy and this transparency, um those that have sound structures in place within the individual organisations I believe would give value in terms of understanding what the value chain risk is to them and the transparency would hopefully provide them with a higher degree of comfort as to some of the risks that they've probably anticipated but never really had a method of understanding, are these mitigated, aren't they mitigated, to what extent etcetera.”

4.2.4.3 Electricity supply

From the data, the category ‘electricity’ was identified as a risk by five of the eight research participants. Four of these participants were from the service suppliers grouping. The data reflected on the supply of electricity as follows:

a. The ability to have electricity supplied to the service industry in the bulk coal export chain:

“Because we all seem to depend on Eskom, and you know with the growth and so on, the last years have been seriously hampered because of the lack of electricity.”

The management and alignment of operations to include the electricity constraints also pose a risk.

"Currently we have got constrains on the line where we are actually dictated by Eskom saying how many train is allowable in certain sections and I mean if we are going to increase the number of trains you know Shongololos where you have got eight locos instead of six."

"You know we, you look at RBCT and we have always, we have dual lines that are supplying us with electricity. We had an instant where both lines failed within twenty hours of each other."

b. **Mitigation –** Proactive communication and planning of electricity cuts and disruptions between Eskom and TFR to certain rail sections on the coal-line can reduce the risk in this category.

"I know from the Eskom perspective we do take it to Eskom."

" the electricity load usage in the infrastructure is balanced"

"Currently we are managing it by managing the service to ensure that we don't have too many trains in certain sections, however it does slow down the traffic significantly, which adds to our cycle time and obviously impacts our cost risk."

"You know we have started engagements with Eskom, if you remember two years ago Eskom was one of our high risks"

In summary, electricity supply and the correct use of electricity (load usage) were identified in the data as potential risks and the mitigating action was to address the matter with the energy supplier.

4.2.4.4 Operational management

a. Part of the operational management is to manage the day-to-day risk. Although in the data, the 'operational risk' code was identified by five participants, the definition and direct referencing towards operational risk, is vague. This code was reflected in such a way that operational risk is part of the operational management and that this risk is experienced on an operational level.

"Because operational risks, to me, is something you can fix yourself off the shelf."

"That is the one thing, another thing but this is talking more to the operational risk that I have identified, you know your ability to recover and your ability to balance, the expertise you know where the mine synchronization all those things."

"And then we will be sharing the risks across the, as to what risk have we identified, how do they impact on the operations or the movement of coal and how, how do we minimise the impact"

"If we don't move the coal at a good, regular consistent pace, then the risk of your coal heating up at Richard's Bay poses another problem."

b. **Mitigation** – However, through the data analysis and confirmed by the content analysis, the participating companies do have operational risk-mitigating processes in place to manage the identified operational risks.

"So I think that is one of the areas of, because everything, you know between the supply chain we have an extensive register that records all the incidents and the risks, no matter how small, then you can be able to create a database that can show you, you know the, if you have X amount of incidents happening, you know that at some stage that is going to result in a major incident."

It was indicated that in a particular segment of the bulk coal export chain, risk management is actioned in a scheduled monthly meeting that reviews the current operational processes, the risks in the processes, new identified risks and discusses mitigation actions of incidences that occurred during the review period.

"We have got a committee that we have formed between ourselves, TFR, TNPA [Transnet National Port Authority] where we share our risks and we share the contingency measures that we have put in place to manage the risks. And we review that, you know either quarterly or every six months. Depending on whether there is a new risk that we have experienced or that is emerging."

Operational risk can appear as symptoms in other themes and categories. In category 4.2.5.2 for example, operational risk can occur as a result of labour and social impact. The individual stakeholders in the bulk coal export chain do possess risk management systems that contribute to the reduction of operating risks.

4.2.5 Theme 5 - People

Theme 5 reflects on 'people' and this theme was addressed by all the participants in one way or the other. The main categories in the theme are indicated in Table 6.6. From the data the overarching findings are that 'people' are the key and can be a source of risk or a risk absorber (Fuchs and Wohinz, 2009:234).

Table 4.6: Theme 5 - People

Theme	Category	Code
Theme 5 **People skills, labour and social impact** **(Section 4.2.5)**	4.2.5.1 People skills	Skill/s, knowledge, expertise, people, succession, transfer, old, groom
	4.2.5.2 Labour and social impact	community, political, labour, strikes

Source: Compiled by author (2016)

In the policies and procedures of the participating companies, the code 'people' in the theme, relates to the people or employees. It was further established that the code 'people' also includes the intent to protect people and employees against risk. The purpose of the content analysis of the policies and procedures was to identify if they cover risk management relating to people-induced risks, such as strikes, labour disputes or unrest. It was found that the intent to protect the business against strikes, labour, unrest and community actions is contained on both a strategic and tactical level. The data further reveals that there are specific strategies in the risk management policies and procedures to manage community relationships.

4.2.5.1 People skills

Research by Heyns and Luke (2012:121) indicates that there is a significant skills shortage in the supply chain field in South Africa. A lack of skills in logistics planning, management and execution can lead to disruption in the logistic chain.

a. The data analysis reflects that most of the participants view current skill, knowledge or expertise to be a risk, particularly the coal exporting parties. The 'skills' refers to operational and technical skills, at grass root level, including engineering, maintenance and equipment operations. The lack of skilled people in the bulk coal export chain poses a risk:

"Because in the short term you need to just make sure in your company that you've got the right skills employed to manage this part of your business. With the necessary experience and networks."

"Again firstly if we look at … [Stakeholders name was removed in this comment], major lack of skills, just to ……..."

"It is to have that expertise and knowledge to understand why it is so important to have a balanced system."

A continued loss of skills is a concern as it poses a risk.

"If I can look further, and you know I think in terms of ..[Stakeholders name was removed in this comment], we talk about skills, there's another risk that I can identify there that we are losing in terms of brain drain."

"Ja, uhm one of the things…I am saying this now with really a tongue in the cheek but let me say it. I think we are losing some expertise on the coal line."

b. **Mitigation** - Research data from the participants indicated that the lack of skills experienced in some areas of the bulk coal export chain can be mitigated by skills transfer.

"The industry developed and I think there was a lot of trial and error but they have perfected it, especially the big transporter, the big exporters. They have perfected the chain. They know exactly how ever train is loaded, how it goes along the way, how it is discharged. And they just not telling the new generation coming in, they are not spending the time in sort of developing the next generation for, for export expertise, let's call it that."

"The big risk is some of our old hands are getting older and older, people are retiring earlier and earlier because of different dynamics and to have your

succession plan to such an extent that smooth transitions between the retiree and the young taking over."

In summary, the lack of skills and the exit of skilled people, in the absence of a succession planning programme, pose a significant risk. The proposed mitigating action is that there should be a skills transfer and succession planning programme.

4.2.5.2 Labour and social impact

Wagner and Bode (2008:311) identify sabotage, vandalism, labour strikes, and industrial incidences as human-centred issues that cause risk.

a. The data analysis shows that 'labour and social impact' is a category that tends to be a root cause. This root cause then manifests as a symptom in other themes and categories. If the codes are analysed as individual code elements in the responses, it doesn't display significance. However, due to the interrelation between these codes it results in such a significance to warrant a separate category.

   "I know this is political, a political slant, but I think our country's biggest risk doesn't matter what you analyse, is that people not having stuff, starting to become more and more demanding, want their fair share of the cake."

   "And again labour, and those are challenges in any one of the three, whether it's at the mine, whether it's at TFR, whether it's at the terminal."

   "Because they've got nothing to lose, so you will start having labour unrest, they will start influencing the normal execution of business, we've seen it here and there already, it's already started to happen in municipalities."

   "There's the likelihood of having strikes. In South Africa we have a culture, definitely we have a culture in South Africa of striking, and to me it works."

   "With our process running we have had incidents ….., when they are unhappy about certain issues for example employment opportunities, claims for their cattle and so forth, it is very easy for them to disrupt the services by for example laying objects on the railway lines, stealing cables, you know those kind of actions to disrupt the service.

b. **Mitigation** - The labour disputes and labour unrest data suggest that longer-term agreements with labour be concluded:

"I know the mining sector has a joint wage discussion, but I think we should look at long term agreements as a way of mitigating the labour issues."

Proactive strategy can provide a risk mitigating solution.

"I think the community management; it is not a root cause, it's a result of our inability or lack of a strategy to proactively manage the communities across the line."

"They do add value, if I can use the community involvement as an example. All our initiatives are sponsoring primary schools, doing mobile libraries to the communities and we have seen that a lot of the communities, especially here in Richards Bay where we have started to proactively engaged with, we find that the incidents of theft and the incidents of disruptions on the railway lines are significantly decreased."

In summary, the category 'labour and social impact' was identified to be a category of risk and the possible mitigating actions can be longer-term wage agreements with labour and proactive community strategy.

4.3 POSSIBLE CHANGES TO REDUCE RISK IN THE BULK COAL EXPORT LOGISTIC CHAIN

The data analysis revealed that there are three recommended actions that could reduce the risk in the bulk coal export logistic chain. These three actions require an integrated approach across the bulk coal export logistic chain. This will be possible with:

a. Alignment of strategy, capital investment and goals throughout the bulk coal export logistic chain:

"When I sit and I look at the fundamentals that have taken place in this value chain over the last three years, um and you know you could, you can argue, you can sit there and say well maybe it's just timing, but the reality is the relationships and the enhancement of the relationships um CEP lines of

communication, common agenda, common understanding, have probably been the biggest wins in the value chain."

b. An integrated risk management approach with an extensive risk register, transparency regarding reporting of incidences and a risk forum:

   "I think there is risk if we do not look at the integrated approach."

   "I think the transparency would, would give value to all stakeholders, because I think you're, you're breaking down barriers, I think you are, you are possibly facilitating and understanding of each other's businesses that many not exist already and an appreciation for some of the challenges that are, are currently in place in various parts of the value chain."

   "I would hazard a guess that you know that the value chain to me, you build an integrated risk register to me would be that value chain sitting down and saying you know what, what are the top, identify those top five, top ten key risks that are, that are problematic and potential at this stage and ensure that there's a general degree of comfort across and know it could be, I mean whether those are discussed at the COT forum or whatever forum that is which serves all parties just to you know that, and I mean at, by the nature of a risk process, risks change from time to time, circumstances change from time to time. Um are those forums in place to ensure that all parties are on the same page, in terms of what the dynamics are at that point in time."

c. A programme to broaden the vision and improve the knowledge of stakeholders in order to understand the integrated nature of the bulk coal export chain and the various drivers in the chain and the effect of those levers.

   "You want to start swapping out best practices, between the three. I said earlier that you know you've got some really good guys in the mining space that know how to sweat assets right now, and those skills could be made available, or the knowledge could be transferred to TFR, vice versa TFR may know something about, or not may know something, but have knowledge of how perhaps to deal with certain materials, handling challenges both in the mines and the terminal. You've got terminal guys that understand conveyer belts second to none for example, so you've got the technology layer which

TFR seems to be missing out on, whereas you've got the mining houses with some of the best technology in the world. So and planning and scheduling and all of that. So it's a matter of bringing the best of the breed out of all of these and putting them together in a – as I said, same bed, same dream."

4.4 CONCLUSION

Chapter 4 focused on the analysis of the data of the study. The chapter started with a brief overview of the participants and an overview of the data obtained in the risk management policies and procedures of the participating companies. This was followed by the identification of themes, categories and codes of the data obtained through the personal interviews, and a discussion of the themes, categories and codes, and suggested risk mitigation options.

Chapter 5 will conclude the dissertation with a reflection on the objectives of the study, the findings and finally, the recommendations of the study.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapters 1 to 4 of the study covered the research question, the objectives of the study, the research methodology to obtain the data, and the data analysis and findings.

In this chapter, the research question, purpose and the objectives will be revisited. Then a summary will follow that links the study objectives to the data analysis and findings. Study objectives will be discussed and aligned to the empirical data findings and a conclusion will be provided. Then following on this the main research question will be answered. The chapter continues with recommendations and the limitations of the study. The chapter will end with areas for future research and a conclusion.

5.2 THE RESEARCH QUESTION, RESEARCH PURPOSE AND OBJECTIVE

5.2.1 The research question

The research question of this research study as posed in Chapter 1 is:

What are the current risk management approaches in the bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain?

5.2.2 Research objectives

The main aim or objective of this study is to develop a framework for an integrated approach to risk management in a bulk coal export logistic chain.

The secondary objectives are:

- To conduct a literature study on risk management in supply and logistic chains (that will form the basis for the research instrument for the empirical study):
- To identify and explore the risks and risk management practices of the stakeholders in the bulk coal export logistic chain (by means of interviews);

- To explore the current policies and procedures of the different stakeholders (by means of a content analysis);
- To explore the possibility of an integrated risk management approach that can reduce the risk in the bulk coal export logistic chain (content analysis and interviews).

5.2.3 Linking the objectives to the data findings in the study

A literature study was done to explore the topic, and which formed the base for the empirical study. The data from the interviews with the participants in the study formed the primary data. A content analysis of the policies and procedures of the participating companies was used to triangulate the findings of the primary study. Linking the primary and secondary data with the objectives will serve as confirmation that all the objectives have been achieved in order to answer the research question. Table 5.1 reflects this linking.

Table 5.1: Linking the objectives to the findings and relevant sections

Objective	Finding	Applicable section
To conduct a literature study on risk management in supply and logistic chain.	Literature study	Chapter 2
To identify and explore the risks and risk management practices of the stakeholders in the bulk coal export logistic chain.	**Identified risks**	
	Infrastructure	4.2.1.1 a
		4.2.1.2 a
		4.2.1.3 a
		4.2.1.4 a
		4.2.1.5 a
	Macro-economy	4.2.2.1 a
	Uncontrollable events of nature	4.2.3.1 a
	Disruptions and risks that occur in operations and management	4.2.4.1 a
		4.2.4.2 a
		4.2.4.3 a

		4.2.4.4 a
	People skills, labour and social impact	4.2.5.1 a
		4.2.5.2 a
	Identified risk management practices	
	Infrastructure	4.2.1.1 b
		4.2.1.2 b
		4.2.1.3 b
		4.2.1.5 b
	Macro-economy	4.2.2.1 b
	Disruptions and risks that occur in operations and management	4.2.4.1 b
		4.2.4.2 b
		4.2.4.3 b
		4.2.4.4 b
	People skills, labour and social impact	4.2.5.1 b
To explore the current policies and procedures of the different stakeholders.	Infrastructure	4.2.1
	Macro-economy	4.2.2
	Uncontrollable events of nature	4.2.3
	Disruptions and risks that occur in operations and management	4.2.4
	People skills, labour and social impact	4.2.5
To explore the possibility of an integrated risk management approach that can reduce the risk in the bulk coal export logistic chain.	Possible changes to reduce the risk in the bulk coal export logistic chain	4.3

Source: Compiled by author (2016)

It is clear from Table 5.1 that the objectives were addressed in the study. The next section will continue with the discussion and conclusion of the objective of the study.

A proposed framework for an integrated approach to risk management in a bulk coal export logistic chain will follow on this.

5.3 DISCUSSION OF THE RESEARCH OBJECTIVES

5.3.1 Research objective 1:

To conduct a literature study on risk management in supply and logistic chains.

The first objective was to understand risk and risk management in supply and in logistic chains. A literature review on the export bulk export coal logistic chain was conducted to understand the interaction of the flows and processes in this chain. The main purpose of this literature research was to guide the researcher in formulating the questions in the interview to form the empirical study. The literature study revealed that risk cannot be avoided, but it can be mitigated, and that risk and risk mitigation has a cost to it. Risk management evolved from an operational field of study to an integrated process across all levels and operations in an organisation in terms of ERM. Supply chain and logistics risk management became a risk management study field on its own. Risk in logistics and supply chain management have risk sources and risk drivers. Risk sources are the originating point of risk, while risk drivers influence the effect of the risk in terms of amplifying or reducing the risk.

From a logistics risk model by Fuchs and Wohinz, it is evident that all elements in the logistics supply chain contain risk, from the design of the logistic chain, to the operational execution, and even up to the performance measures. However, these risks can be mitigated and there are mitigating strategies that can be applied.

The questions in Section 2.10, Section 3.6.2 and the questions in Figure 3.4 were all derived from the literature study.

5.3.2 Research objective 2:

To explore and describe the risks and risk management approaches of the stakeholders in the bulk coal export logistic chain.

To obtain insight into the risks that the participants experience in the bulk coal export logistic chain, the interviewer asked an open-ended question. The open-ended

question presented the participants with an opportunity to freely respond on their experience, insight and views regarding risk and risk management in their company and in the bulk coal export logistic chain. In order to ensure that rich information was provided, further prompting questions were asked. The participants identified the risks as: Infrastructure (Section 4.2.1); the macro-economy (Section 4.2.2); uncontrollable events of nature (Section 4.2.3); disruptions and risks that occur in operations and management (Section 4.2.4); people, including skills, labour and social-related issues (Section 4.2.5).

5.3.2.1 Infrastructure

There was a concern amongst all of the participants that infrastructure posed a significant risk. This was the risk with the most mention in all the data. The risk infrastructure referred to superstructure as well as the capital equipment that is used in the operations. The biggest risk in terms of ageing (Section 4.2.1.3a) was attributed to the Transnet rail infrastructure which includes the rolling stock, namely, the locomotives and the RCBT capital equipment. Although it was noted that the mitigation action of recapitalisation was in progress (TFR Locomotives and RBCT recapitalisation plan) the risk of proceeding with further capital investment for this infrastructure was at stake. The risk management actions employed by the participants are to ensure the continuation of recapitalisation and the review of monetary funds available for capital investment (Section 4.2.1.3b). The depressed macro-economy (Section 4.2.2.1a) is the root cause that has reduced the confidence to spend capital and investment in infrastructure which has resulted in an infrastructure risk (Section 4.2.1.1a). The capital investment for maintenance was identified as the key risk in infrastructure due to the ageing of the infrastructure. Should the capital investment for infrastructure maintenance fail, it will increase the risk in the areas of operations and management (Sections 4.2.4.1a). This failure to provide capital for infrastructure maintenance will start a cycle of self-perpetuating demise (Section 4.2.1.2a).

The risk management process is to review the investment capital and redirect the capital to maintenance (Section 4.2.1.2b). The risk of less capital investment in infrastructure for growth is a risk that has a knock-on effect on the longer term of the coal commodity cycle and the stakeholders in the chain (Section 4.2.1.1a). Ignorant

withdrawal of this much-needed capital investment can cause the risk of delayed investment in other parts of the bulk logistic chain, such as new mines (Waterberg resources), while current assets are depleted (Mpumalanga resources) (Section 4.2.1.1a). This will lead to an inefficient logistics infrastructure in bulk coal export chain, loss of GDP in the South African economy and a potential miss in the upswing of the coal commodity cycle (Section 4.2.1.1a). The risk management actions that could mitigate the risk include actions to optimise the current system with technology and the consolidation and sharing of un-optimised infrastructure (Section 4.2.1.1b). The risk management register of one participant in the bulk coal export logistic chain specifically focused on the infrastructure risk of a service supplier.

The Overvaal tunnel represented a two-fold risk. As a primary link to transport coal to RBCT the tunnel presents a strategic risk (Section 4.2.1.5a). With the ageing of infrastructure, this point of throughput becomes a bigger risk day by day. The Overvaal tunnel further possesses a capacity constraint risk (Section 4.2.1.5a). With TFR - Coal Business and TFR - General Freight Business operating on shared infrastructure, there will be a competition for capacity in the event of a sudden upswing in the coal export market. The risk of full-capacity rail lines and inefficiency in the bulk coal export logistic chain will prevail. The risk management actions are of a strategic nature but the economic conditions at this stage do not support the opening of a second tunnel, hence the risk management will hinge on business continuity measures if there is a disruption (Section 4.2.1.5b).

The infrastructure risk in terms of technology (Section 4.2.1.4) represents a double-edged sword. The fact that the infrastructure technology is old and is in the process of becoming redundant presents the risk of loss of potential efficiency and optimisation. With new technology, the current risks in operations and management (Section 5.3.2.4) could be reduced. Advanced scheduling and operation management systems could optimise the current infrastructure capacity and reduce the necessity and risk in required infrastructure growth. However, if there is not enough pre-investigation and implementation planning of new technology, one can find that the level of technology does not complement the systems, which will create a new and unexpected risk (Section 4.2.1.4a).

5.3.2.2 Macro-economy

The macro-economy of coal as a commodity in South Africa was identified by the participants as a risk (Section 4.2.2). The macro-economic risk can be associated with other risks, such as infrastructure risks (Sections 4.2.1.1 and 4.4.1.2) and people skills, labour and social impact (Sections 4.2.5). The macro-economy might be the root cause of these risks. The macro-economy is a product of the external macro-environment and it is beyond the risk management of an individual company. However, it needs to be mitigated with business-continuity measures and control. The macro-economy is a strategic risk and requires a senior-level risk management intervention and long-term vision (Section 4.2.2.1b). The only short-term management action to mitigate the macro-economic risk is to keep the cost under tight control (Section 4.2.2.1b).

5.3.2.3 Uncontrollable events of nature

The uncontrollable 'events of nature' is a risk that manifests itself in this research study in the form of the risk of water availability. Water is required in the bulk coal export chain to produce coal. Without coal-product the bulk coal export logistic chain becomes redundant. The current risk management actions to increase the security of water, is to recycle water in coal mining operations (Section 4.2.3).

5.3.2.4 Disruptions and risks that occur in operations and management

The lack of an aligned vision, objectives and goal seem to be a risk as indicated by the participants in the study. The different objectives, divergent views, where operational performance of the chain is and where it should be, pose a risk to optimal performance and capacity utilisation (Section 4.2.4.1a). However, understanding the total bulk coal export chain, sensitive and critical nodes and the relevant drivers of these processes can assist in mitigating the risk (Section 4.2.4.1b).

Communication, as identified in the research by participants, includes transparency of information and information sharing or withholding information. Communication is also found to be the root cause of various other risks. Once again, communication is a double-edged sword and can be a risk-enabler (Section 4.2.4.2a) or a risk management tool (Section 4.2.4.2b).

Electricity is a risk. Participants identified this risk in a two-fold manner. The shortage in electricity supply poses a risk towards potential growth in the export of coal through the bulk coal exports logistic chain. The unstable electricity supply to the service industry in the bulk coal export logistic chain impacts on their operational ability (Section 4.2.4.3a). The risk management processes applied to mitigate the risk was to engage in constant constructive engagements with the energy supplier (Section 4.4.2.3) and from an application point of view, additional infrastructure resources (locomotives and rail wagons) could assist.

The operational risk is the risk that occurs on an execution level. The frequency of the occurrence of these incidences is high, but the effect seems to be of low impact. These risks are vaguely defined by the participants of the study (Section 4.2.4.4a) and are associated with other root cause risks (for example, vandalism and theft – social and economy risk – Section 4.2.5.2). However, the risk management of these types of risk are prone to be more detailed and extensive. Risk management matrixes and risk management registers are kept and incidences are captured and investigated in great detail by individual stakeholders (Section 4.2.4.4b).

5.3.2.5 People skills, labour and social impact

People skills are identified as a risk, and this includes the current skills of people in the bulk export coal logistic chain, and the risk that skilled experts are leaving the environment, without sufficient skills transfer taking place (Section 4.2.5.1a). The skills risk is at various levels of the operation in the chain and ranges from operations level into managerial level. The risk management process to ensure that this risk could be mitigated resides within a secure skills transfer and succession planning programme within the participating companies (Section 4.2.5.1). This lack of skills and knowledge introduces risk in other areas such as operations and management. Research by Heyns and Luke (2012:121) suggests that research in training and skills transfer should be done to develop future training programmes that are necessary to address the current risk in skill shortage in supply chains in South Africa. It is further stated that the skills shortage is believed to have an impact on the competitiveness, as well as the economy as a whole (Heyns and Luke, 2012:121).

The labour and social demands in the country are becoming a risk that affects the operations of the bulk export coal line. Theft, vandalism and communities disrupting

operations are symptoms of labour and social demands. Sectorial labour strikes in the various sectors within which the stakeholders in the bulk export coal logistic chain operate, and the risk associated with these actions, is a reality (Section 4.2.5.2a). Senior-level risk management interventions in terms of strategies to manage community relations and long-term wage negotiations assist in the reduction of these risks and can reduce the disruption frequency (Section 4.2.5.2b).

5.3.2.6 Conclusion

From the above findings, conclusions in terms of the objective 'To explore and describe the risks and risk management approaches of the stakeholders in the bulk coal export logistic chain', five risks were identified in the bulk coal export logistic chain: infrastructure; macro-economy; uncontrollable events of nature; disruptions and risks that occur in operations and management; and people skills, labour and social impact.

For the risks identified, the participants provided risk management measures in the interviews. The content analysis of the risk management policies and procedures of individual participating companies in the bulk coal export logistic chain revealed that some of the identified risks are managed on a general basis and only selected risks are managed with a focused risk management strategy. The risks that are managed with a focused risk management strategy are: disruptions and risks that occur in operations and management; macro-economic risks; and labour and social impact risks.

5.3.3 Research objective 3:

To explore the current policies and procedures of the different stakeholders.

The second objective was achieved through content analysis of the policies and procedures of the participating stakeholders. The purpose of the content analysis was to obtain data to triangulate the research information and ensure credibility.

5.3.3.1 Infrastructure

The analysis of the policies and procedures indicated that infrastructure is a risk and is part of the risk management process. The data shows differences between the service suppliers' policies and procedures and the CEPs' policies and procedures.

Infrastructure as a theme in the service supplier policy tends to have a more general focus. The risk register matrix of one of the stakeholders in the bulk coal export logistic chain indicated that there is a focus on the management of infrastructure risk (Section 4.2.1).

5.3.3.2 Macro-economy

The content analysis (Section 4.2.2) of the policies and procedures indicated that there is a focus on the macro-economy and the risk effect it exerts. The service supplier participants referenced this risk as “market risk”. Matrixes attached to the risk policies and procedures reveal that there are specific risk management strategies to manage macro-economic risk and ensure business continuity.

5.3.3.3 Uncontrollable events of nature

The content analyses (Section 4.2.3) revealed that all the participants include risk management to manage uncontrollable events of nature in the policies and procedures. It is referenced as natural disasters or *force majeure* events in the policies. However, the policies do not provide for detailed risk-mitigating strategies, although they are referred to in the policy.

5.3.3.4 Disruptions and risks that occur in operations and management

The operational and management risks are contained in the policy document, and the actual management of these risks occurs on every level (Section 4.2.4). References in the policies and procedures enforce risk management, investigation and mitigation of incidences and potential hazards. Operational and managerial risk management tends to focus on the company-specific risks and not on the integrated bulk coal export logistic chain.

5.3.3.5 People skills, labour and social impact

The content analysis of the policies and procedures was also done to determine if the policies and procedures cover risk management relating to people-induced risks, such as strikes, labour disputes or unrest (Section 4.2.5). It was found that the intent to protect the business against strikes, labour, unrest and community actions is contained on both strategic and tactical level. The data further revealed that there are specific strategies in the risk management policies and procedure to manage community relationships. There are also general and specific risk management

strategies to manage labour (strikes and labour unrest) and social impacts (communities).

5.3.3.6 Conclusion

The content analysis of the policies and procedures confirms the risk themes identified in the primary data from interviews. The credibility of the primary interview data is confirmed and the identified risk themes in the bulk coal export logistic chain are: infrastructure, macro-economy, uncontrollable events of nature, disruptions and risks that occur in operations, and people skills, labour and social impact.

5.3.4 Research objective 4

To explore the possibility of an integrated approach to reduce the risk in the bulk coal export logistic chain.

Participants were asked the question. “What changes if any would you recommend to stakeholders in the export logistic chain to reduce the risk?” The purpose of this question was to stimulate the participant in revealing cross-functional risk approaches they would like to share with other stakeholders in the bulk coal export logistic chain.

Not all of the participants answered this question directly. Some participants indicated that there are three recommended actions that could reduce risks in the bulk coal export logistic chain. These three actions required an integrated approach across the bulk coal export logistic chain. The recommendations can be summarised as:

- Alignment of strategy, capital investment and goals throughout the bulk coal export logistic chain (Section 4.3a);
- An integrated risk management approach for the whole chain, with an extensive risk register, transparency regarding the reporting of incidences and a risk forum (4.3b);
- A programme to improve the vision and knowledge of companies in the chain to understand the integrated nature of the bulk coal export chain and the various drivers and the effect of those levers (Section 4.3c).

5.4 ANSWERING THE MAIN RESEARCH QUESTION

The aim of this study was to develop a framework for an integrated approach to risk management in a bulk coal export logistic chain. In order to achieve this the research question needed to be answered – *What are the current risk management approaches in the bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain?*

Figure 5.1 (on the next page) illustrates the answer to the main question and provides a summary of the findings in this study. The first phase of the study comprised of a literature review. From this literature review, possible questions for the semi-structured interview were formulated. The second phase consisted of the field work. In this phase, semi-structured interviews were conducted and the data was captured and analysed. The analysed interviews produced the primary data of the study. The policies and procedures of the stakeholders were obtained and a content analysis of the policies and procedures was conducted which produced the data for triangulation to assure the trustworthiness of the study. The outcomes of this triangulation were used as a basis to develop a framework for an integrated risk management approach in the bulk export logistic chain.

To summarise, the first objective was obtained through a literature study in Chapter 2. The second objective was answered by deriving the risk and risk management practices from the primary data. The third objective was answered through the content analysis of the risk management policies and procedures. This data from the content analysis was used to confirm the risk themes identified from the primary data through triangulation. The fourth objective was achieved by asking the participants what changes they would recommend to reduce the risk. The successful answer of the first, second, third and fourth objectives led to the answer of the research question and to the fulfilment of the aim of the study.

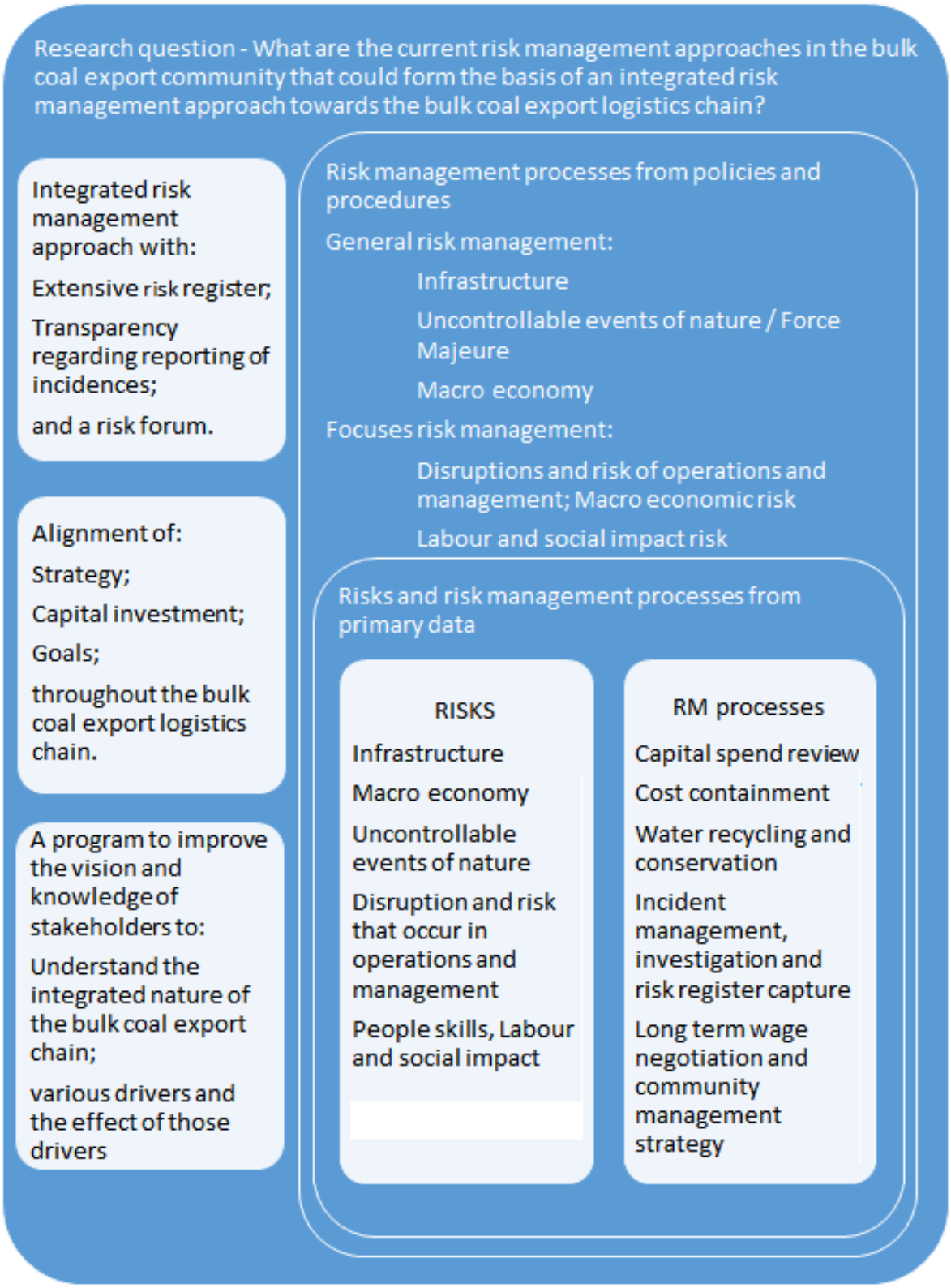

Figure 5.1: Summary of the answer of the research question

Source: Developed by author (2016)

5.5 LIMITATIONS OF THE STUDY

This section addresses the limitations of this study.

The study pertains to the bulk coal export logistic chain in South Africa commonly defined as the coal-line and the coal exporting parties and Richards Bay Coal Terminal. The findings of this study are relevant to the coal export chain and might not be applicable to other commodities, commodity bulk logistics systems and such systems in other countries and environments.

5.6 FURTHER RESEARCH AREAS

During the field work and part of the data gathering, a participant raise the question regarding the risk the bulk coal export line faces in the wake of new technology such as renewable energy.

Two possible areas for new research can be outlined as below:

- What is the risk that renewable energy imposes on coal as a commodity?
- What will the effects of renewable energy be on the bulk coal export supply chain?

Thus, possible further research opportunities exist on the risk management in the same bulk coal export logistic chain. The study can also be copied for other commodity export chains.

5.7 CONCLUSION

The main purpose of this chapter and study was to answer the main research question, namely, what are the current risk management approaches in the bulk coal export community that could form the basis of an integrated risk management approach towards the bulk coal export logistic chain? The findings from the literature review and empirical studies were used to answer this research question.

The exploratory questions from the research revealed clearly the current risk, and the risk management approaches that are implemented to address the identified and explored risks. Triangulation and validation of the research could be established through the content analysis of the risk management policies and procedures of stakeholders.

This dissertation concludes with the verbatim quote of one of the participants regarding integrated risk management in the bulk coal export logistic chain:

> *"I don't think there are two organisations that have got an exact system, I don't think there is an exact or a perfect system, but I think an integrated approach, to me, those that are, are not there in terms of their risk management process would probably benefit more from this sort of integrated strategy and this transparency, than those that have sound structures in place within the individual organisations. I believe this would give them value in terms of understanding of what the value chain risk is, to them and the transparency would hopefully provide them with a higher degree of comfort as to some of the risks that they've probably anticipated but never really had a method of understanding, are these mitigated, aren't they mitigated, to what extent … So I would think that there would be a value adds to probably all products, all parties within the value chain."*

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APPENDIX A – ETHICAL CLEARANCE

UNISA university of south africa

20 October 2015

Ref #: 2015_CEMS_SES_005

SCHOOL OF ECONOMIC SCIENCES
RESEARCH ETHICS REVIEW COMMITTEE

This is to certify that the application for ethics clearance submitted by

Mr André Botha (student #32748477, 32748477@mylife.unisa.ac.za)

An integrated approach to risk management for a bulk coal export logistics chain
received Ethics Approval

The application for ethics clearance for the above mentioned research was reviewed by the School of Economic Sciences on the 20th of October 2015 in compliance with the Unisa Policy on Research Ethics. Ethical Clearance for the project is granted.

You may proceed with the research project. The research ethics principles outlined by the Unisa Policy on Research Ethics must be adhered to throughout the project. Please be advised that the committee needs to be informed should any part of the research methodology as outlined in the Ethics application (Ref #2015_CEMS_SES_005) change in any way or in case of adverse events. This certificate is valid for the duration of the project. The SES Research Ethics Review Committee wishes you all the best with this research undertaking.

Kind regards,

Loedolff

Ms C Loedolff
Chairperson

Executive Dean: CEMS

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
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APPENDIX B –LETTERS OF CONSENT

UNISA university of south africa

Consent form to participate in this study

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the interviews.

I have received a signed copy of the informed consent agreement.

Participant name & surname _____ (please print)

Participant signature _____Date:_____

Researcher's name & surname _____(please print)

Researcher's signature_____Date:_____

University of South Africa
Preller Street. Muckleneuk Ridge. City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone + 27 12 429 31 I | Facsimile: + 27 12 429 4150
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APPENDIX C – LETTER TO THE PARTICIPANT

Participant information sheet

Date :

Title: An integrated approach to risk management for a bulk coal export logistic chain

Dear Prospective Participant

My name is **Andre Botha** and I am doing research with **Prof JA Badenhorst-Weiss**, a professor, in the Department Transport and Logistic towards MCom degree at the University of South Africa. We are inviting you to participate in a study entitled *An integrated approach to risk management for a bulk coal export logistic chain.*

The aim of this study is to make a contribution to efficiency of the bulk coal export logistic chain in terms of risk management. I am conducting this research to understand how the different participants/partners in the bulk export supply chain conduct and manage risks. Through this study I plan to develop and suggest a framework for an integrated approach to risk management in the chain. This study will not be possible without the inputs of knowledgeable individuals such as you. I would like to kindly ask you to participate in the study. I plan to collect the data by means of face-to-face, semi-structured interviews at a place that is convenient to you. In addition to your knowledge we would like to include you in the study because your organisation is an important member of the Channel Oversight Team (COT).

During the interview you will be asked to share your views, experiences, knowledge and activities regarding risk management in bulk coal export logistics. To assure credibility, dependability and conformability the interview will be audio recorded, but you can be assured that we will handle the recording with utmost security and confidentiality.

The interview should not take longer than 1½ hours.

Although we would appreciate your participation in the study you are under no obligation to take part. If you decide to participate, you will be given this information sheet to keep and you will be asked to sign a written consent form. You are free to withdraw at any time before or during the interview without giving a reason.

There will be no direct benefits for you as participant, besides a summary of the findings that will be send to you after the conclusion of the study.

We assure you that all information will be handled with the utmost confidentiality and your name will not be recorded, no personal information will be used and no one will be able to connect you to the answers you have given. There are other individuals involved in my study who will have access to the data, for example the transcriber, consultant who will assist with the analyses of the data and a language editor. However, these people will maintain confidentiality by signing a confidentiality agreement.

The results of this study will be used for academic purposes only and the results may be published in academic journals or presented at conference presentations. However, as researcher I will adhere to the confidentiality of this research, and the anonymity of individual participants will be protected and respected.

Hard copies of the transcribed interviews will be stored for a period of five years in a locked cupboard/filing cabinet in my office for possible ethical audit by the Research Ethics Committee. Electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. After the five years all hard documents will be destroyed. All electronic information will be deleted permanently from the computer.

This study has received written approval from the Research Ethics Committee of the College of Economic and Management Sciences, Unisa. You can obtain a copy of the approval letter can be obtained from me if you so wish.

Should you require any further information or want to contact me about any aspect of this study, please contact me by phone at 083 468 1179 or email 32748477@mylife.unisa.ac.za

Should you have concerns about the way in which the research has been conducted, you may contact my supervisor Prof JA Badenhorst-Weiss on badenja@unisa.ac.za.

Should you require any information regarding UNISA research ethics policy, please consult
http://www.unisa.ac.za/contents/research/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf/

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

Andre Botha

Ref: Andre Botha
Tel: 083 468 1179

Date - XXXXXX

The participant name

The participant title

The participants postal address line 1

The participants postal address line 2

The participants postal address line 3

Email: Email address of the participant

Request for permission to conduct research at "Company Name"

"***An integrated approach to risk management for a bulk coal export logistic chain"***

Dear "participant name"

I, **Andre Botha** am doing research with **Prof JA Badenhorst-Weiss,** a professor, in the Department of Transport and Logistics towards a MCom degree at the University of South Africa. We are inviting you to participate in a study titled - ***An integrated approach to risk management for a bulk coal export logistic chain***

The aim of this study is to make a contribution to efficiency of the bulk coal export logistic chain in terms of risk management. I am conducting this research to understand how the different participants/partners in the bulk export supply chain conduct and manage risks.

Your company were selected to participate because you are a member of the COT and represent either a CEP or TFR or RBCT in the coal export logistic chain.

The study will entail face-to-face interviews with selected participants. Participants will include, managers tasked with logistics, operation and risk management.

We assure you that all information will be handled with the utmost confidentiality and your company's name will not be recorded, no personal information will be used and no one will be able to connect answers or information provided to your company or interviewee (participants). There are no potential risks for any of the participants; however, we might inconvenience them by taking time out of their busy schedule for the interviews.

An abbreviated report of the findings will be provided to the participants after my study has been concluded.

Yours sincerely

Andre Botha

APPENDIX D – INTERVIEW GUIDE

INTERVIEW GUIDE
Questions to be used for this study

AN INTEGRATED APPROACH TO RISK MANAGEMENT FOR A BULK COAL EXPORT LOGISTIC CHAIN

Introduction

Good Morning! (Introduce yourself)

Thank you so much for taking time out your busy daily schedule to participate in this study. Thank you, for your willingness to share your experiences, knowledge and activities with us, regarding risk management in the bulk export coal chain (Coalline and RBCT).

We should not take more than one and a half hour of your time. First, I want to ask you if we may audio record our discussion on this topic. *(If yes, switch on the recorder).* In our previous communication we promised you confidentiality; even though being recorded, we will adhere to that promise and therefore each discussion will be be transcribed by a professional transcriber, anonymously. We will keep the audio recording at a secured place until it will be destroyed eventually. Your personal details will not be linked to specific statements in the transcript.

You are welcome to ask any questions before we start.

SEMI-STRUCTURED OPEN-ENDED QUESTIONS TO BE ASKED

Question 1: What do you think are the risks in the bulk coal export logistic chain?
Prompting question (if not indicated by participant in main question):
Explain your reason for identifying those risks.
Is the identified risk a root cause or a symptom?

Question 2: How do you / your company manage these risks in the logistics export chain.

Prompting question:

Is the risk management a general strategy or focussed.

How does each of these strategies add value?

Question 3: What changes if any would you recommend to stakeholders in the export logistic chain to reduce the risk.

Prompting question:

Why would you recommend these changes?

How will these changes add value to all stakeholders or only certain stakeholders holders?

Question 4: Do you have any other ideas related to risk that were not covered or explored to add to the discussion.

CONCLUSION

Thank you so much for participating in this study. Your knowledge and experiences will be a valuable asset to this study.

If you have any opinions, view on any of these questions and on the topic of this study, will you please share this with us? You can contact me and we can arrange to add it to your view points. Your views are very valuable to us and it will be treated confidentially.

Thank you

APPENDIX E – DECLARATION BY EDITOR

Retha Burger
B.A.(HUM)
tel : 012 807 3864
cell : 083 453 3255
fax : 012 807 3864
e-mail : retha@skillnet.co.za
Independent Skills Development Facilitator

Dear Mr Botha

This letter is to record that I have completed a language edit of your dissertation entitled **"An integrated approach to risk management for a bulk coal export logistic chain"**.

The edit that I carried out included the following:

-Spelling
-Vocabulary
-Pronoun matches
-Sentence structure
-Formatting
-Grammar
-Punctuation
-Word usage
-Correct acronyms (matching your supplied list)
-Captions and labels for figures and tables
-Spot checking of ten in-text references
-Generation of Table of Contents, Lists of Figures and Tables

The edit that I carried out excluded the following:

-Content
-Correctness or truth of information (unless obvious)
-Correctness/spelling of specific technical terms and words (unless obvious)
-Correctness/spelling of unfamiliar names and proper nouns (unless obvious)
-Correctness of specific formulae or symbols, or illustrations.

Yours sincerely

Retha Burger

29 October 2016

APPENDIX F – DECLARATION BY TRANSCRIBER

cyber transcription
Virtual Speech to Text & Copy Typing
Tax No.: 1672677158

C: 083 227 5966
F: 086 647 6813
P: PO Box 7827, Centurion, 0046
E: juliamb1@mweb.co.za

23/05/2016

To whom it may concern;

RE: TRANSCRIPTION FOR A QUALITATIVE STUDY FOR STUDENT NO: 32748477

This is to confirm that I have completed the transcription of data on behalf of Mr. Andre Botha, towards his MCom Logistics Degree, subject study entitled; AN INTEGRATED APPROACH TO RISK MANAGEMENT FOR A BULK COAL EXPORT LOGISTICS CHAIN.

All the data was handled in a strictly confidential manner and has now been deleted from our records.

Sincerely,

Julia Martinelli

Transcriber

APPENDIX G – INTERVIEW QUALITY CONFIRMATION

Andre Botha
to Andre Botha

Sat, Dec 5 4:43 AM

FW: I shared "GWTCSA.mp3" with you in OneDrive

FYI

Andre Botha
Mobile 0834681179

From: Andre Botha
Sent: Friday, 04 December 2015 21:59
To: Maritz, Jeanette
Cc: Prof Badenhorst
Subject: RE: I shared "GWTCSA.mp3" with you in OneDrive

Dankie Professor.

Ek sal so voortgaan. Ek sal die onderhoude struur om ge'transcribed' te word en die data vir u dan stuur vir tematiese groepering en kodifisering.

Groete

Andre Botha
Mobile 0834681179

From: Maritz, Jeanette
Sent: Friday, 04 December 2015 16:09
To: Andre Botha
Subject: RE: I shared "GWTCSA.mp3" with you in OneDrive

Hallo Andre
Ek dink dit is n uitstekende onderhoud. Die persoon gesels maklik en jy onderbreek hom nie. Jy maak ook effektief gebruik van opsommings en verdere eksploreering met of sonder ‚prompts'. Ek dink dit is belangrike data wat hulle wel n antwoord voor het en wat nie. Ek sou dit persoonlik nie stuur nie. Jy kan altyd dit wat hulle nie weet nie aanvul met jou veldnotas, persoonlike notas of literatuur in die vorm van n ‚literaure control'.
Sterkte en doen so voort.
Groete JM

From: Andre Botha [mailto:andre.botha@outlook.com]
Sent: 04 December 2015 4:19 AM

APPENDIX H – FIELD NOTES

Notes Interview 1

Audio Recording

Export coal

Look total chain

- What will stop at export the coal
- Ageing infrastructure
  - Railway line +

- Wagons - Locomotives
-

- RBCT → 30 year old
  Design + equipment - not
  Sweating the assets
- Drawbacks infrastructure

→ Capital expenditure to fix the capex - Commitment from parties
Contracts with parties to cover the expenditure

— Having asset good relations

- Reliability of the assets

→ Ageing in infrastructure
→ Call on
→ Risk of it

→ Safety no compromise
timing

(2) Market to be risk in the process. Slow down
Supply demand

(3) Regulation
Nationalization

(4) Responsibility of the exporting party
Customer receives the coal
incoterms

(5) Weather patterns — play a role - coal flow
How to export coal cons... bay.

(6) Stockpile - not more coal → Be Risk -
Manage the heated coal
Heat coal cause disrupt

(7) Piracy - coal - Horn of Africa
Costly shipping companies
cost it spread - exporter to pay - freight rate
Risk

(8) Maritime protest strikes
Labour disputes — many
still in the process
How to deal with. Will
effect the governance —
Minimum wage —

(9) Aging infrastructure - system
performance based on well
Neglected —

TFR not [illegible]
Derailments increase
Specification is cost [illegible]

expecting the cost

(2) Many
(1) Control
(2) Not control Not in control

⇒

TFR → CEP might
influence
TFR

Try control [illegible] risk
Not + engage with providers
to understand the impact

Many exporters.

⇒ Total view on export

(a) Safety manage (where and how)
effect employees
industry
Platforms
Committees
People [illegible]
workshop
Brothers' keeper

Awareness program
Workshops on monthly basis

(b) Water resource
Wash coal — is challenge
RBCT manage water to
Weather pattern or risk

Water managed on mine

Water managed on mine

(c) Correct equipment

(d) Maintenance program
+ Safety of people
+ Maximise output

Risk management Focus or not guaranteed Coal line

- People
- How to manage the people
  Values + efficiency - people first

- Incentives to manage risk
  KPI + recognition + reward
  Drive over risk

People

(3) Social responsibility. Point
Happy people to reduce risk
Best people near the organisation
+ skill
Improving the skill that we
require

Fit ... enable to look up

at the board – heat fairly

Movement of coal - Transport
Efficient manner →
Cable theft risk – Try operate
differ
Diesel locomotive
Electricity + supply it on
risk
cost +

- R&D skill → Brain drain
People → Other parts + loose
skills → Business program
to replace the
person

Replace
Combined effort force
for everybody
GDP SA benefit
Not industries – everybody
that is involved - all
will benefit Game →

(Q4)
Overvaal tunnel
bottleneck →
Plan to bypass the
tunnel → Business problem
Double to single line
7 mm out ... of 7 ...

Not is done enough
Collection
→ Carbon emissions
possible to burn coal
COP 21 →
Test theory → coal generate
CO_2 → Decide ...
coal has has an
existence in the current

?
Renewable energy
→ Risk what happen Globally

Micro + Macro economics

Audio Recording

Audio Recording

① Risks

Operation risk +
Capital risk ! | why say it is a risk

Evolved line

More coal → Overall time line + risk

Producer risk

Risk in infrastructure - line Rolling Stock + Transnet

Capital for development study

Evolved → Different loading

– Infrastructure ⇒
No infrastruct – develop

Combined development – money + staff down → What do you mean

Risk → Resource
Lo Skills – Don't have

CEO transform + outreach
Loss – skills

Industry → Risk of not transferring skills

The loan – trial + error perfection the skill on how + new generation transfer of skill

Export expertise →
TNPA] → also →
CEO + Track
Richardsbay → Older retire and new work force – transfer skills → look successful

CEO → Teaching the next

– Capital big risk ⇒ why
Fiscal year – capital cut →
+ Spend Capital to be sustainable | Maintenance Capital
Develop capital

Root skill resource
↳ R
Skills transfer
→ Sometimes

Operational
↳

More risk in contracting

Missing operational risk. Operationally understanding delivery + performance

X understand and do!

Y do not know & service delivery not there

Service performance → Issue
Cancellation – ₹ Theft – cable theft
– Resources not to run

Discount between ① & ② – in all a operational risk

② How to Manage people | Relationship manage risk

Do not say

Know ... Mitigate by knowing - chain + people to manage risk → Knowing people?

Other Info

Information [Contact]

Living relationship -

Difference to add value + Not ...

Customer + supplier as close as possible

Call relationship ⇒ Pick up the call of need

- Understand each other's business - increase + mitigate the risk

Pro-active → Mitigating risk

Should be pro-active

talking to - not scheduled

Check to be pro-actively

⇒ How to

IO the ops

→ who supplier

→ Service flow

→ Why you ... do

- Operational ...

→ Understand the whole

Holistic view of the total system

Need know people to trust you

Best interest of ... &

...

Risk is and should not be ... as ...

One flow →

One team focal

Devoted division + risk

Bigger risk → proactive

Devoted line

Moving + shipping - ... risk

Commercial - ops

Members understand all cohesion ... → Mitigate risk

— Cross ... division

Operational

• Operational design should address risk

• Product understanding the risk as

③ → Specific →

① Open door | whole -

Log

TFR

RBCT

Individual - open door to ...

① TFR → Line between ops | commercial

Difficulty in the agreement LTD

Shut down - Commercial -

Not available

...

No access →

ⓑ Structure changes → CEP

one line not 2

© ... - of problem -

Not entirely pro-active

Low risk

Planning · Forms

→ How will you ...

→ Infrastructure consideration

→ Future rail infrastructure

Infrastructure not working together

CEP not

Sharing infrastructure Share cost # reduce risk

Capital drain if not work together →

People seem to lack co-operation

Distrusting nature

Operate as professional miners

Consolidate supply

Communication → Un

Clear ... — ... smaller rolling stock

when needed

Saving cost —

Practice

Smaller deal — energy need to flow

If stuck → Risk is there

Consolidation

Capital risk

Economy will force to work together

(4) Concerns

Capital Spend Transnet TFR capital

• Right equipment →

• Spend — pricing — loose

R&A competitiveness — pay for ... Cost of service

• SOC side Public Enterprise side → Minister – legislation environment can cause risk

• Alignment risk [Smaller cost] lower cost etc]

→ National carrier. If their plan roll out wrong will cost to package

• Reserve exploitation decline – low quality coal – Natural resource – etc [Macro]

Infrastructure address →

Business swing factor → Cycle and the potential

What do you do when the market is in decline?

Shale ... lost hedge & natural hedge do not exist.

Eskom risk

Risk on both Eskom + export more to do / to deliver

Risks → Vast + ... tising

Risk is not Rail WD + delivery the coal to

Accumulation — can you move all your product

45 mil to Eskom market

Current Commercial agreement —

Big risk → Industry will sit ... excess capacity if ...

not developed.

Cost to develop + [illegible] rail in 4-5 year time + coal burning [illegible]. Coal burning + supply chain. Will the demand [illegible] coal [illegible] in future

Integrated approach [illegible]

Risks
ability to supply :
Infrastructure
Ability to produce the
Ability to handle the volume
> TNP
Limited storage area TNPA
full stockpile - not export
to/through TNPA
BAD weather
TFR

TFR infrastructure

Derailments - Infrastructure
High Risk area (Natal)
Second line / Market
conditions

Tunnel is a risk

TFR - Locomotive supply
new Risk

RBCT => Capacity sufficien
Terminal control system
Terminal
Process automated arrive
and
Process control system

Routes or grades Destination
control - Route control system
System / choose - Automation
Temperature - Fully integrated
system Experience technical
TCS system upgrade

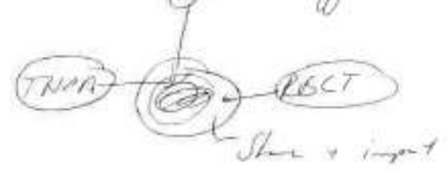
Contamination of coal -
Also -
From and where or
System flaws -> People
interface or machine -

Systems ->
Derail - Ageing infra

Maintenance

System ageing
Analysis of risk - Quality
Done wrong + lost supplier
Risk

Q2 Consider forward to
manage the risk -
Discuss the risk - new
or manage the old risk



~ ops
Have to minimise
+ Action or plan
Focused on the chain itself
Prevent the cost from flowing
& Focused → Focussed approach
Simulate events affect test readiness + response
if happened the review plan vs actual

Shared loss → Event risk analysis & check to

prevent / mitigate /

Added Value Yes →
Not see control the Risk is prompted
Duct bus electricity fail
Power supply → Not happen and check → learned
treat each risk and you Value is captured.

Question 3

* Changes →
People need to disclose

the risks.
Data base for analysis

Minor Minor

Then major Stats.

Power failure → Dip Dip check → feed to the triangle
Oil leak pressure failure
→ Extension done.
* Credit of the risk thought

Less open the other parties
Risks — upfront
→ Better understanding of the risk across the chain
Visibility - Provoke others to check + also enlighten own exposure
→ Add value to all parties
Expats - CEO's → Difficult
Value in be great but

due to the [illegible]

Question 4

RSR → Rail Safety Regulator

Standards of Risk → Good
but also counter productive
check - open line & shutting
can be bad
good initiative go wrong
'Risk stat. to [illegible]

Risk area need to be
extensively [illegible]
concern area

Operational [illegible] - developed [illegible]
Reporting Industry need to
develop

7) Risk

Future of coal industry &
the service
level of investment + commitment
External funding
Find Cycle → Investment
risk.
Halt and not invest in expansion
Sustaining Capital Maintenance
and
No new technology

Insufficient leading to
increased rates + → market share
time to invest + going to

Sustaining + maintenance (Capital)
Rate of demand on coal
Dominant Capital
- Labour + training
- Maintenance - management

Mine - Service → move
away

Terminal in place at 91 Mt
Management challenge Efficient

level →
Slackness → Level Good
+ Relative new equipment not
investment need
Labour + challenge
[Political interference
Terminal
Due + investment]
- Mine + labour → mine houses
diversify → Mine out of
SA + Political pressure
Key → Volume
Management → Big problem

Slow uptake →
Not mine speak
Terminal - Seen ok
Rail system -
Skilled
Institutional memory
Risk
Board → Current not Board
performance
→ Challenges is
ignored
Operational risk →
Equipment + technology is
there but concern going
forward → child
more difficult areas. & not

addressed

Mask ? inefficiencies
Big load stations unlocked
Later ~~??~~ collapse –
Now deal with it large
train + model not roll
out anywhere – choose to
do it

→ Forward ⇒

Root cause / symptom
TFR Ownership → Challenge
County / State owned
Inclusive
⟹

Root is cause is the structure
from as required

State → Fiscal
↓
State owned
↓
TFR
Management
↓

Fiscal
↓
Who will
fund etc
↓
↓
Same fund
problem

Future →
other matter

Q_2^1

— Automated environment
by technology to underpin

Rolling stock not the greatest
– System management is strong
Scheduling + planning (Commercial)

→ Mine → Technology is great

→ Terminal → Reasonably old
Biggest → Some stuff to
do

Personnel + Training
* TFR to manage risk
* Remuneration to be managed

Maintenance → Sense of (technical)
?

Strategy → Where to go
Deal with ownership of the
line. Have to deal with it 2016

Terminal → 2,5 Competing agendas
across the Chain. Political
relationships

New model require to allow
a system investment
Not split (Terminal / line) all
together
→ Capital need to deal now
for future risk
Current model → TFR not work
Partnership
Stakeholder need to be brought
in 15 year agreement

From sector wortland required

Engagement levels - other players
other non coal pelagics
Partnering model → Would be
a better risk management and
move away from us vs them
* Focus → General or focussed
risk manage
→ Align with other players
→ Industry perspective → Looking
at current eco-system + fisheries
management
Buy in - to solution
Agree - Roadmaps + own

→ Biggest problem
+ expertise & skills - so focus
as part of general
Do not look at the complete
business   Mine deal with
2 Three   Risk

Risk management processes to be
aligned
(CEP) (TFR) (RBCT)
All view different
All different alignment

Because of system so
counter strengthening
Deliver value in different
Ops per unit
Even technical
High level might not
Interfaces can work →
Not dealing with bigger picture

Q3 Engagement levels look
fine on paper
Ops → raised + deal with
but not dealt with the
higher title level

Our check
wrapped around the whole
system

Look at different model to
adopt a system approach
Tension - more + problematic
as the pace + price burden +
Samancor etc
US - Them → 1
Need another model before another
break -
Mini breaks →
Current environment

Government as shareholder

Missing rebranding people

Risk of distress between 2 parties

Government thinking + keep industry going - Job retention

Merged model

System approach →

Best practises will come from ... and bring better process.

Best of breed one of all

System does not run away →

Open their mind more

within someone recognise that best

of breed 1st U

* Reduce capital any require
* Improve performance

→ Difficulty to compete between greater risk

System if

→ Point → everybody has to see all the value

Penalties + benefit scheme

Gov Has to add value to all

Got to to see value for every element

What (TFA)

What (TFA)

(vmc)

(RBCT)

Like this - get ... detail each element

Question 4

Competitive Risk

State of industry →

Dual listed companies - SA

Notes → Country risk / Sovereign risk

With ... environment - Small start out

... Technical challenge becoming greater

Disinvestment risks → all will be gone.

Will enhance other risks

Rationalisation of investment

Not Industry level to deal

Need Government Support

Notes - interview 5

→ ① Commodity outlook +
the pricing - the
path

② Ageing of coal assets
Lasting of coal assets
Within deplete
Sustain + coal challenge
Long term investment
Service provider + capital
investment + dependency
+ Capital investment

→ Future road - + capitalisation
where we are
Quiet
Investment have
I
→ Countries move away from
coal

→ Risk → Shareholder
Small players → ToP
Small
Competition → Exposure
dynamics is
Smaller asset to produce the
volume - Sustainability

volume - Sustainability
future it is difficult to
have

Commercial risk - Rail
on road → Shipping +
no default

Operation perspective - Reliability
Future + long - availability
of the line
SOC - Financial difficulty
Total commodity knock → +
Bigger picture affect Volume
business →
Concept is about logistic
nature of the beast

nature of the beast

Prospect to view Sustainability
being BC Business Continuity
Envelope
Operational risk ... Can
fix and off the shelf
Look at
82 → TTR → Pulling
Out set
→ Performance + quality of
coal the exports → *
Volumes - Rain / operation
have not full evaluation

more not full production
Old + recognition →
Take out of overhead cost →
Depleting →
Watching → IN →

Strategic importance of coal
IRR – Do we know the
energy source mix will be?
B Permission coal → justify
[illegible] – – – – – – –
Do you at least →
Uncertainty is a root cause.
Lost of play but at the [illegible]
Will more energy efficient
Wild card is low oil price ⊕

Wild card is "low" oil price ⊕
Energy competition →
Strategy policy? →
O' [illegible] that coal →
Best to Rail – open operation.
Good project → Fundable – always
better [illegible]

Leg as barrier or not
Extent of the coal field
⊕ Government understand to
I of the risk

• Asset is planning to sustain
the [illegible] in the
Plan A + B to sustain the
volume
Offshore to obtain a section to

Offshore to obtain a section to
get and be in business
• Quality is [illegible] + off [illegible]
RDCT → Now [illegible] 10 years
Swing about different [illegible]
by economics
⊕ Short term risks
Right skill – people +
[illegible] networks – business
[illegible] to grow
Logistics skills → Skill we manage
– Relationship with Stakeholders

Measurement → Metrics →
Performance drivers manage the risks
to see where you fall short
Tel work.

Tel work.

Specific focus → Added portfolio
for part of the contract +
[illegible] structure
Leg report into →
Manage into the bigger team
Not manage as more responsible for
Logistics →
Specifics not to manage the
value chain → [illegible] – Port
24/7 operation – Ensure
[illegible] ability →
→ Another Communication channels
that are possible → [illegible]

— the value all
competitive environment create and
will do (stocks) — return
Rand 2nd biggest cost to
drive

→ Waterberg open to more players
the Botswana Sustainability to
projects in W/B
If happen will create a transition —
Resource continuity. Security
of road + product. Link
product to market. Nice to have

all — tariffs down
Rand hurts needs customers Ok.

Question 4

- World war — + influence +
  the term
- Oil price
- China's economy + melt down
  Growth + how it is in
  → Currency.
- Green legislation & influence
  on carbon — real risk
  impact
- Power generation substitution.

- Pressure from ... have
  upset the stability →
  Labour unrest & low execution
  Mineral/political/regions

Notes - Interview 7

→ Res

→ Risk in the chain -
coal price → Issue
Why risk
→
Eskom capacity on the
coal line - Eskom to power
failure power supply

→ Overvaal tunnel is a
single line portion - delay +
incur problems

→ [illegible] line

- That technology is gone one
influx locomotive [illegible] -
19E → Problems occurring
Is it the ideal. Risk (back)

Coal price → Capacity - is there
Offer to client → Drop is
Costing perspective → The cost
is high. Eb-down makes
them re-invest
Eskom dictate the number of
trains in a section

Simulation — capacity
on overvaal tunnel →
Disruption
45 minutes → 30 minutes
Shunting only signal → delay at

only → Timing
Timing - Capital projects
→ Capacity

Right type equipment → Risk
People to maintain the equipment
Guarantee →

Loosing expertise on the coal line
Complex - By-pass -
Need expertise → To do decision
making → Loose trains
Delivering the service - People
knowledge + skills →
Understanding the line
Balance the wagons - 7800 wagons

Balance blockages → congest the yard
+ measure the balance - Not [illegible]
within the [illegible] - Incident [illegible]
30 trains a day
Crew + resource to Balanced
system

→ Planning from mine where there
derailment cause problem trains
late
→ People need to align - not
[illegible] down
Incident - Learning
Domestic
Export

→ Keeping to the [illegible] →
Equipment to the [illegible] site
is crucial to risk

~~Root~~ Root cause

In general root causes →

~~Ø~~ Attention [illegible] people

Integrated approach

Monthly COT meeting →

- Id the risk for the total [illegible]

- Forum with TNPA + RBCT → in integrated [illegible]

- SLA ⇒ → Id and [illegible] discuss the risks

Execution → ? → [illegible]

TFR

a) All [illegible] → [illegible] [illegible] [illegible] [illegible] addressed at the [illegible] the appropriate level

→

General ⇒

Coal → [illegible]

Strategy ⇒ Department [illegible]

to Strategy → [illegible] → Strategy

close Interface ⇒

Very specific → Capital projects

Risk management is general → not paper exercise. Not enough

Do add value → HQ they add value

The coal [illegible] smaller risk

New technology ⇒ Do not add value

Strat risk → added value

Tactical / Operational → not that much value

Question 3

Take or pay agreement → Execute it and protect the EBITDA →

- Strategic

Risk forum for the chain + follow the correct process + procedures

- Logistics chain risk forum.

- Ops ~~■~~ risk → balance + [illegible] sync

SOC planning + monitor execution

CTC [illegible] → [illegible] [illegible]

Holistic view > [illegible] [illegible]

Integrated process → [illegible]

[illegible] Information [illegible] flow + [illegible]

- Forward view ⇒

Assist from a planning view - logistic chain

Addition idle → no demand

Every person understand the impact - Better solution will [illegible]

- Focused view and apply focus to specific areas [illegible] [illegible]

Understand the risk on the business

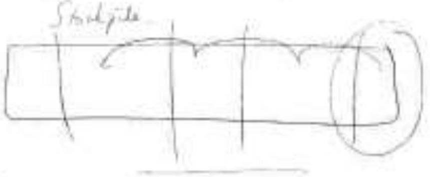
→ Pit to Port ⇒ Vessel planning

TNPA

Stockpile around the year [illegible] [illegible] the flow

Resourcing + planning - SOC will be able to assist

Best method & stockpile impact
it is great
Depending [illegible] approach
Base on the insight ⇒
Stockpile



Question 4

⇒ Stockpile variability

⇒ free planning ⇒ Safer ⇒ for next
month ⇒ Need a longer
horizon
→ Longer term view ⇒ GFB
has a < serious impact
Volume ⇒ Info availability ⇒
Planning ⇒

Impact of GFB ⇒ Coal line
Swing length 20/20
Overall view ⇒ Longer term planning
require to happen –

Notes - Interview 8

① Commodity price
② People skills
③ Eskom power failure
④ Community along the line
⑤ Theft and vandalism
⑥ Production cost

- Spot trading - Coal price - Capacity reduce
Cancelled risk
MDS ⇒ Capital program

Commodity price to expand the capacity

- Labour environment - Process and disrupt operations - Daily risk Go to strike Current legislation production

- Community - unique
3x Communities - livestock + farm
Incidents of accidents + employment to damage & sabotage Cable theft Service as dependent on the happiness of the community

- Capacity 83 mt - General freight traffic

Eskom power supply - Max demand in a section
Maximum demand - section
Not too many trains Cycle of trains

Theft + vandalism - Expensive
Copper cable for sale - to feed the Solid retrenched
RME employees - contract area - to slow the unhappiness ⇒
Syndicate - capable + well pass Infrastr

- Product quality - the mine + last minute cancellation Stock + new process to be better

+ new process

Identified one by one ⇒

Not direct to

Risk = Customer base is shifting
Market - Client + new markets

Q2 - Treatment - Take or Pay - for commercial price process - income for capital program

- Asset base - Resource requirements
low coal demand - deploy assets

- Cost – Reduction Vendor agreement
- Internal control to manage the risks financial

Community – Strategy is in development
Theft and vandalisms –

General strategy → Transit
plan to a focussed strategy
Need focussed strategy – condition is different
The contracts

Q4 / / [illegible] between

Q3 • Long term agreements between suppliers + customers ⇒
• Local community
• Long term wage agreements
labour stability no strike ⇒
other sector – long term agreements
• Governance SOC Tran – Manage the community
create a forum that address the issues → [illegible]
• Dedicate 1 [illegible] coal product LTP ⇒ [illegible]
as [illegible] →
Pro-actively ⇒ Not reactive
Disruptions cost money

⊙ Everything

Emergence of new sources energy ⇒ → Risk to coal industry – and how to mitigate

Reduction reduces carbon emission – a threat to local power station of coal burning