

The application of Soft Systems Methodology to Supply Chain Risk
Management in Small and Medium Enterprises

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A research report submitted to the School of Mechanical, Industrial and Aeronautical Engineering, Faculty of Engineering and the Built Environment, University of the Witwatersrand, in partial fulfilment of the requirements for the Degree of Master of Science in Engineering.

Johannesburg, 2015

DECLARATION

I declare that this research report is my own unaided work. It is being submitted to the Degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

..... day of, 2015
Mpho Maje (day) (month)

ABSTRACT

Supply chain risk management is one of the strategies that assist enterprises in the identification, assessment and control of supply chain risks. With the increased dynamics and complexity of supply chain risks for small and medium enterprises, an innovative approach in analysing these risks is required. The purpose of this research is to assess supply chain risk management in five small and medium enterprise cases using soft systems methodology.

The systems thinking approach will assist in the analysis of the dynamics and complexity of supply chain risks for small and medium enterprises. A qualitative approach was utilised to obtain insight into current issues that small and medium enterprises, in the manufacturing sector, face within the supply chain.

The results of the application of soft systems methodology on small and medium enterprises for obtaining insight into supply chain risk management for these enterprises proved to be fruitful. The replication logic used in each case, lead to similar results as expected.

In memory of my father

Darius Sinki Maje

(24 January 1955 - 08 January 2010)

“I carry your heart with me (I carry it in my heart)

I am never without it

(Anywhere I go you go, my dear;

and whatever is done by only me is your doing, my darling)

I fear no fate (for you are my fate, my sweet)

I want no world (for beautiful you are my world, my true)

and it's you are whatever a moon has always meant

and whatever a sun will always sing is you

here is the deepest secret nobody knows

(here is the root of the root and the bud of the bud

and the sky of the sky of a tree called life;

which grows higher than the soul can hope or mind can hide)

and this is the wonder that's keeping the stars apart

I carry your heart (I carry it in my heart)”

~ E.E. Cummings

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my Supervisor, Bernadette Sunjka, for her guidance, continuous support and invaluable commitment to me as a student. She kept her office open for me to answer my questions and clear my confusion but also allowed me the freedom to put my point across on the research report. In addition, I would also like to thank her for her excellent feedback, which has helped me improve the quality of my research report.

My thanks also go to the management team of each company I interviewed for the valuable time and information. This research report would not be possible without their willingness to share their company information and experiences.

My thanks also go to my colleagues and the management team at Impala Platinum Refinery for their professional and financial assistance. The moral support I received when I had to abandon my role at the workplace has allowed me to complete my research report with minimum delays.

Finally, I want to thank my fiancée, Sithembiso Temba, for his support and encouragement. I would not have been able to achieve all my goals without his support and understanding. Thanks to my son, Thabo, for understanding why I had to be away during some weekends and evenings. I am also indebted to my parents, Darius and Duduzile, for all their sacrifices. Thanks to my sister, Lerato, for her love and faith.

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NOMENCLATURE

SC - Supply Chain

SCM - Supply Chain Management

SCRM- Supply Chain Risk Management

SME - Small and Medium or Small, Micro and Medium Enterprises

SSM - Soft Systems Methodology

CHAPTER 1. INTRODUCTION

This chapter of the research report provides an overall perspective of the study and motivates why the research is important. The chapter commences with a background statement that sets the scene for the research report. This is followed by the purpose of the research, which explores the significance of the research, before the research question is presented. The objectives of the research report are then determined before the report structure is discussed.

1.1 Background Statement

Small and Medium Enterprises (SMEs) are one of the drivers of economic growth. These enterprises contribute to the economy through job creation, generation of higher production volumes and increased exports (Mahembe, 2011). With South Africa facing an unemployment crisis, nearly 40% of the population being unemployed, the survival of these enterprises has become vital (Morgan, 2012). Unfortunately, due to the lack of resources and proper management, most of these enterprises fail to survive in the supply chain (Morgan, 2012).

Numerous tools are available in the supply chain management (SCM) discipline that assist enterprises within the supply chain to deliver competitive products and/or services to their customers. The effectiveness of some of these tools is mainly dependent on resources and good management structures. The implementation of these SCM initiatives becomes exhaustive and expensive for SMEs (Norek *et al.*, 2007). SCM has introduced concepts such as supply chain risk management (SCRM) to assist enterprises within the supply chain in anticipating and managing risks associated with the supply chain. Since the foundation of this concept is from SCM principles, it also becomes problematic in terms of its implementation in SMEs (IBM, 2008). With the dynamic behaviour of the

supply chain, the complexity of the supply chain increases. More complexity in the supply chain leads to newer risks, which create a need for innovative ways to manage complexity.

A framework for managing the complexity associated with the risks involved in supply chains of SMEs will assist in obtaining insight that will ensure the survival of SMEs and thus benefit the South African economy. Soft systems methodology (SSM) is a theoretical framework that is suited for complex problems. This framework is expected to assist in the understanding of how SMEs manage the risks within their supply chain, given their limited resources.

1.2 Purpose of Research

The aim of this research report is to explore SCRM from the perspective of SMEs. Due to the complexity involved in SCs for SMEs, SSM will be used to explore SCRM. This exploration will assist in obtaining an insight into SCRM from the perspective of SMEs. This insight will contribute towards the survival of SMEs in supply chains.

1.3 Research Questions

The research question for this research report is:

How can Soft System Methodology (SSM) be used to investigate SCRM in SMEs?

1.4 Research Objectives

The objective of this research report is to:

- develop the theoretical frameworks upon which this research report will be based upon,

- investigate and discuss SCRM in SMEs using SSM,

1.5 Limitations

This research report is only limited to small and medium enterprises in the manufacturing sector. The research report will only focus on a specific sector, as there are many other different sectors, which would make it impossible to achieve the objectives of this study in the time provided.

In this research report, the term small and medium enterprises (SME) will be used instead of small, medium and micro enterprises as defined in the National Small Business Act (2003). Small and medium enterprises for manufacturing organisations will be defined according to the National Small Business Act.

1.6 Report Structure

This research report will continue onto the literature review chapter (Chapter 2). The literature review chapter explores SCM and its initiatives. This will be followed by the exploration of SCRM before SMEs and their challenges are discussed. SSM will then be discussed in great detail. A conceptual framework, upon which this research report is based on, will be formulated. The research methodology chapter (Chapter 3) will follow and explain the method design of the research. The results (Chapter 4) and discussion chapter (Chapter 5) then follow, where the results of the study are analysed and evaluated. Conclusions and recommendations are then explored in the last chapter (Chapter 6).

CHAPTER 1: Introduction



CHAPTER 2: Literature Review



CHAPTER 3: Research Methodology



CHAPTER 4: Results and Analysis

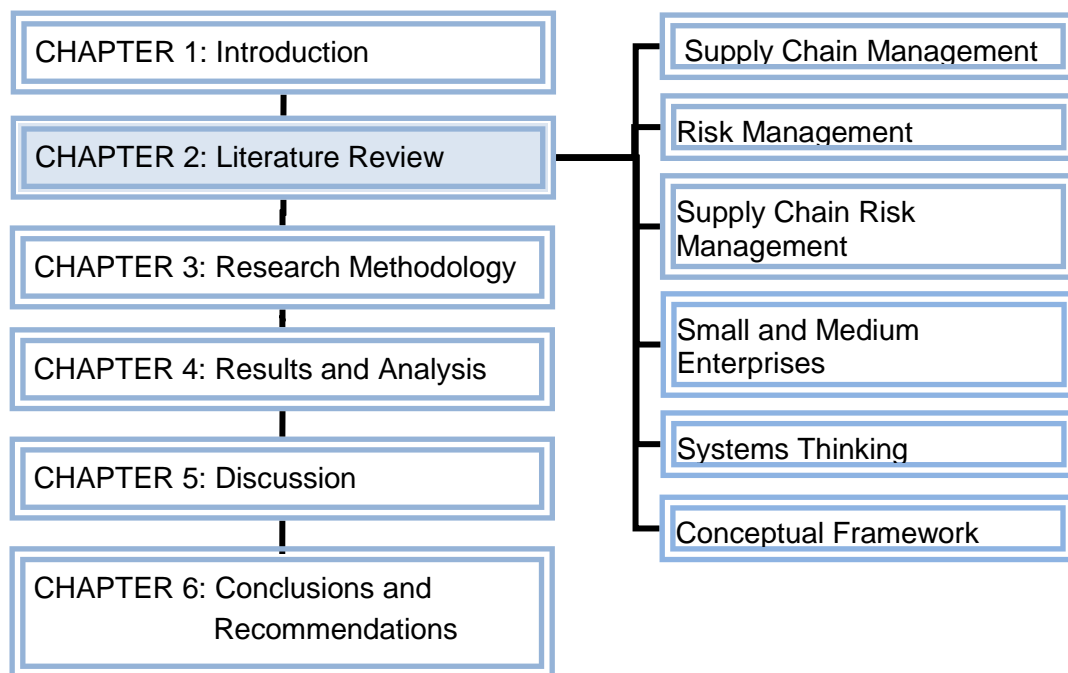


CHAPTER 5: Discussion



CHAPTER 6: Conclusions and
Recommendations

CHAPTER 2. LITERATURE REVIEW



The literature review chapter explores SCM and its initiatives. This will be followed by the exploration of SCRM before SMEs and their challenges are discussed. Systems thinking will then be discussed in detail. A conceptual framework, upon which this research report is based on, will be formulated.

2.1 Supply Chains Management

A supply chain is a linkage of organisations that turn materials, products and services into finished products for the customer (Beamon, 1998). Each organisation within the supply chain has a customer but in the objective of the supply chain, the end user is the main customer. Materials, products and services in the supply chain have a flow in a forward direction, while information flows backwards (Beamon, 1998). The supply chain performance is measured by qualitative and quantitative measures. Beamon (1998) listed the main qualitative measures as

customer satisfaction, flexibility and supplier satisfaction and quantitative measures as those based on cost and customer responsiveness. A typical supply chain, as depicted in figure 2-1 below, follows either a pull or a push philosophy. In a pull philosophy, customers determine the products and services while in a push philosophy, the parties push products and/or services (Naude, 2009).

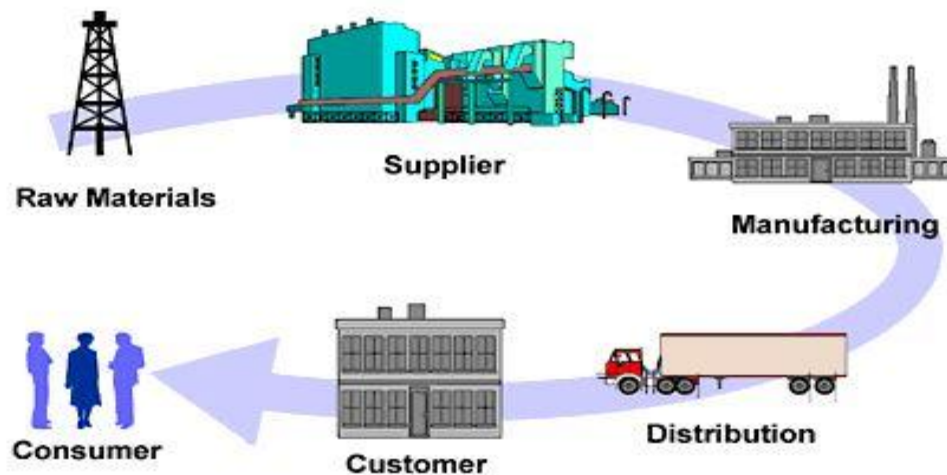


Figure 2-1 Components of the Supply Chain [Mitchell, 2009]

Ab Rahman *et al.* (2008) defined SCM as the process of planning, implementing, managing and improving the operations of the supply chain and its value in the entire network. This management approach allows the organisations in the supply chain to have a long-term objective of working as one entity to deliver added-value products and/or services to the consumer (Beamon, 1998). The organisations achieve the long-term objective through a combination of client value definition, supplier relationship establishment, integration of activities and continuous improvement. This collaborative effort by the organisations in the supply chain leads to a competitive advantage and prevents them from conducting their business in isolation. According to Zigiáis (2000), SCM also assists in reducing working capital, accelerating cash-to-cash cycles and increases inventory returns.

The benefits of SCM are achieved by the effective implementation of SCM initiatives. These initiatives include total quality management (TQM), continuous improvement (CI), just-in-time (JIT), lean production, outsourcing and consolidation of suppliers. Naude (2009) defined TQM as the management of the entire organisation so that it excels in all dimensions of products and services that are important to the customer. The goal of this initiative is to ensure that the business' systems consistently produce a product or service according to its design. CI involves the improvement of the processes within the organisation. JIT means producing goods and services precisely when they are required. Lean production involves obtaining the same output from half the resources required by older production. Outsourcing, which is the subcontracting of non-essential functions, maximises the product speed and reduces or distributes risk in the supply chain (Naude, 2009).

Enyinda *et al.* (2008) found that SCM initiatives enabled organisations to contain costs, focus on strategic core competencies and operate at optimum efficiency and ultimately boosted supply chain efficiency. A study conducted by Ab Rahman *et al.* (2008) found that even with these benefits, the adaption of these initiatives is rare in some organisations, especially in SMEs. The study revealed a number of factors that limited the adoption of these initiatives. These factors include limited expertise, higher costs and lack of cooperation from other parties in the supply chain. Those organisations that can overcome these challenges can successfully adopt SCM initiatives. However, the adaptation of these initiatives has presented challenges to supply chains. Nagurney (2012) explored the consequences of SCM initiatives in a study. This study revealed that outsourcing led to loss of control, consolidation of suppliers resulted in potential for supplier failure while JIT and lean production increased efficiency but not effectiveness. ISO 9001: 2008 (p. 2) also states that outsourced processes do not absolve the organisation of the “*responsibility of conformity to all customer, statutory and regulatory*

requirements". This means that the organisation is still responsible for any outsourced products and services. Marchese & Paramasivan (2013) viewed the never-ending objective of improving efficiency and reducing costs to have led to increased complexity in supply chains. This increased complexity, together with high uncertainty, high customer expectations and high vulnerability has presented greater risks to supply chains (Shaohua, 2008). According to IBM (2008), avoiding or at least confronting risks in today's complex supply chain can strengthen competitive advantage and even lead to financial longevity.

2.1.1 Risk Management in Supply Chains

According to Bosman (2006), disruptions to the supply chain can reduce an organisation's revenue, cut into its market share, inflate cost, damage its credibility, and threaten production and distribution. These disruptions, which can be caused by any supply chain problem, can affect all the parties in the supply chain (Oehmen, 2009). Naude (2009) categorised supply chain problems into internal and external problems. Internal supply chain problems included supplier inflexibility, supplier capacity and low or lack of local supplier base as internal problems, while external problems include load shedding, oil price and B-BBEE requirements. Disruptions caused by these problems are a major risk to the survival of any supply chain. Jutter *et al.* (2003, p. 7) defined supply chain risk as "*any risks to the information, material and product flows from original supplier to the delivery of the final product for the end user*". Organisations need to manage supply chain risks in order to reduce or eliminate the impact of any disruption.

The Economist Intelligence Unit (2009) conducted a global survey that revealed that many organisations continue to underestimate the risks of supply chain failure. This notion has changed considering the number of significant supply chain events that have occurred. These events include

the terrorist attacks on the World Trade Centre that affected Toyota and Ford due to Canadian border constraints and the Thailand flood that affected Dell due to a shipment shortfall (Gregory & Kumar, 2012). Lleo (2009) found that learning from financial disasters to have been critical to the advancement of risk management. The economic impact of these supply chain disruptions has increased the importance of risk management in supply chains (Schlegel, 2012).

2.2 Risk Management

The risk management standard (AIRMIC *et al.*, 2002) defined risk as the probability of loss, injury or damage that exists in all activities and organisations. Due to catastrophic consequences of some of these risks on activities and organisations, it is important to define and manage those risks. This process of identifying, evaluating and setting up a strategy to manage risks is called risk management (Manuj & Mentzer, 2008). Risk management assists organisations in predicting and managing uncertainties. It is a good management tool, which provides an organisation with an objective view of the required resources and skills to eliminate and/or reduce risks (Pharmaceutical Quality Control, 2010). This is a good tool, which is applicable in all activities and organisations, including supply chains. Different authors have classified risks into different groups. Table 1 below displays common risk classifications in the research field.

Table 1: Classification of Risks [developed by Author]

| Author | Risk Classification |
|---------------------------|---|
| Churchill & Coster (2001) | Operational, institutional, financial management and external |
| AIRMIC, ALARM & IRM, | Strategic, operational, financial, |

| | |
|--------------------------------|---|
| (2002) | knowledge management and compliance |
| Department of Transport (2003) | External, demand, supply and environmental |
| HM Treasury (2004) | Political, Economic, Socio cultural, Technological, Legal & Environmental |
| Enyinda, <i>et al</i> (2008) | Environmental, organisational and network work-related |
| Deloitte (2012) | Functional, operational, extended value chain and macroenvironment |

Supply risks relate to the potential or actual disturbances to the flow of product or information within the network, upstream from the focal company. Demand risks also relate to the disturbance to flow of product or information but are downstream from the focal company. Operational and functional risks are internal risks that are under the organisation's control (Deloitte, 2012). External or extended value chain risks, which according to Gilaninia *et al.* (2013) have a greater impact than internal risks, are out of the organisation's control. Environmental or macro environment risks are similar to, if not the same as, external or extended value chain risks. Due to many and varied different views and descriptions of what risk management entails, a risk management standard was developed (AIRMIC, ALARM & IRM, 2002). This standard ensured that the objective, terminology and process of risk management are agreed upon. Undertaking this risk management process can assist organisations safeguard the quality and supply of their products to customers. The Pharmaceutical Quality Group (2010) expressed how risk management can develop and improve the business relationship between customers and suppliers, reduce costs, minimise costs of non-conformance, improve

business efficiency, increase confidence of customers, reduce liability, increase security of supply and avoid waste and scrap.

The benefits of risk management justify this widely utilised tool. The risk management process identifies the organisation's exposure to uncertainty. This requires an intimate knowledge of the organisation, the market in which it operates and the environment in which it exists. HM Treasury (2004) have developed the risk management model shown in figure 2-2 below. This model can only function in an environment that has a defined risk appetite. HM Treasury further defined risk appetite as the amount of risk than an organisation is prepared to accept, tolerate or be exposed to at any point in time.

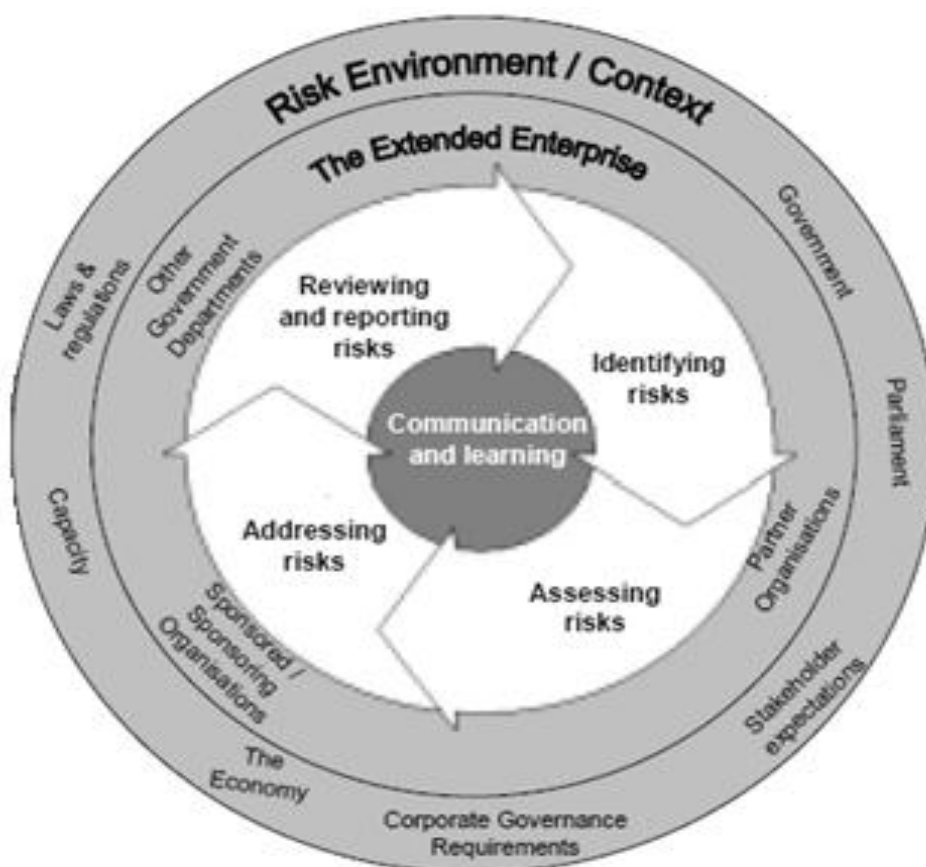


Figure 2-2: Risk management model [adopted from the Orange Book (HM Treasury, 2004)]

The effectiveness of the risk management process requires a continuous balance of the elements in the model and thus is not a linear process. Communication with all stakeholders is vital throughout this process. The process consists of the following phases: context identification, risk identification, risk assessment, risk evaluation, risk addressing, and monitoring and reviewing. The first phase, context definition, identifies the area of risk. This ensures that the risk management process is focused on a specific area before you can start identifying the risks (HM Treasury, 2004).

2.2.1 Risk Identification

Risk identification is an essential phase as it might misguide other phases of the risk management process, if done inaccurately (Kayis & Karningsih, 2012). An accurate and well-defined risk identification phase, with all possible sources of risks, will ensure that stakeholders select the best solutions to address the risks. Table 2 illustrates the risk identification tools used and their advantages and disadvantages:

Table 2: Risk identification tools [developed and summarised by author from Pharmaceutical Quality Control (2010)]

| | Brainstorming | What If? | Process Mapping | Mind Mapping | Cause and Effect Diagram | Hazard & Operability Studies (HAZOP) |
|---|---------------|----------|-----------------|--------------|--------------------------|--------------------------------------|
| Advantages | | | | | | |
| Reasonable simple | √ | √ | | | √ | |
| Effective for defined processes | | √ | √ | | √ | √ |
| Requires few resources | √ | √ | | | √ | |
| Minimal training required | √ | √ | | | √ | |
| Can identify areas not considered before | √ | | | | | √ |
| Disadvantages | | | | | | |
| Requires impartial facilitator | √ | | | | | |
| Active participation required | √ | √ | | | √ | √ |
| Can generate too much data | √ | √ | | | √ | |
| Lengthy process | | | √ | | | √ |
| Requires training | | | | √ | | √ |
| Requires other tools | | √ | | √ | | √ |
| Requires substantial knowledge on processes | | √ | √ | | √ | √ |
| Limitation in scope of use or data | | | | √ | √ | |

The tools displayed above range from simple to more complex tools. A variety of industries has been using these tools. Their use depends on the knowledge and preference of the user. These tools are effective methods

to identify risks for the next phase, which is risk assessment (Pharmaceutical Quality Control, 2010).

2.2.2 Risk Assessment

The assessment of risks involves analysing risks, identified in the previous phase, based on the probability or likelihood and consequence or impact of occurrence. Table 3 illustrates the risk assessment tools used and their advantages and disadvantages:

Table 3: Risk assessment tools [developed and summarised by author from Pharmaceutical Quality Control (2010)]

| | Control Charts | Pareto Charts | Risk ranking and Filtering | Preliminary Hazard Analysis |
|------------------------|----------------|---------------|----------------------------|-----------------------------|
| Advantages | | | | |
| Reasonably simple | √ | √ | √ | |
| Requires few resources | √ | √ | √ | |
| High visual impact | √ | √ | √ | √ |
| Statistically based | √ | √ | | |
| Prioritise risks | | | √ | √ |
| Disadvantages | | | | |
| May be biased by error | √ | √ | √ | √ |
| Requires other tools | √ | √ | | √ |

The risks assessment tools above are effective tools that will assist organisations to evaluate risks before they can be addressed (Pharmaceutical Quality Control, 2010).

2.2.3 Risk Evaluation

The risk evaluation tools are used for analysing and prioritising risks, based on the results from the risk assessment phase. The risk evaluation phase also utilises brainstorming, from risk identification phase, and Pareto analysis, from the risk assessment phase. The other tool that can be utilised in this phase is the carrot diagram. The carrot diagram is a simple tool that also has a high visual impact. The downside to this tool is that it requires knowledge to set the tolerable regions and placement of risks. Effective completion of this phase provides a good platform for selecting the best options to address these risks (Pharmaceutical Quality Control, 2010).

2.2.4 Risk Addressing

The risk-addressing phase involves setting up controls that will address the risks and ultimately reduce their impact or consequence. This phase utilises three main tools (Pharmaceutical Quality Control, 2010). These tools include Root Cause Analysis (RCA) that is used to reduce or remove the cause of the risk and then observing its effect. The Corrective Action and Preventive Action (CAPA) is a tool adopted from the Quality Management System. Ideally, an organisation with a proactive culture uses preventative actions (Pharmaceutical Quality Control, 2010). The last tool is called the “4 T’s”. These are treat, transfer, terminate and tolerate. The organisation can treat the risk by reducing or preventing it from occurring. The organisation can also transfer or share the impact of the risk. In the termination of risks, the organisation stops doing whatever is exposing the business to the risk. The organisation also has the option of

tolerating or accepting the risk. Organisations have also adopted risk avoidance as a strategy. This strategy is used when the risks associated process, product or service are considered unavoidable (Jutter *et al.* 2003).

2.2.5 Monitoring and Reviewing

In the monitor and review phase, the effectiveness of the risk management process is evaluated (HM Treasury, 2004).

2.3 Supply Chain Risk Management

In the risk management process, defining the context as supply chains leads to supply chain risk management (Berenji & Arantharaman, 2011). Jutter *et al.* (2003, p. 9) defined SCRM as the “identification and management of risks for the supply chain through a co-ordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole”. This SCM initiative is vital for the survival of supply chains. However, this management of supply chain risks is a process that presents difficulties in its application due to the complexity and dynamics of the risks. Deloitte (2012) depicted supply chain risks in the classification shown in figure 2-3 below.

who presented a new system-oriented approach to support SCRM, observed how SCRM solutions lacked a systemic understanding of the supply chain risk situation. Most research papers, which are spread over various industries or sectors, also suggested a holistic approach to the application of SCRM (Ghadge *et al.*, 2012; Marchese & Paramasivam, 2013). They found that using system thinking was a largely unexplored area and that it is the missing link in SCRM literature. A more holistic approach will assist in obtaining an insightful understanding of SCRM and thus fill the gaps in this research area. Ghadge *et al.* (2012) examined SCRM from a holistic system thinking perspective. They found that the systems approach provided a rich, unbiased and holistic picture of the advancement in the field of SCRM. Vanany *et al.* (2009) also reviewed the literature on SCRM. Their review found that only 9% of the literature was exploratory in nature, while 6% was conceptual. They also observed that SCRM research was biased towards large enterprises. Having noticed this observation, Sunjka & Bindeman (2011) presented a system-oriented framework for SCRM in SMEs. The authors found the framework useful for a manufacturing SME but required sufficient data and commitment from the SME and found the framework's application to be more applicable in a workshop environment.

While some papers have suggested further development of existing SCM initiatives such as SCRM, Chopra & Sodhi (2004) have suggested the opposite of these initiatives. They suggested increased capacity, redundant suppliers, increased inventory, responsiveness and flexibility as mitigating approaches to supply chain risks. These approaches have led to 'resilience', as an approach to SCRM. Deloitte (2012) explored what resilience means in SCRM. The authors found the four pillars of supply chain resilience to be visibility, flexibility, control and collaboration. Visibility enables organisations to address supply chain risks by tracking and monitoring supply chain events and patterns. Flexibility is being able to adapt quickly in response to problems without significantly increasing

operational costs. Control is having robust policies, monitoring and control mechanisms to help ensure the proper procedures and processes are followed. Collaboration is the ability to work effectively with supply chain partners in order to avoid disruptions and achieve common goals. According to Mitchell (2009) collaboration will yield better results in SCRM. Ultimately, the key will be to build a “resilient” supply chain that not only seeks to reduce risks but is also prepared to quickly adjust and recover from any unanticipated supply chain disruptions that occurs (Marchese & Paramasivan, 2013).

2.4 Small and Mediums Enterprises

Small and medium enterprises (SMEs) are essential for the economy as they play a major role in any industry (Chimucheka, 2013). This research paper will use the international term SME instead of small, medium and micro enterprises (SMMEs) as defined in the National Small Business Act. SMEs in the manufacturing sector will be defined according to table 4 below, adopted from the National Small Business Act.

Table 4: Classification of SMEs in the Manufacturing sector [*National Small Business Amendment Act No. 29, 2003*]

| Sector | Size of Class | Total full-time equivalent of paid employees | Total Turnover | Total gross asset value (fixed property excluded) |
|----------------------|---------------|--|----------------|---|
| Manufacturing | Medium | <200 | <R51m | <R19m |
| | Small | <50 | <R13m | <R5m |
| | Very Small | <20 | <R5m | <R2m |
| | Micro | <5 | <R0.20m | <R0.10m |

In general, SMEs contribute to the country's national products by producing goods of value or through the provision of services to both consumers and/or other enterprises (Berry *et al.*, 2002). From an economic perspective, enterprises are not just suppliers but also consumers. With between 1.6 and 3 million SMEs in South Africa, the collective contribution of these SMEs towards the South African economy is quite significant (Berry *et al.*, 2002). Chimucheka (2013) investigated the SME sector in South Africa and included job creation, and economic growth and development, as contribution made by SMEs. SMEs in the manufacturing sector form 44% of the manufacturing sector's employment rate. The South African government has noticed the contribution made by SMEs towards the South African economy. The government has introduced a number of initiatives to assist SMEs in increasing the competitiveness of their businesses. However, according to Mago & Toro (2013), the biggest issues with these government initiatives are the lack of awareness amongst SMEs, the lack of follow-up support and the focus of the number of SMEs supported rather than the quality of support.

SMEs exist in an environment that requires constant changes in order to survive in supply chains (Chimucheka, 2013). The South African environment presents increased pressure on these enterprises. There is increased pressure on these enterprises to comply with government regulations (Brink *et al.* 2003). There is also pressure within supply chains for SMEs to align the management of their operations with those of larger enterprises. SMEs are then required to comply with any safety, environment and quality system requirements imposed on them, which require increased resources (Brink *et al.* 2003). Small Enterprise Development Agency - SEDA (2012) and Chimucheka (2013) added customers' bargaining power, suppliers' bargaining power, insufficient opportunities for training staff, competition regulations, economic constraints and skills shortage as other challenges faced by SMEs. SMEs, being smaller players in any supply chain, are under enormous pressure

to overcome these challenges. According to the Business Environmental Specialists (2013) 80% of the SMEs in the manufacturing sector found it hard to run in the year 2012. This number is not surprising considering that most SMEs spend over 62% of their turnover on input materials and labour only, which yields a small profit margin (Business Environmental Specialists, 2013). With limited resources and current economic constraints, SMEs are expected to deliver competitive products and services at lower costs. This constant battle to ensure compliance with the requirements of the supply chain (or of large enterprises) and still offer a competitive advantage increases the complexity within its supply chain (Deloitte, 2012).

2.5 Systems Thinking

Traditionally, problems are solved by separating individual parts (subsystems) from the whole entity (system) being studied. These individual parts of the whole entity are analysed in isolation of the whole. The problem with this approach of solving problems is that the interactions between the systems are ignored. This way of thinking is only relevant for ideal situations, as problems in the real world are more complex and the interactions between systems have significant effects on the systems under study. Most problems, which are said to be wicked, are complex and dynamic in nature. Barry & Fourie (2001) described wicked problems as those problems that cannot be easily defined, require iteration and have no specific alternative solution. Ramo & St. Clair (1998) suggested a systems approach for the analysis of these 'wicked problems'. This approach will assist in analysing the problem in its entirety by taking all the parameters of the problem into account.

The systems thinking approach views a whole system as an entity that adapts to the changing environment. This system, which may contain subsystems or may be seen as a subsystem in a larger system, has

communication processes, control processes and 'emergent properties'. These 'emergent properties' are properties that the system has as a single whole (Bjerke, 2008). Systems' thinking forms the basis for systems methodologies, which are either 'hard' or 'soft'. In hard systems methodology, the problems are well defined and consistent. Simonsen (1994) mentioned how soft systems methodology attempts to give a holistic approach to complex problems in a dynamic environment.

2.5.1 Soft Systems Methodology

Soft systems methodology (SSM) is an organised 'learning paradigm' that is based on the work of Peter Checkland. Checkland (1981) produced the methodology in the 1970s at the Department of Systems at the University of Lancaster. This methodology highlights problem identification, problem structuring and the acceptance of multiple problem-perspectives (Lehaney & Paul, 1996). The essence of Checkland's approach is to identify one or more problem areas in a system and then model only those business processes that are relevant to that problem area (Kingston, 1995). Checkland's SSM has proved to be powerful as a systemic approach to defining and solving problems in organisations (Mathiassen & Nielsen, 1989). According to Checkland (2000), this methodology, which focuses on problematic situations, is a way of thinking. SSM deals with two kinds of activities, 'real-world' activities involving people in the problem situation and 'systems thinking' activities where the analyst tries to abstract from the real world using systems thinking and where people from the problem situation may or may not participate. SSM involves seven stages, which address the 'real-world' and the 'systems thinking' about the real world (Checkland, 2000). The first two stages involve developing a deeper understanding of the problematic situation, the 'real-world'. The next two stages involve developing an understanding of the ideal situation, which is the 'systems thinking' about the real world. The fifth stage involves the comparison of the two worlds, while the last two stages involve the

improvement of the problem situation (Simonsen, 1994). Figure 2-4 below illustrates these stages.

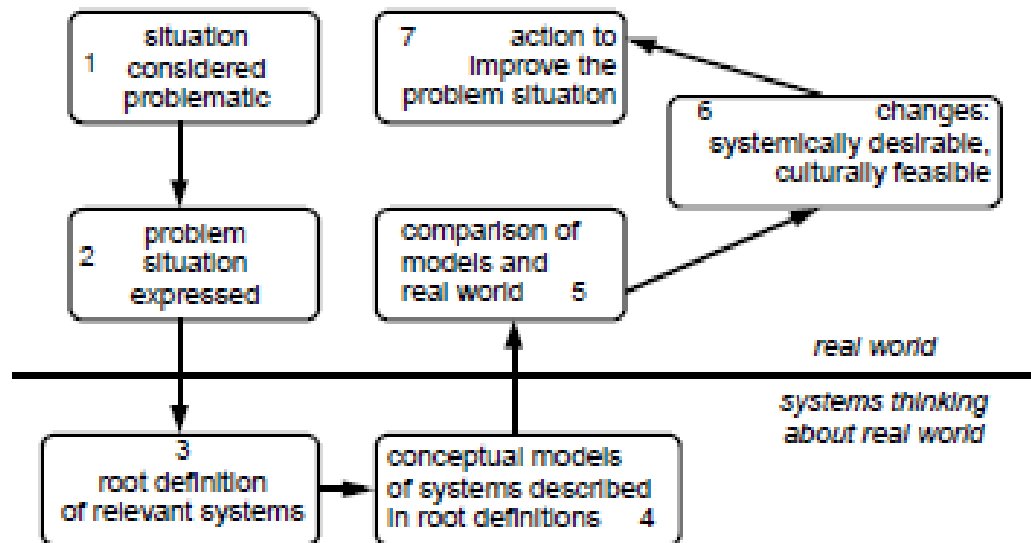


Figure 2-4: Stages in Soft Systems Methodology (Adopted from Checkland [1981])

Stage one of the methodology defines the problem situation while the second stage involves building a rich picture of the problem situation. Checkland (2000) recommended that a rich picture should include the system structures, processes, climate, people and conflicts. The rich picture should capture all the elements that affects and is affected by the problem situation. According to Dempster (2003), rich pictures illustrate a problem situation in all its richness and complexity. They also encourage a holistic rather than reductionist thinking about a situation. However, these rich pictures are not always comprehensive, accurate or informative. In the third stage, the ‘root definitions’ of the relevant systems are defined. Checkland presented the mnemonic ‘CATWOE’ as a guideline for defining these root definitions. This mnemonic describes six elements:

C – Customers of the system or those affected by the system’s activities

A – Actors within the system who carry out or cause to be carried out the main activities of the system,

T – Transformation process by which inputs to the system are transferred into outputs,

W – Weltanschauung or worldview,

O – Owners of the system who have control over the system's activities,

E – Environment within which the system exists

These elements are then used to define the root definition, which provides an idealised view of what the system does, how it does it and why it does it (Checkland, 2000). In the fourth stage, the root definition is used to draw up a conceptual model of the system. The conceptual model is an account of the activities, which the system must do in order to represent the system as it is defined in the root definition (Leonard & Beer, 1994). Simonsen (1994) mentioned how the conceptual model takes the form of a drawing with each activity described in a few words depicted in a 'bubble' and with arrows connecting the bubbles showing logical relationships. Stage 5 compares this conceptual model of the system to the problem situation depicted in stage two. The last two stages of the methodology involve generating and implementing changes that will improve the problem situation [Defence Acquisition University, 2001]. The application of this methodology offers a structure to the understanding of a loosely-defined problem situation.

2.6 Conceptual Framework

Having presented the literature of the key concepts upon which this research paper is based, the merging of these concepts forms the conceptual framework. This conceptual framework is the basis for the exploration of SCRM for SMEs in the manufacturing sector. SSM will be utilised to formulate the ideal model for the conceptual framework. Since the aim of this part of the report is to explore SCRM from the literature above, only the first four stages of the methodology will be utilised.

2.6.1 Stage One and Two – Real World

This part of the report defines the problematic situation and depicts a rich picture of the problematic situation. The problematic situation can be viewed as ‘SCRM for an SME in the manufacturing sector’. Figure 2-5 below illustrates a rich picture for a manufacturing SME in the SC. This rich picture depicts the dynamics and complexity involved in SCRM for SMEs.

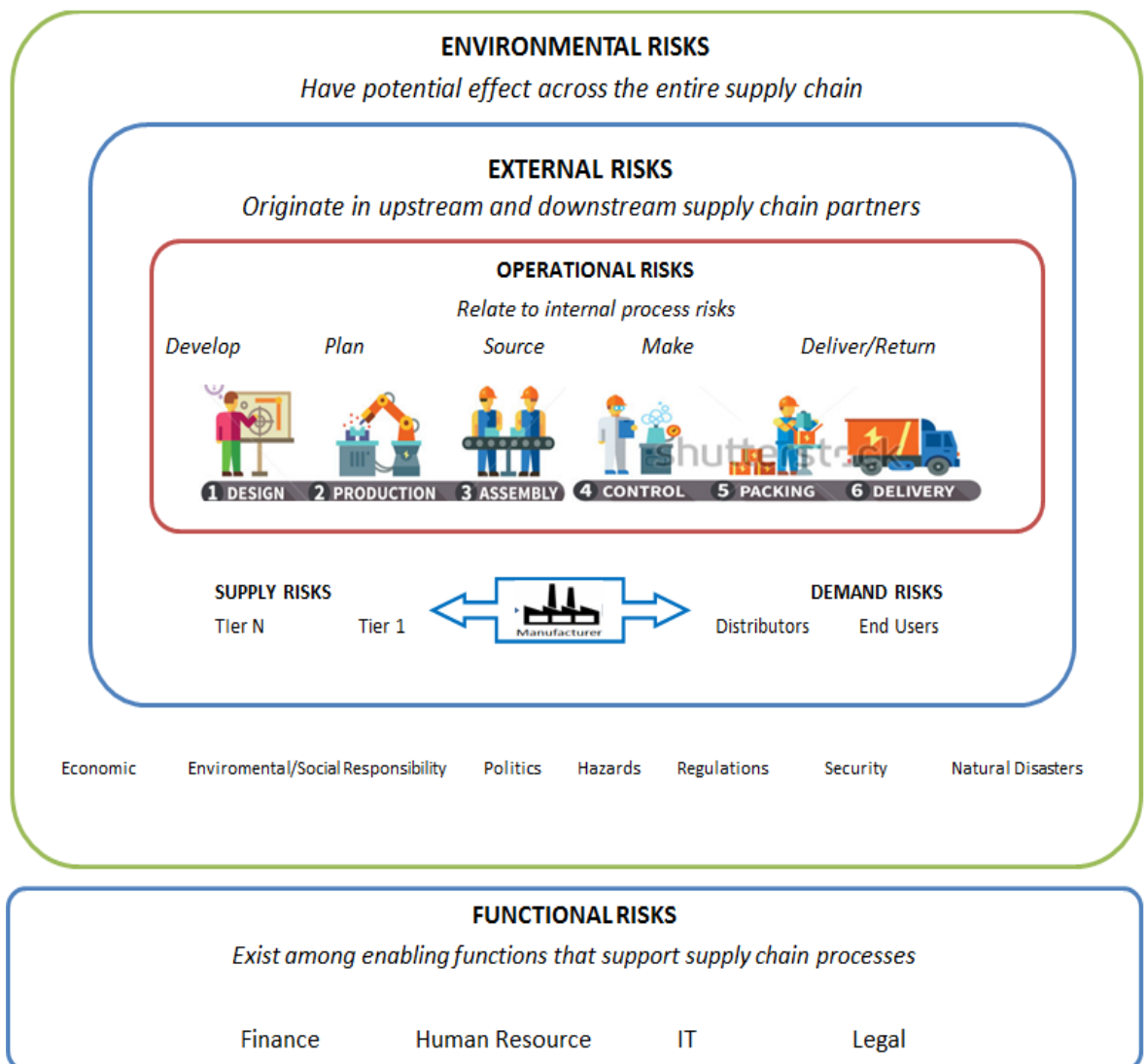


Figure 2-5: Rich Picture of SCRM for a Manufacturing SME [developed by author]

The SME in the rich picture is exposed to supply and demand risks, which are external and affect the SME. There also exist environmental risks that have the potential to affect the entire SC. These risks are the main reason for increased complexity in the supply chain. Within the SME, there are operational and functional risks. These internal risks are tied to the enterprise's operations and include risks associated with any business function that supports the enterprise [Oehmen, 2009].

2.6.2 Stage Three and Four – Ideal World

The root definition of the relevant system is defined in the third stage of SSM. The relevant system of the problematic situation defined in the first stage is the SME in the SC. The CATWOE model, as depicted in table 5 below, is used to assist in defining the root definition of an SME in the SC.

Table 5 : CATWOE Model for an SME in the Supply Chain

| Root Definition Element | SME in a SC |
|---------------------------------|---|
| C – Customers | End user |
| A – Actors | Employees & machines within SME |
| T- Transformation | Resources are used to fulfil customer demands |
| W – Weltanschauung or Worldview | Deliver competitive products and/or services to end user by improving the flows of material and information in the SC |
| O – Owners | CEO of the SME |
| E – Environment | World |

The following root definition for the SME in the supply chain is determined from the CATWOE model:

‘An SME in the SC is a system owned by its CEO, who together with his employees and the machines within the SME use resources to fulfil customer demands. This is undertaken with the understanding that the end user will be supplied with competitive products and/or services by improving the flows of material and information in the SC’.

The conceptual model was then drawn up from the root definition above. This conceptual model, shown in figure 2-6 below, illustrates the relationships of the elements defined in the root definition.

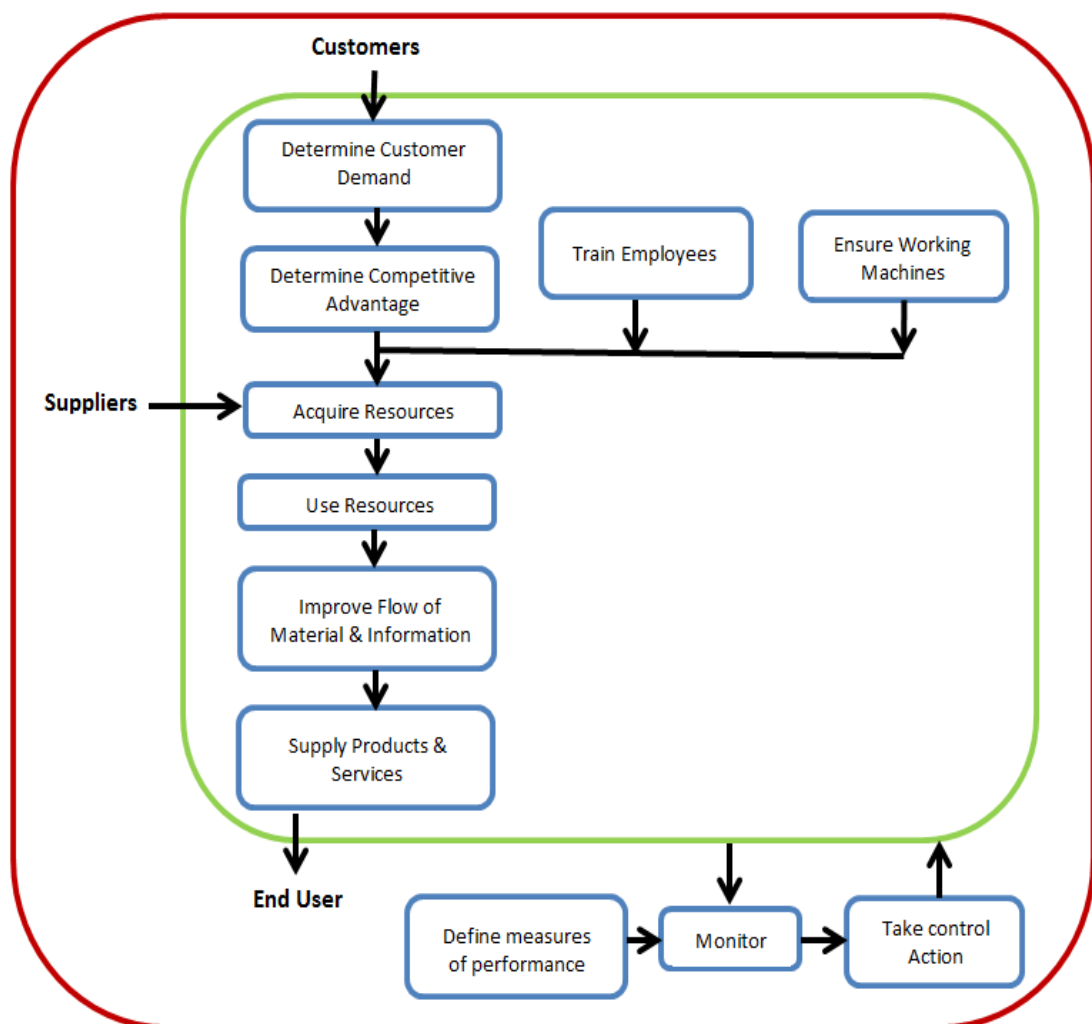
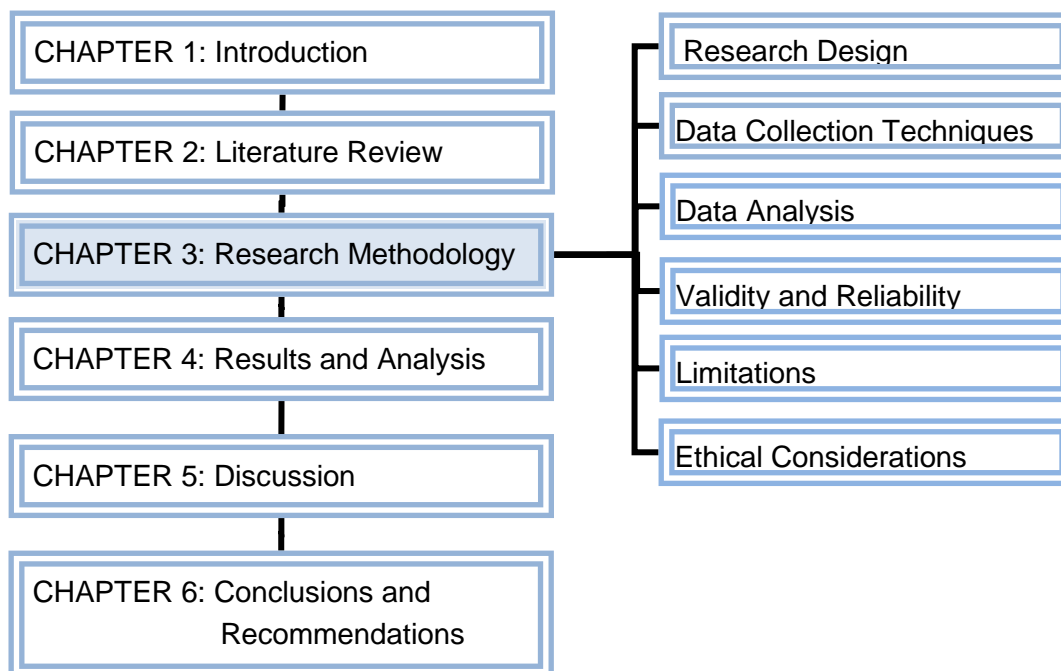


Figure 2-6: Conceptual model of an SME

2.7 Summary of Literature Review

The literature review chapter covered SCM in great detail. It started with SCM initiatives and explored their advantages and disadvantages. The reasons for the difficulty in implementing these initiatives in SMEs were then explored. SMEs and the challenges they faced were explored. Risk management was then explored and contextualised from the perspective of supply chains yielding SCRM. After the exploration of SCRM, SSM was also discussed in great detail. These frameworks were then merged to form the conceptual framework upon which this research study will be based on.

CHAPTER 3. RESEARCH METHODOLOGY



This chapter discusses the research design and methodological issues upon which the research is based on. The research methodology is a guideline for the collection and analysis of the research data. This research design depends on the type of information desired, the availability of resources and the capability of the researcher (Punch, 2006). The research objective and the characteristics of the study population determine the type and size of the sample (Hafner, 2012).

3.1 Research Design

Yin (2009) defined research design as the logical sequence that connects the empirical data to a study's initial research questions and thus to its conclusions. The initial research question, defined in Chapter 1, should assist in identifying the relevant information to be collected about the unit of analysis under study. Once data has been collected then it needs to be analysed.

The design of this study is based on multiple case studies. Yin (2009) found that evidence from multiple cases is more compelling and leads to the study being more robust. Tlhomola (2010) also suggested the promotion of case study research in order to gather data on supply chain challenges faced by SMEs in the manufacturing sector. In this research study, the case study design will be used on five SMEs in the manufacturing sector. The figure below, adopted from Yin (2009), represents the sequence that will be followed in this research paper.

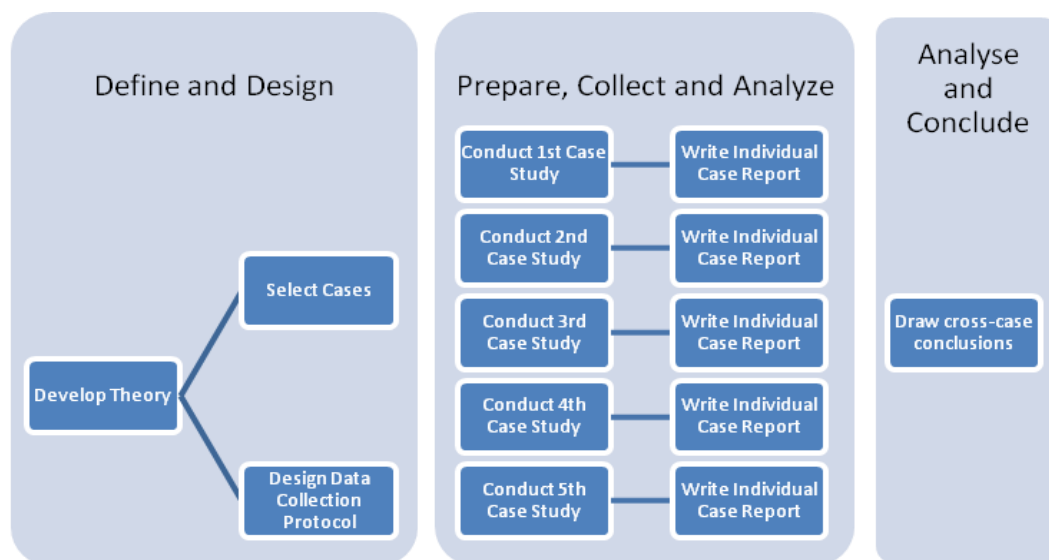


Figure 3-1: Sequence for a multiple case design [adopted from Yin (2009)]

In the figure above, the study starts with the 'define and design' stage where the theory is developed and then the cases are selected and the data collection protocol is designed. The 'prepare, collect and analyse' stage then follows. In this stage, the five cases studies will be conducted and individual case reports are then developed. Replication logic is used to conduct each case. The data collection protocol is duplicated in each case in order to predict similar results. The last stage involves 'analysing and concluding'. In this stage, cross-case conclusions are drawn up from similar results obtained in the second stage.

A decision was made to conduct the replication logic in five case studies. The research report's objective and the characteristics of the unit of analysis assisted in determining the type and size of the 'samples' or cases to study (Hafner, 2012). The researcher uses purposeful 'sampling' in this research report. Purposeful sampling is the selection of information-rich cases for the study in depth. Information-rich cases are those from which one can learn a great deal about issues of importance to the purpose of the research (Coyne, 1997). The research will evaluate SCRM using SSM in five SMEs in the manufacturing sector. Due to the depth of the SSM the sample size should be adequate for the purpose of the study.

3.2 Data Collection Techniques

The researcher will use qualitative methods to collect data for this research. The qualitative method is suitable for small-scale analysis, in which first-hand information about the problem is analysed (Woods, 2006). Interaction with the SMEs was achieved through semi-structured interviews based on a questionnaire, written documents and field notes. A member of the management team answered questions from the questionnaire with the help of the researcher, through an interview, by email and by telephone. A voice recorder was utilised to capture all the information obtained during the interview and the recordings can be found in section C of Appendix B to F. The interview approach allowed the researcher to obtain insights and a deeper understanding of the current study. The interviews were conducted at the SMEs' premises and it lasted between one and two hours. The interview questionnaire was based on SCRM and SSM concepts. Brainstorming techniques were used to develop the questions in section C of Appendix A of the questionnaire. The following figure is a mind map that was used during the brainstorming session to develop the questions.

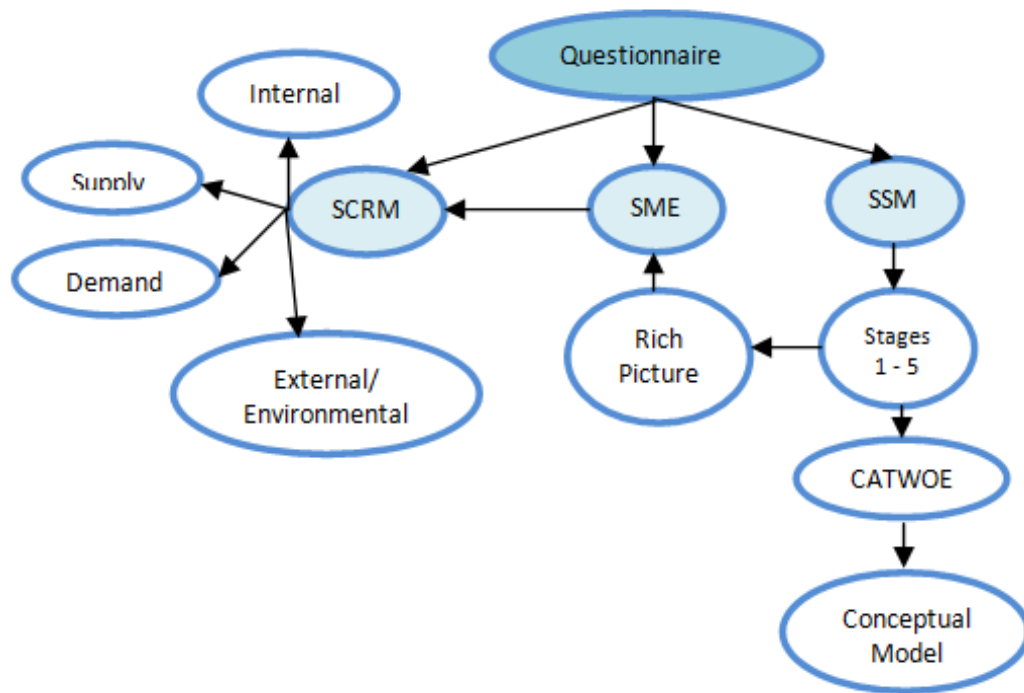


Figure 3-2: Mind map of brainstorming session

Prior to the interview, a telephone interview was also obtained with the owner or management of the enterprises to obtain general information on the enterprises (see section B of Appendix A) and the company profile was emailed to the researcher. This information assisted the researcher in obtaining more information on the enterprises.

3.3 Data Analysis

In this research report, data collection will be conducted in conjunction with data analysis. This is due to the exploratory nature of the methodology utilised for the SMEs. Explanation building, pattern matching and cross-case analysis will be used for data analysis (Yin, 2009). Data analysis will be conducted in two stages, as shown in figure 3-1, which depicts the sequence for multiple case designs. Firstly, each case will be individually analysed and then findings of each case will be analysed in the cross-case analysis. In the individual analysis, the first five stages of

the SSM were followed for each SME. These stages will yield a 'real' and 'ideal' world of each SME. The 'real' world of each SME was developed from the interview and additional information acquired from each SME, while the 'ideal' world was developed from the root definition. These worlds will then be compared in stage five for their analysis. The results of the five cases will then be compared with each other in the cross-case analysis.

During the analysis, risk management will be explored with respect to the risk classes identified in the SCRM literature, Chapter 2. These supply chain risk classes will form the risk areas in the risk management process and thus define the context of the process. Each class of risks consist of dynamic risks that interact with one another. These risks can be divided into supply, internal, demand, external and environmental risks [Mitchell, 2009]. This classification of supply chain risks covers all the aspects of the supply chain.

3.4 Validity and Reliability

This section of the research report addresses the validity and reliability of this qualitative study. Validity and reliability are criteria used to evaluate the quality and trustworthiness of a research study. The validity criterion is divided into internal and external validity. These criteria will be evaluated in order to ensure that this research report is trustworthy and of good quality (Golafshani, 2003).

3.4.1 Internal Validity

Internal validity is a criterion that evaluates whether a qualitative study is observing or measuring what it is supposed to observe or measure. This criterion evaluates the credibility of a study. The researcher will use triangulation and peer checks to check or assess the internal validity of the

research report (Merriam, 1995). Triangulation is the use of multiple sources of data to confirm findings. Pamphlets, company profiles and general internet research information will be gathered in correlation with the interviews, see section B of Appendix B to F. The findings of the research will be taken back to peers for evaluation for peer validation.

3.4.2 Reliability

Reliability is a criterion concerned with the extent to which one's findings will be found again. This criterion evaluates the dependability or consistency of a study. The researcher will use audit trails to check or assess the reliability of this research report (Shenton, 2004). Audit trail is a detailed record of the data collected and the rationale for important decisions made, which can be found in see section B and C of Appendix B to F. This includes the submission of the original interviews conducted by the researcher.

3.4.3 External Validity

External validity is a criterion concerned with the extent to which the findings of a study can be applied to other situations. This criterion addresses the transferability or generalizability of a study. The researcher will use thick description and purposeful sampling to check or assess the external validity of this research report (Bitsch, 2005). Thick description involves providing enough information or description of the phenomenon under study and purposeful sampling allows the researcher to generalize the study to a specific group using replication logic.

3.5 Limitations

This research report is only limited to SMEs in the manufacturing sector. The research report will only focus on one specific sector, as there are

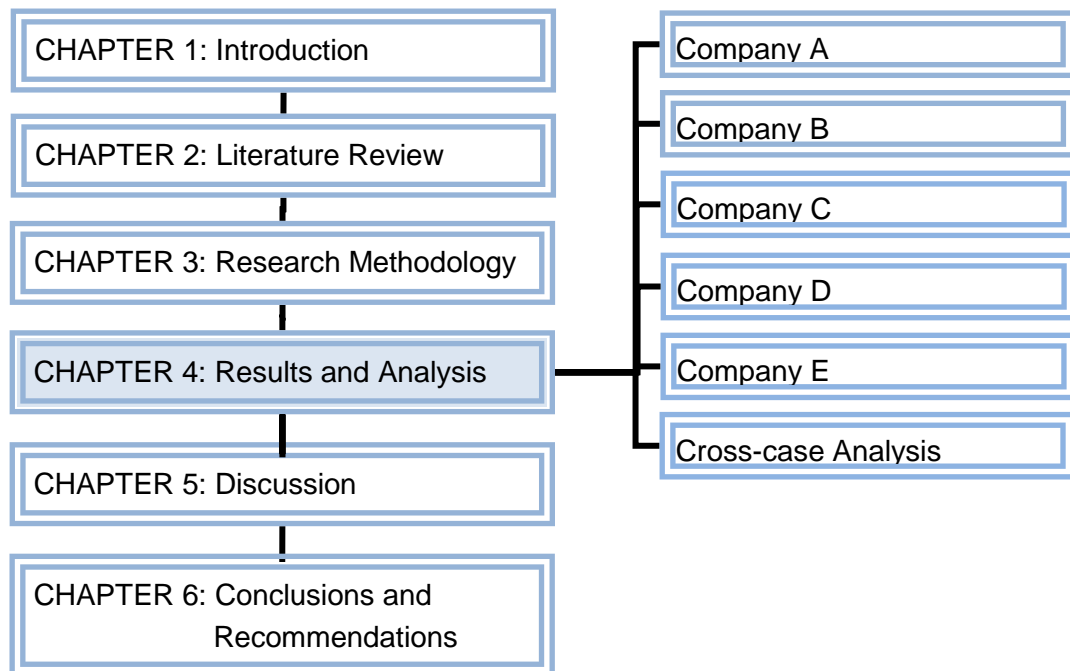
many other different sectors, which would make it impossible to achieve the objectives of this study in the time provided. This research report will use the internationally recognised term 'small and medium enterprise' (SME) instead of small, medium and micro enterprise (SMME) as defined in the National Small Business Act. The SME in the manufacturing sector will be defined according to the National Small Business Act.

3.6 Ethical Considerations

The research to be undertaken does not involve animal experimentation or human participants defined in A.4 of the Senate Standing Orders on Higher degrees of the University of the Witwatersrand. The researcher commits to:

- Ensure that the subjects or informants to be studied have consented to the research without coercion.
- Communicate the aims and possible implications of the research to all the subjects or informants.
- Do everything in their power to protect the subjects or informants' social and psychological welfare and to honour their dignity and privacy.
- Ensure that the relevant people understand the use of tape recorders and cameras.
- Ensure that the questions posed for the subjects or informants are not insulting or embarrassing.
- Ensure that there is no exploitation of the subjects or informants for personal gain.

CHAPTER 4. RESULTS AND ANALYSIS



In this chapter, the first five stages of the SSM will be applied to manufacturing SMEs that will be studied. The methodology will assist in obtaining a real picture of SCRM from the perspective of each SME. The methodology will also assist in drawing up a conceptual model of each SME, which will then be compared to the real picture. This chapter will allow for the exploration of SCRM from the perspective of SMEs. The results obtained from the SSM were then used in the cross-case analysis. This was done in order to determine any similarities and differences between the five SMEs.

4.1 Company A

Company A is the first SME that was evaluated. Company A was founded in 1993 and is situated in Gauteng. This company provides engineering services and products by means of CNC manufacturing with customers ranging from the car industry to the mining sector. Company A's mission is to supply all their customers with the highest quality products in a timely manner and at a competitive price. SCRM for this company will be explored utilising SSM and the following represent the results of the analysis. This information was obtained from section A and B of Appendix B.

4.1.1 Stage One and Two – Real World

In the case of Company A, the problematic situation is viewed as 'SCRM for Company A'. The second stage of the methodology involves depicting a rich picture of the dynamics and complexity involved in Company A. Figure 4-1 below illustrates all the dynamics involved in this SME. The detailed company information and the interview session recording in Appendix B were used to construct the rich picture. Most of the questions in the questionnaire in Appendix A were covered in the interview session.

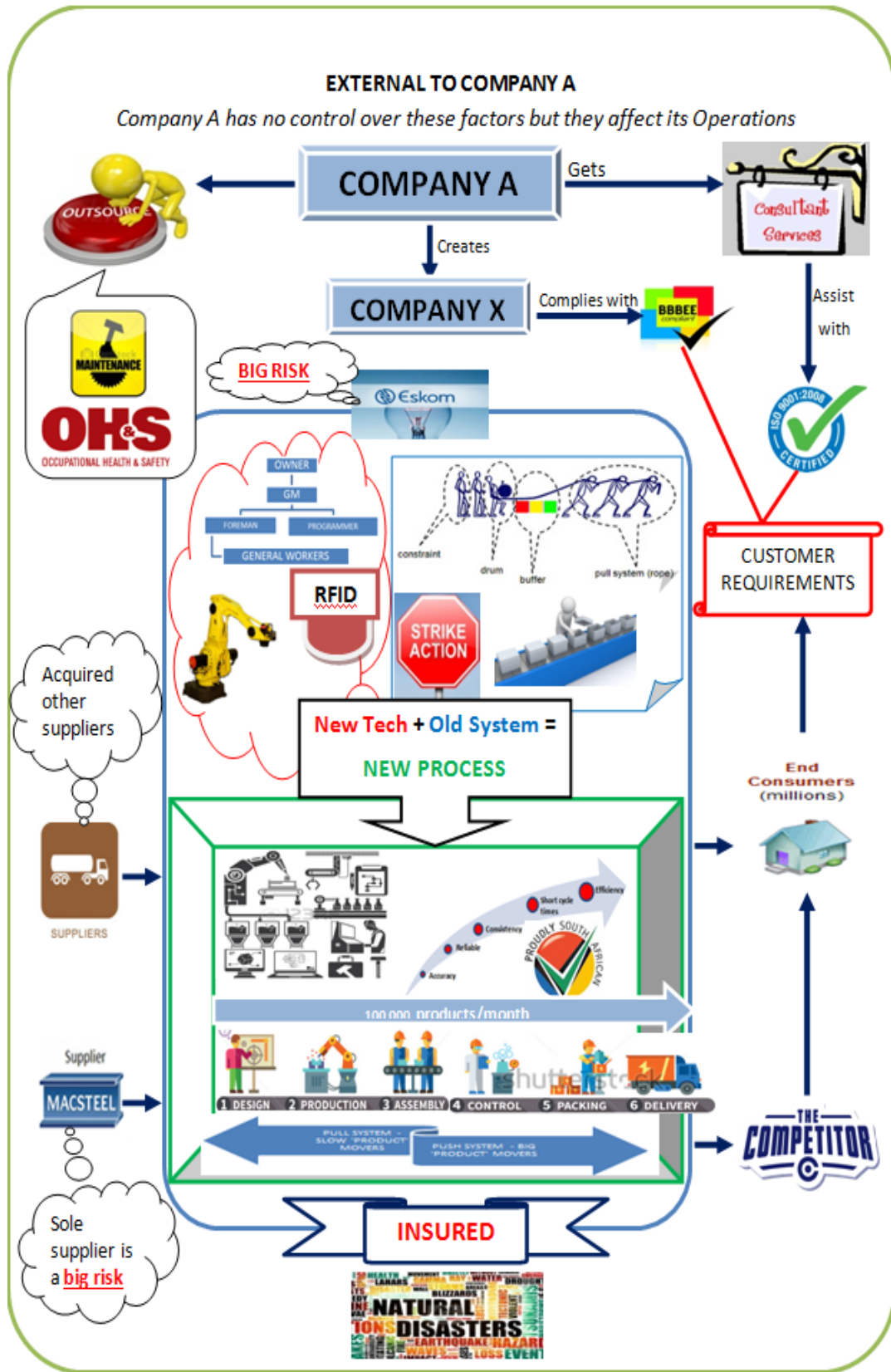


Figure 4-1: Rich Picture of Company A

In the rich picture above, Company A receives materials from Macsteel, who supplies them with materials specially designed for this specific industry. These materials, which arrive in different sizes, are delivered in batches, which are linked to this SME's Radio Frequency Identification (RFID) system. These materials then undergo various processes before being dispatched to the customer, who also includes some of Company A's competitors. In the hierarchical management structure, the CEO of the SME together with the GM, are responsible for the management of the enterprise. The supervisor, who reports to the GM, leads the general workers who do not require specialised skills to run the production line. Most of the processes within this SME have been automated in order to improve productivity and efficiency of the production line. The automation has led to an increase in reliability, consistency and shorter cycle time. This also meant that fewer employees were required. This enterprise also highlighted the following risks, as their top ten risks and the solutions they have adopted:

Table 6 : Top Ten Risks in Company A and their Treatment

| Top Supply Chain Risks | Treatment of Risk |
|--|---|
| Disruption from single supplier | Sourcing of alternate Suppliers & having excess stock |
| Product quality Issues | Assignment of quality checks & complete traceability of products (RFID) |
| Machine/Robot Failure | Sourcing of Local Replacement machines and regular maintenance by third party |
| Robot Programming Issues | Easy-to-follow resetting procedure & Employment of Programmer |
| Labour issues (Strikes and lack of productivity) | Automated processes |
| Technological Issues (Robots) | Re-designed system to accommodate new technology |
| Power Cuts | Acceptance of Risk |
| B-BBEE requirements | Creation of Company X, as a BEE brand name of Company A |
| Safety Requirements | Sourcing of third party for compliance |
| Quality Requirements | Sourcing of third party for compliance |

Company A management and the researcher have identified these top risks as those that may have a significant impact on the objective of their business. As indicated in the answer of the manager to question 38 of the questionnaire, these risks have been identified through experience. The answer can be heard in the interview recording.

4.1.2 Stage Three and Four – Ideal World

Company A has been identified as the relevant system in the problematic situation. Exploring Company A as a system will assist in determining its root definition and then its conceptual model. Table 7 below illustrates the CATWOE model for the system identified.

Table 7 : CATWOE Model for Company A

| Root Definition Element | Company A |
|---------------------------------|--|
| C – Customers | Company A's immediate customers and competitors |
| A – Actors | Employees and machines within Company A |
| T- Transformation | Raw materials from suppliers are used to manufacture products |
| W – Weltanschauung or Worldview | Supply customers with the highest quality products in a timely manner and at a competitive price |
| O – Owners | CEO |
| E – Environment | Supply Chain |

From the CATWOE model above, the following root definition for Company A was defined:

'Company A is a system owned by the CEO, who together with his employees and machines, use raw materials from suppliers to manufacture products. This is undertaken with the understanding that Company A's immediate customers and competitors will be supplied with

the highest quality products in a timely manner and at a competitive price in its supply chain’.

The conceptual model, shown in the figure below, was then drawn up from the root definition of Company A above.

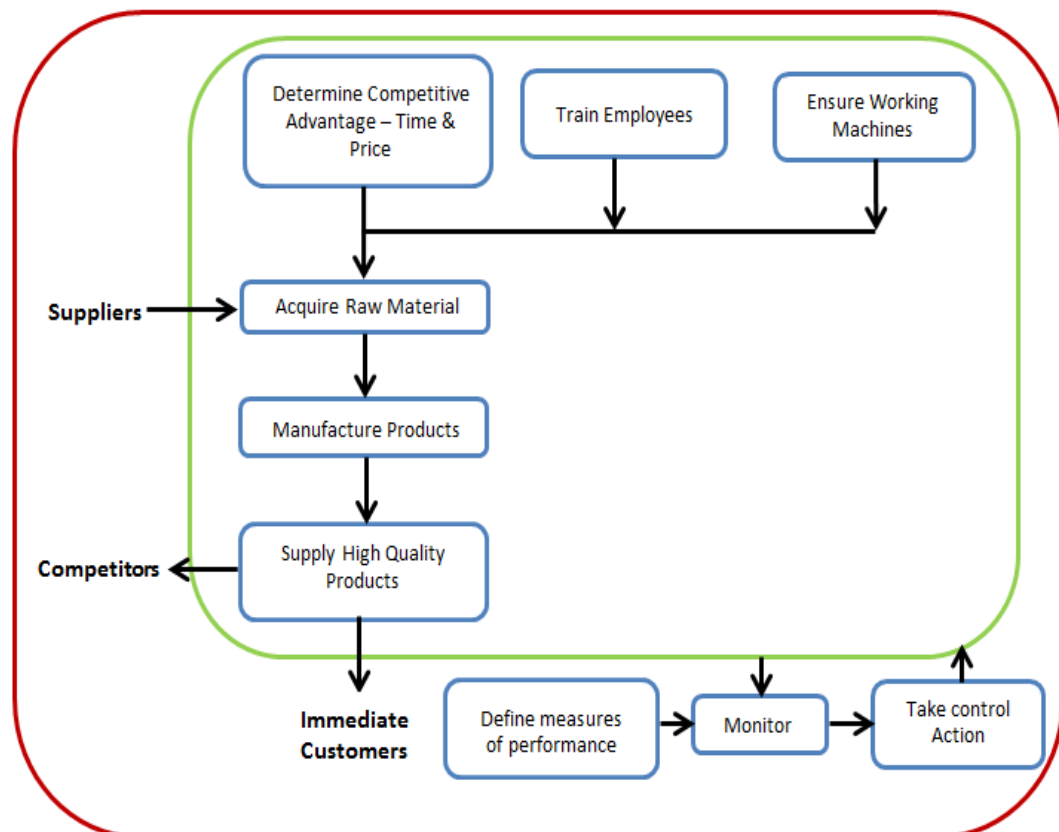


Figure 4-2: Conceptual Model of Company A

4.1.3 Stage five – Real versus Ideal World

In this stage of the methodology, the rich picture of the 'real' world depicted in stage two is compared to the conceptual model of the 'ideal' world determined in stage 4 of the SSM. This comparison has been depicted in table 8 below.

Table 8 : Comparison of 'Real' world with 'Ideal' world

| 'Ideal' World – Conceptual Model | 'Real' World – Rich Picture | Risk Associated | Risk Area |
|--|--|---|--|
| Determine competitive advantage – time and Price | Company A implemented robots to increase reliability, consistency & cycle time and lower costs | High cost of implementation | Internal Risks |
| Train employees | No specialised skill required & thus training is simple | Labour issues | Internal risks & external or environmental risks |
| Ensure working machines | Maintenance of machinery is outsourced | Machine failure, programming issues | Internal risks |
| Acquire raw material | Raw material is acquired from Macsteel | Disruption from supplier | Supply risks |
| Manufacture products | Products are manufactured with the use of robots | Power cuts, labour issues, technological issues | Internal risks & external or environmental risks |
| Supply high quality products | High quality products are supplied to customers and competitors | Safety, quality, & B-BBEE requirements | Internal risks , demand risks, external or environmental risks |

In the table above the activities of the conceptual model are related to the activities depicted in the rich picture. Each activity is linked to risks, whose treatment option was stated in table 6. Supply risks are viewed as those that affect the supply of products required for their operations, while demand risks are viewed as those risks that are linked to customer satisfaction. This includes any customer requirement (quality, safety, B-BBEE and price) that is imposed onto Company A. Internal risks are those risks linked to the actors within Company A. External or environmental risks are viewed as those risks that cannot be controlled.

4.2 Company B

The second SME under study for the evaluation of SCRM is Company B. Company B is a company that was established in 1992 and is situated in Gauteng. This company manufactures a range of conveyors and their components to various industries including the mining sector. This company strives to be a market leader by providing quality products and excellent service to its customers. The following sections are the results of the application of SSM on Company B. This information was obtained from section A and B of Appendix C.

4.2.1 Stage One and Two – Real World

In the case of Company B, the problematic situation can be viewed as 'SCRM for Company B'. The second stage of the methodology involves depicting a rich picture of the dynamics and complexity involved in Company B. The figure below illustrates all the dynamics involved in this SME. The detailed company information and the interview session recording in Appendix C were used to construct the rich picture. Most of the questions in the questionnaire in Appendix A were covered in the interview session.



Figure 4-3: Rich Picture of Company B

In the rich picture above, Company B acquires conveyor belts from its supplier, located in China. This supplier, who is part of Company B, supplies at a lower cost and is more productive than local suppliers are. Company B also acquires other materials from various suppliers and requires the relevant certificates from them (material safety data sheets (MSDS) or material certificates). Raw materials then undergo various processes before being dispatched to the customers. Throughout the process, Company B measures its performance by the increase in sales and the quality of their products. Customers initiate special orders while spares are pushed through the system. Once completed, the products are then delivered to the customers where they are installed. Company B usually experiences entry delays at customer sites. With delivery of products, Company B incurs extra costs due to travelling expenses. Customers also require that Company B comply with their B-BBEE, ISO 9001 and safety requirements. The safety requirements have necessitate the use of full-time safety officers as Company B's customers vary from those that comply with the Occupational Health and Safety Act to those that comply with the Mines Act. This has led to Company B having safety files for over 30 of its customers. Company B is also SABS approved and is a member of Conveyors Manufacturers Association (CMA), from where its research and development is based. The company has highlighted the following risks, as their top ten risks and the solutions they have adopted:

Table 9 : Top Ten Risks in Company B and their Treatment

| Top Supply Chain Risks | Treatment of Risk |
|--|---|
| High cost of supplier | Use cheaper supplier from China |
| Crime | Utilise security surveillance system and watch dogs |
| High transportation (petrol and e-toll) cost | Acceptance of risk |
| Entrance delays at customer sites | Acceptance of risk |
| Labour issues (Strikes) | Acceptance of risk |
| Disruption from single supplier | Acceptance of risk |
| Power Cuts | Acquire back-up generators |
| B-BBEE requirements | Comply with requirements |
| Safety Requirements | Employed full-time employees to attend to safety requirements |
| Quality Requirements | ISO 9001 rated |

Company B management and the researcher have identified these top risks as those that may have a significant impact on the objective of their business. As indicated in the answer of the manager to question 38 of the questionnaire, these risks have been identified through a formalised risk management system, which was developed from ISO 9001 procedures. The answer can be heard in the interview recording.

4.2.2 Stage Three and Four – Ideal World

Company B is the relevant system in the problematic situation. Exploring Company B as a system will assist in determining its root definition and then its conceptual model. Table 10 illustrates the CATWOE model for the system identified.

Table 10 : CATWOE Model for Company B

| Root Definition Element | Company B |
|---------------------------------|---|
| C – Customers | Company B's immediate customers |
| A – Actors | Employees and machines within Company B |
| T- Transformation | Raw materials from suppliers are used to manufacture products |
| W – Weltanschauung or Worldview | Provide quality products and excellent service to its customers |
| O – Owners | CEO |
| E – Environment | Supply Chain |

From the CATWOE model above, the following root definition for Company B was defined:

‘Company B is a system owned by the CEO, who together with his employees and machines, use raw materials from suppliers to manufacture products. This is undertaken with the understanding that Company A's immediate customers will be provided with quality products and excellent service in its supply chain’.

The conceptual model, shown in the figure below, was then drawn up from the root definition of Company B above.

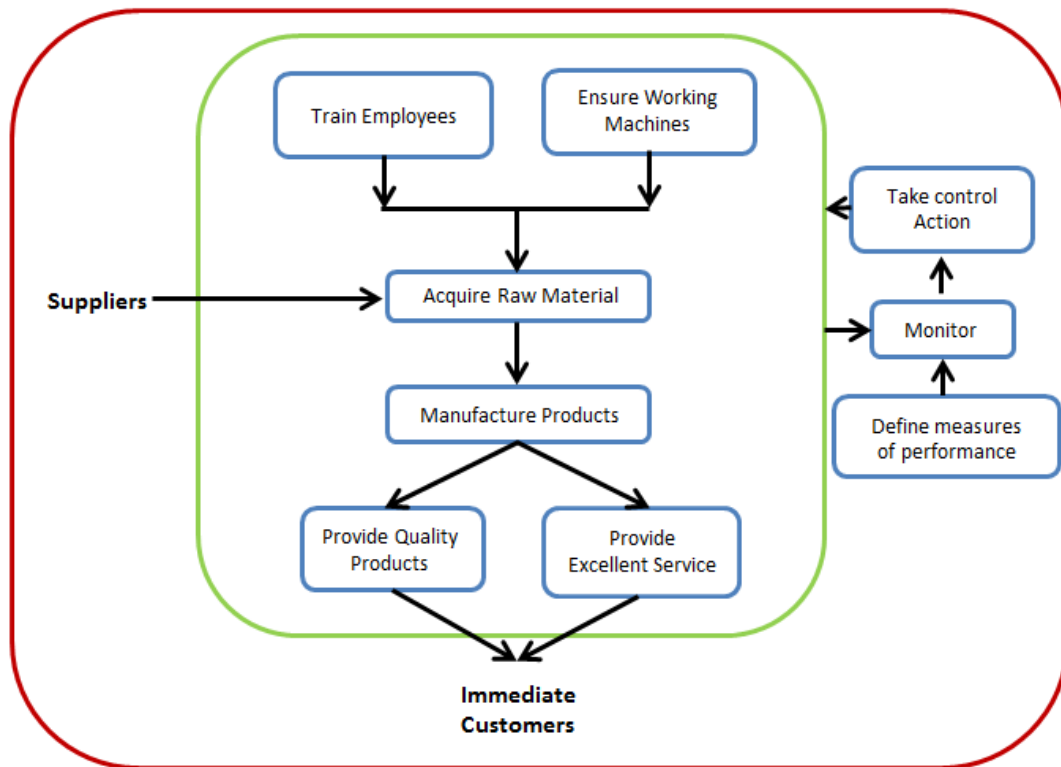


Figure 4-4: Conceptual Model of Company B

4.2.3 Stage five – Real versus Ideal World

In this stage of the methodology, the rich picture of the 'real' world depicted in stage two is compared to the conceptual model of the 'ideal' world determined in stage 4 of the SSM. This comparison has been depicted in table 11 below.

Table 11 : Comparison of 'Real' world with 'Conceptual' world

| 'Ideal' World – Conceptual Model | 'Real' World – Rich Picture | Risk Associated | Risk Area |
|----------------------------------|-----------------------------|-----------------|-----------|
|----------------------------------|-----------------------------|-----------------|-----------|

| | | | |
|---------------------------|---|---|--|
| Train employees | Employees are trained | Labour issues | Internal risks & External or Environmental risks |
| Ensure working machines | Maintenance of machinery is done both internally & externally | Machine failure | Internal risks & External or environmental risks |
| Acquire raw material | Raw material is acquired both locally and internationally | Disruption from supplier, high cost of supply | Supply risks |
| Manufacture products | Products are manufactured through various processes | Power cuts, Labour issues, Crime | Internal risks & External or environmental risks |
| Provide quality products | Products are delivered to customers | Safety, quality, & B-BBEE requirements, entrance delays, high transportation cost | Internal risks , Demand risks, External or Environmental risks |
| Provide excellent service | Company B provides excellent service to its customers | Any requirements from customers | Demand risks |

In the table above the activities of the conceptual model are related to the activities depicted in the rich picture. Each activity is linked to risks, whose treatment option was stated in table 9. Supply risks are viewed as those that affect the supply of products required for their business, while demand risks are viewed as those risks that are linked to customer satisfaction. This includes any customer requirement (quality, safety, price and delivery time) that is imposed onto Company B. Internal risks are those risks linked to the actors within Company B. On the other hand, the external or environmental risks are viewed as those risks that cannot be controlled.

4.3 Company C

The third SME that was used to evaluate SCRM is that of Company C. Company C is a company that was established in 1999 and is situated in Gauteng. This company manufactures and maintains fans and their components to various customers. Company C is dedicated to delivering quality products and good service at all times. SCRM for this company will be explored utilising SSM and the following represent the results of the analysis. This information was obtained from section A and B of Appendix D.

4.3.1 Stage One and Two – Real World

In the case of Company C, the problematic situation can be viewed as 'SCRM for Company C'. The second stage of the methodology involves depicting a rich picture of the dynamics and complexity involved in Company C. Figure 4-5 below illustrates all the dynamics involved in this SME. The detailed company information and the interview session recording in Appendix D were used to construct the rich picture. Most of the questions in the questionnaire in Appendix A were covered in the interview session.

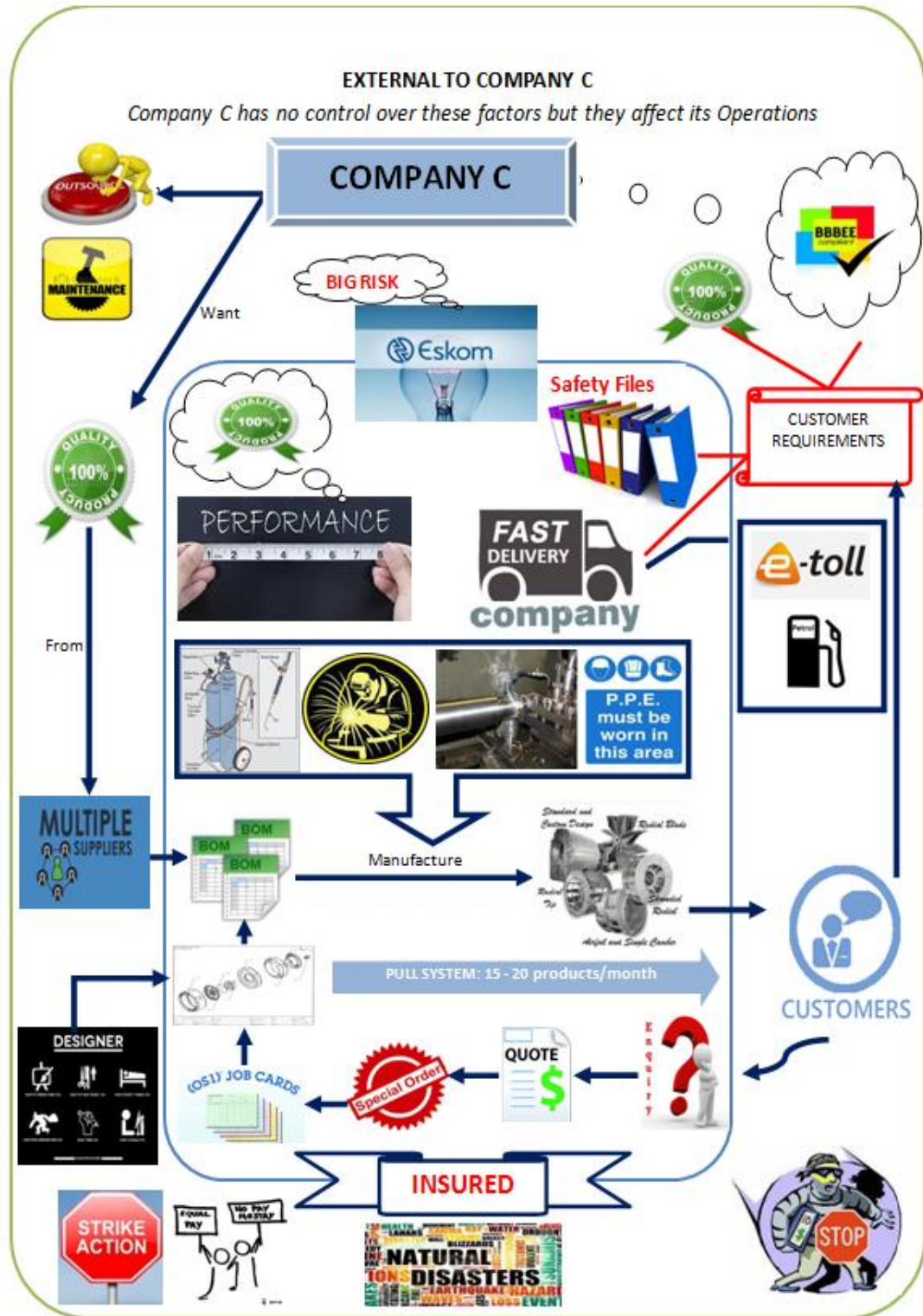


Figure 4-5: Rich Picture of Company C

In the rich picture above, the CEO and his wife are the owners of Company C. This CEO mainly communicates with his Workshop Manager about operational issues and the buyer about supply issues. The welders and unskilled workers report to the Foreman who reports to the Workshop Manager. The welders are qualified and work according to work procedures when manufacturing a product in the production line. The CEO tries to keep the employees motivated and assist with their personal issues, if possible.

A customer, who will load an enquiry, initiates the production line. A quotation is issued to the customer who will then accept or decline it. If accepted, an order will be placed and a job card will be created. The services of an external designer will then be utilised to make up a drawing for the product. Once the drawing has been completed and the required materials have been acquired, the product is manufactured. The materials required for manufacturing the products is acquired from different suppliers. The enterprise does not have single suppliers for any materials required. Any specialised work that is out of their expertise is outsourced to other companies. Once the product has been manufactured, it is delivered to the customer's premises using the company vehicle.

An external company maintains any specialised equipment, including gas bottles and the crane. The enterprise provides personal protective equipment to all its employees and enforces compliance to safety requirements. The enterprise also installs the products it manufactures at customer sites and thus needs to comply with safety requirements from the customer. Due to different requirements from different customers, the enterprise needs to have a safety file for each customer. They are also Level 4 BEE compliant but due to customer requirements, are considering different options of improving their BEE level. The enterprise is faced with

many other risks and table depicts their top ten risks and how they are treating those risks.

Table 12 : Top Ten Risks in Company C and their Treatment

| Top Supply Chain Risks | Treatment of Risk |
|---|--|
| Safety requirements from Customers | Acceptance of Risk |
| B-BBEE requirements from Customers | Currently trying to address risk |
| Inefficient Labour | Keep the employees motivated and assist them with personal issues |
| Disruption from single supplier | Source multiple suppliers |
| Short delivery time required by customers | Acceptance of risk |
| Transportation Issues (Petrol, E-toll) | Acceptance of risk |
| Specialised skill required (designer) | Outsourced function |
| Crime | Backup systems and acquired services of 2 armed response companies |
| Power Cuts | Acceptance of risk |
| Labour issues (Strikes) | Acceptance of risk |

Company C management and the researcher have identified these top risks as those that may have a significant impact on the objective of their business. As indicated in the answer of the manager to question 38 of the questionnaire, these risks have been identified through experience. The answer can be heard in the interview recording.

4.3.2 Stage Three and Four – Ideal World

Company C has been identified as the relevant system in the problematic situation. Exploring Company C as a system will assist in determining its root definition and then its conceptual model. The table illustrates the CATWOE model for the system identified.

Table 13 : CATWOE Model for Company C

| Root Definition Element | Company C |
|---------------------------------|---|
| C – Customers | Company C's immediate customers |
| A – Actors | Employees and machines within Company C |
| T- Transformation | Raw materials from suppliers are used to manufacture products |
| W – Weltanschauung or Worldview | Deliver quality products and good service at all times |
| O – Owners | CEO |
| E – Environment | Supply Chain |

From the CATWOE MODEL above, the following root definition for Company C was defined:

'Company C is a system owned by the CEO, who together with his employees and machines, use raw materials from suppliers to manufacture products. This is undertaken with the understanding that Company C's immediate customers will receive quality products and good service in its supply chain'.

The conceptual model, shown in the figure below, was then drawn up from the root definition of Company C above.

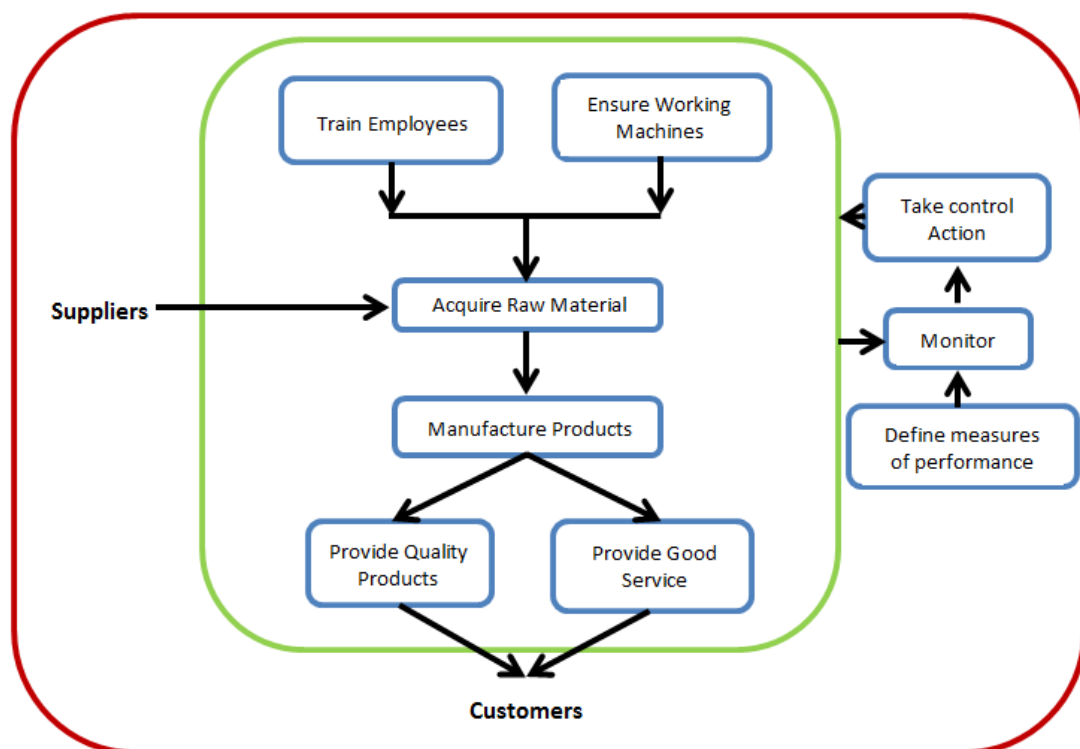


Figure 4-6: Conceptual Model of Company C

4.3.3 Stage five – Real versus Ideal World

In this stage of the methodology, the rich picture of the 'real' world depicted in stage two is compared to the conceptual model of the 'ideal' world determined in stage 4 of the SSM. This comparison has been depicted in table 14 below.

Table 14 : Comparison of 'Real' world with 'Ideal' world

| 'Ideal' World – Conceptual Model | 'Real' World – Rich Picture | Risk Associated | Risk Area |
|----------------------------------|---|---|--|
| Train employees | Welders & other workers are trained | Labour issues, Inefficient labour, specialised skill required | Internal risks & External or Environmental risks |
| Ensure working machines | Any maintenance required is outsourced | Machine failure | Internal risks |
| Acquire raw material | Raw material is acquired from suppliers | Disruption from supplier | Supply risks |
| Manufacture products | Products are manufactured according to work procedures | Power cuts, Labour issues, crime | Internal risks & External or environmental risks |
| Provide quality products | Products are delivered to customer sites using company vehicles | Safety, & B-BBEE requirements, and transportation issues | Internal risks , Demand risks, External or Environmental risks |
| Provide good service | Company C needs to provide good service when dealing with customers | Delivery time requirements | Demand risks |

In the table above the activities of the conceptual model are related to the activities depicted in the rich picture. Each activity is linked to risks, whose treatment option was stated in table 12. Supply risks are viewed as those that affect the supply of products required for their operations, while demand risks are viewed as those risks that are linked to customer satisfaction. This includes any customer requirement (B-BBEE, quality, safety, price and delivery time) that is imposed onto Company C. Internal risks are those risks linked to the actors within Company C. On the other hand, the external or environmental risks are viewed as those risks that cannot be controlled.

4.4 Company D

The fourth SME that was used to evaluate SCRM is Company D. Company D is a company that was established in 1979 and is situated in Gauteng. This company designs, manufactures, refurbish and maintains locomotives for the mining and industrial sectors. Company D provides products that are designed to meet customers' needs without ignoring safety requirements. SCRM for this company will be explored utilising SSM and the following represent the results of the analysis. This information was obtained from section A and B of Appendix E.

4.4.1 Stage One and Two – Real World

In the case of Company D, the problematic situation can be viewed as 'SCRM for Company D'. The second stage of the methodology involves depicting a rich picture of the dynamics and complexity involved in Company D. Figure 4-7 below illustrates all the dynamics involved in this SME. The detailed company information and the interview session recording in Appendix E were used to construct the rich picture. Most of the questions in the questionnaire in Appendix A were covered in the interview session.

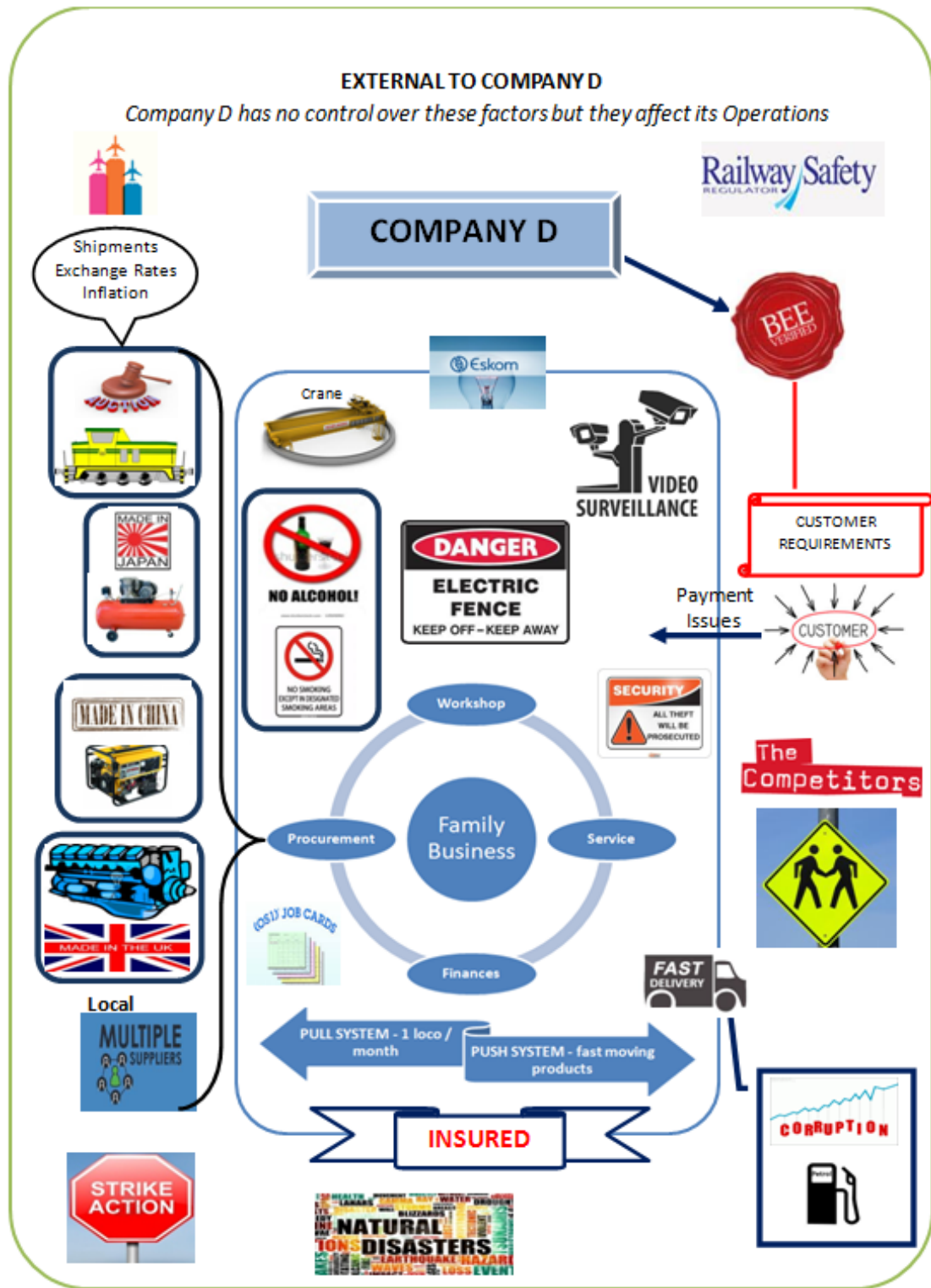


Figure 4-7: Rich Picture of Company D

In the rich picture above, raw materials required are sourced from China, Japan and the UK, while the rest are acquired locally. Company D acquires the body of the locomotives from auctions. Once the body of the locomotive has been acquired, the manufacturing process begins. Various steps take place in the manufacturing process. Company D is a family business, which is divided into procurement, finance, workshop and service departments. Different family members manage these departments. The family members have adopted a smoking and drinking policy, which was drawn up by the employees for the safety of everyone. Employees, including management, are tested for alcohol on a daily basis and are only allowed to smoke at the designated smoking area. Company D has experienced theft in the past but decided to install surveillance cameras and an electric fence. The company has also experienced problems with corruption in surrounding countries, when visiting some customers. One major issue that is caused by customers is late payment, which affects Company D's operation at times. The company has also mentioned the mutual respect they have with their few competitors. The company has identified the following as their top ten risks.

Table 15 : Top Ten Risks in Company D and their Treatment

| Top Supply Chain Risks | Treatment of Risk |
|---|---|
| Safety Issues due to Alcohol and Smoking | Developed a drinking and smoking policy |
| Power Cuts | Acceptance of risk |
| B-BBEE requirements | Acceptance of risk |
| High cost of supply | Use of cheaper supplier abroad |
| Crime | Installation of surveillance cameras and electric fence |
| Labour Issues (Strikes) | Acceptance of risk |
| Customer Payment Issues | Acceptance of risk |
| Corruption | Acceptance of risk |
| Transportation Issues (Petrol and E-toll) | Acceptance of risk |
| Safety requirements | Comply with Railway Safety Regulator |

Company D management and the researcher have identified these top risks as those that may have a significant impact on the objective of their business. As indicated in the answer of the manager to question 38 of the questionnaire, these risks have been identified through experience. The answer can be heard in the interview recording.

4.4.2 Stage Three and Four – Ideal World

Company D has been identified as the relevant system in the problematic situation. Exploring Company D as a system will assist in determining its root definition and then its conceptual model. The table illustrates the CATWOE model for the system identified.

Table 16 : CATWOE Model for Company D

| Root Definition Element | Company D |
|---------------------------------|--|
| C – Customers | Company D's immediate customers |
| A – Actors | Employees and machines of Company D |
| T- Transformation | Raw materials from suppliers are used to manufacture products |
| W – Weltanschauung or Worldview | Provide products that are designed to meet customers' needs without ignoring safety requirements |
| O – Owners | CEO |
| E – Environment | Supply Chain |

From the CATWOE model above, the following root definition model for Company D was defined:

'Company D is a system owned by the CEO, who together with the employees and machines of Company D, use raw materials from suppliers to manufacture products. This is undertaken with the understanding that Company A's immediate customers will be provided with products that are designed to their needs without ignoring safety requirements'.

The conceptual model, shown in the figure below, was then drawn up from the root definition of Company D above.

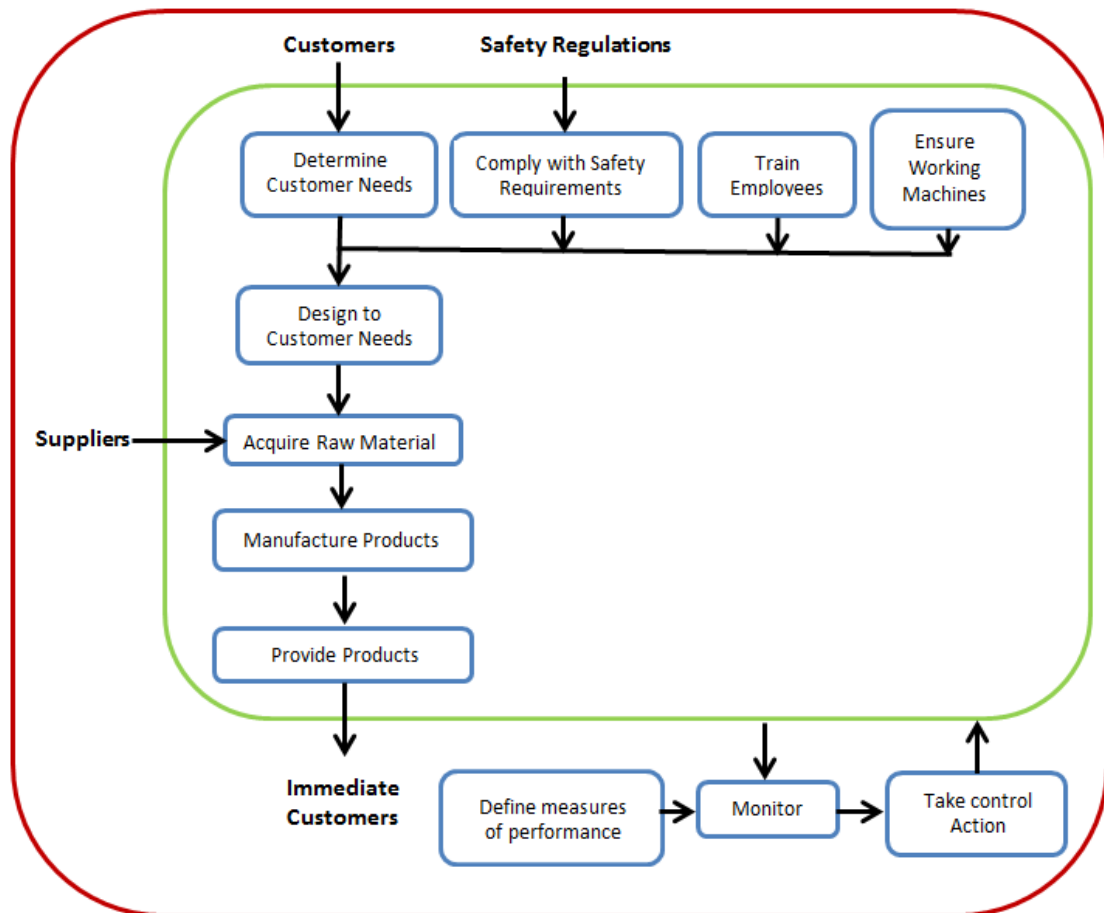


Figure 4-8: Conceptual Model of Company D

4.4.3 Stage five – Real versus Ideal World

In this stage of the methodology, the rich picture of the 'real' world depicted in stage two is compared to the conceptual model of the 'ideal' world determined in stage 4 of the SSM. This comparison has been depicted in table 17 below.

Table 17 : Comparison of 'Real' world with Ideal' world

| 'Ideal' World | – | 'Real' World – Rich | Risk Associated | Risk Area |
|---------------|---|---------------------|-----------------|-----------|
|---------------|---|---------------------|-----------------|-----------|

| Conceptual Model | Picture | | |
|---------------------------------|--|--|--|
| Determine customer needs | Before manufacturing the product, customer needs is determined | Not meeting customer needs | Internal risks, Demand risks |
| Comply with safety requirements | Products are manufactures safely | Safety issues | Internal risks |
| Train employees | Employees are trained | Labour issues | Internal risks & External or Environmental risks |
| Ensure working machines | Maintenance of machinery is done | Machine failure | Internal risks |
| Design to customer needs | Products are designed to customer needs | Customer requirements not being met | Demand risks |
| Acquire raw material | Raw material is acquired both locally and internationally | Disruption from supplier, High cost of supply | Supply risks |
| Manufacture products | Various steps are undertaken to manufacture products | Power cuts, Labour issues, Crime, safety issues | Internal risks & External or environmental risks |
| Provide products | Customers are provided with products | Safety & B-BBEE requirements, customer payment issues, Corruption, | Internal risks , Demand risks, External or Environmental |

| | | | |
|--|--|--------------------------|-------|
| | | transportation issues | risks |
|--|--|--------------------------|-------|

In the table above the activities of the conceptual model are related to the activities depicted in the rich picture. Each activity is linked to risks, whose treatment option was stated in table 15. Supply risks are viewed as those that affect the supply of products required for their operations, while demand risks are viewed as those risks that are linked to customer satisfaction. This includes any customer requirement (B-BBEE, quality, safety, price and delivery time) that is imposed onto Company D. Internal risks are those risks linked to the actors within Company D. On the other hand, the external or environmental risks are viewed as those risks that cannot be controlled.

4.5 Company E

The last SME that was used to evaluate SCRM is Company E. This company is situated in Gauteng. Company E manufactures engineering products for its customers. SCRM for this company will be explored utilising SSM and the following represent the results of the analysis. This information was obtained from section A of Appendix F.

4.5.1 Stage One and Two – Real World

In the case of Company E, the problematic situation can be viewed as 'SCRM for Company E'. The second stage of the methodology involves depicting a rich picture of the dynamics and complexity involved in Company E. Figure 4-9 below illustrates all the dynamics involved in this SME. The interview session recording in Appendix F was used to construct the rich picture. Most of the questions in the questionnaire in Appendix A were covered in the interview session.

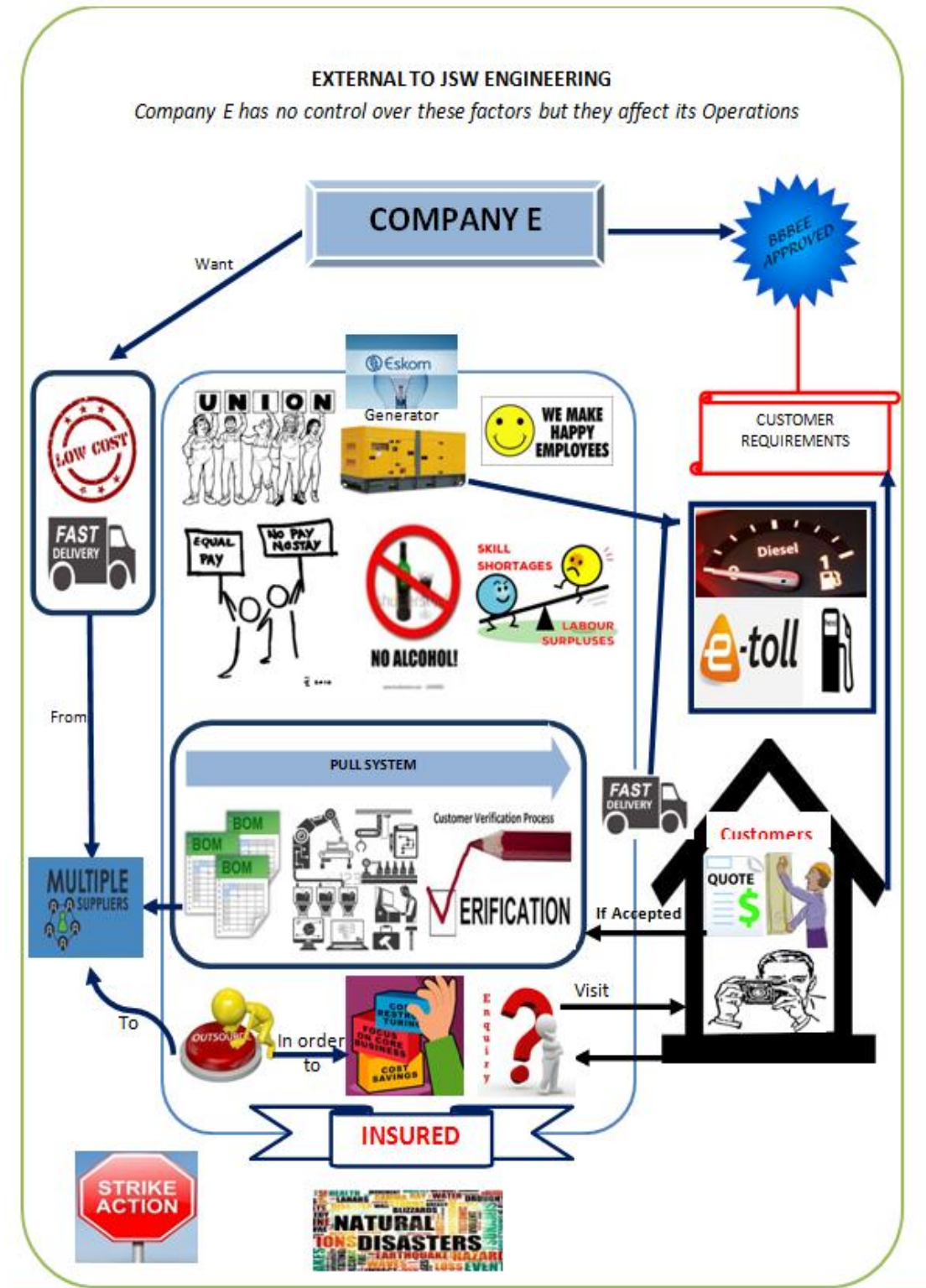


Figure 4-9: Rich Picture of Company E

In the rich picture above, Company E receives an enquiry from a customer to supply a specific product. An employee is then sent to the customer's premises to take pictures and measurements. A quotation is then sent to the customer, who starts the manufacturing process when they accept the quotation. Raw materials required for the product are then sourced from various suppliers. Company E chooses its suppliers by their costs and delivery time. During the manufacturing process, some processes or steps are outsourced to other companies. Once the product has been manufactured, the customer is requested to verify it before it is dispatched to the customer. Company E has various internal issues that affect their business. The first issue is any strike action that affects their operations. The company is also facing a skills shortage as most of their older employees are about to retire. Management tries to keep the young employees motivated and happy so that they are more productive. In order to address safety issues related to alcohol, the company tests its employees for alcohol. Lastly, Company E has acquired a generator to alleviate their power issues. Even though the company can still run when the power is off, the transition between the power going off and the backup power starting damages their products. The following risks and their treatment have been identified as the top ten risks within Company E.

Table 18 : Top Ten Risks in Company E and their Treatment

| Top Supply Chain Risks | Treatment of Risk |
|---|---|
| Disruption from single supplier | Sourcing of multiple suppliers |
| High cost of supply | Source alternative supplier |
| Quality issues | Quality checks and customer verification process |
| Power Cuts | Acquired a generator |
| B-BBEE requirements | Comply with requirements |
| Labour Issues (Strikes) | Acceptance of risk |
| Transportation Issues (Petrol and E-toll) | Acceptance of risk |
| Product quality issues | Product verification check by customer |
| Skill's shortage | Acceptance of risk |
| Inefficient labour | Keep employees motivated and assist them with personal issues |

Company E management and the researcher have identified these top risks as those that may have a significant impact on the objective of their business. As indicated in the answer of the manager to question 38 of the questionnaire, these risks have been identified through experience. The answer can be heard in the interview recording.

4.5.2 Stage Three and Four – Ideal World

Company E has been identified as the relevant system in the problematic situation. Exploring Company E as a system will assist in determining its root definition and then its conceptual model. The table illustrates the CATWOE model for the system identified.

Table 19 : CATWOE Model for Company E

| Root Definition Element | Company E |
|---------------------------------|---|
| C – Customers | Company E's immediate customers |
| A – Actors | Employees and machines of Company E |
| T- Transformation | Raw materials from suppliers are used to manufacture products |
| W – Weltanschauung or Worldview | Manufactures engineering products for its customers |
| O – Owners | CEO |
| E – Environment | Supply Chain |

From the CATWOE model above, the following root definition for Company E was defined:

'Company E is a system owned by the CEO, who together with the employees and machines of Company E, use raw materials from suppliers to manufacture products. This is undertaken with the understanding that Company E's immediate customers will be supplied with engineering products'.

The conceptual model, shown in the figure below, was then drawn up from the root definition of Company E above.

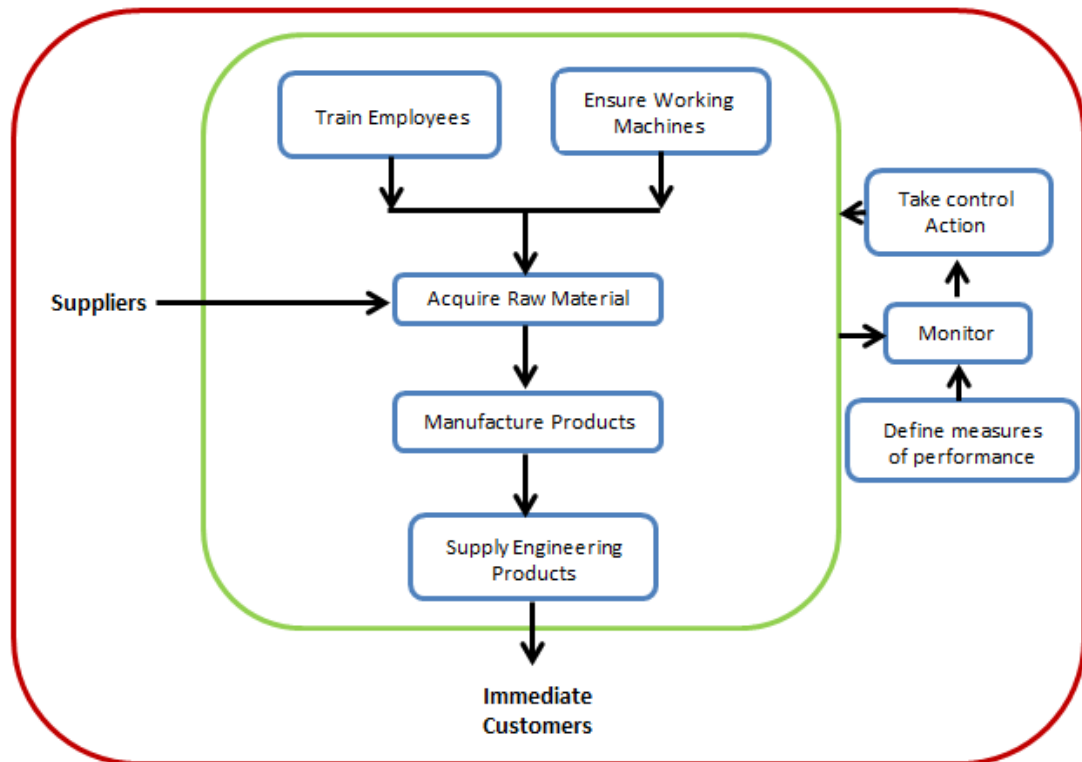


Figure 4-10: Conceptual Model of Company E

4.5.3 Stage five – Real versus Ideal World

In this stage of the methodology, the rich picture of the 'real' world depicted in stage two is compared to the 'conceptual' model of the 'ideal' world determined in stage 4 of the SSM. This comparison has been depicted in table 20 below.

Table 20 : Comparison of 'Real' world with 'Ideal' world

| 'Ideal' World – Conceptual Model | 'Real' World – Rich Picture | Risk Associated | Risk Area |
|----------------------------------|-----------------------------|----------------------------------|------------------------------|
| Train employees | Employees are trained | Labour issues, Skill's shortage, | Internal risks & External or |

| | | | |
|-----------------------------|---|--|--|
| | | Inefficient labour | Environmental risks |
| Ensure working machines | Maintenance of machinery is done | Machine failure | Internal risks |
| Acquire raw material | Raw material is acquired from various suppliers chosen based on costs & delivery time | Disruption from single supplier, high cost of supply | Supply risks |
| Manufacture products | Products are manufactured safely while some processes/steps are outsourced | Power cuts, Labour issues, quality issues | Internal risks & External or environmental risks |
| Supply engineering products | After product verification by the customer, the product is dispatched | Quality & B-BBEE requirements, transportation issues | Internal risks , Demand risks, External or Environmental risks |

In the table above the activities of the conceptual model are related to the activities depicted in the rich picture. Each activity is linked to risks, whose treatment option was stated in table 18. Supply risks are viewed as those that affect the supply of products required for their operations, while demand risks are viewed as those risks that are linked to customer satisfaction. This includes any customer requirement (B-BBEE, quality, safety, price and delivery time) that is imposed onto Company E. Internal risks are those risks linked to the actors within Company E. On the other hand, the external or environmental risks are viewed as those risks that cannot be controlled.

4.6 Cross-case Analysis

In this part of the report, the five cases were compared to each other. This assists in checking any similarities and differences between the five SMEs.

4.6.1 Top Risks

Table 21 is a representation of all the risks identified in the five cases and the number of occurrences between the five cases.

Table 21 : Top risks from five cases

| Supply Chain Risks Identified | Number of Occurrences |
|--|-----------------------|
| Power Cuts | 5 |
| B-BBEE requirements | 5 |
| Labour Issues (Strikes) | 5 |
| Disruption from single supplier | 4 |
| High transportation costs (Petrol, E-toll) | 4 |
| Safety requirements | 4 |
| High cost of supply | 3 |
| Quality requirements | 3 |
| Crime | 3 |

In the table above, the top risks are power cuts, B-BBEE requirements and strikes, which are external to the company. All five companies were greatly

affected by strikes and power cuts. Some companies were affected by strikes because of the existence of unions within their companies while others were affected because their suppliers were affected by strikes and thus could not deliver raw materials. Most of these companies were located in industrial areas and thus were also affected by strikes because of intimidation from striking members or employees or companies. These companies were also affected by B-BBEE requirements from their customers. White family members own three of the companies. This presented difficulties with regards to complying with B-BBEE requirements. One company created another B-BBEE compliant company outside their company, another company is considering bringing in a black partner while the last company has no desire to comply.

The next top risks are disruption from single supplier, transportation costs and safety requirements. Any disruption from suppliers disrupts or delays the manufacturing process and thus delivery of products to customers. During the process of delivering products to customers, these companies encountered high costs due to petrol or diesel prices and e-toll expenses. Once the companies get to the customers' premises they have to comply with safety requirements imposed by different companies. This presents implementation challenges for the companies, as different customers have different requirements. Even though the Occupational Health and Safety Act and Regulations (OHSAct) and the Mines Act specify safety requirements for workplaces, they do not specify the exact details required in a safety file to be used for the workplace. Lastly, high cost of supply, quality requirements and crime labour were identified as the third top risks.

4.6.2 Conceptual Models

The conceptual model is defined from the root definition, which is based on the CATWOE model. This means that in order to compare the conceptual models of the five companies, then one needs to compare the

elements of the CATWOE models. The two main elements that are significant in the CATWOE model are the T – transformation and the W - worldview. Table 22 below depicts the transformation of the conceptual models identified for the five companies that are all the same.

Table 22: Transformation of the five cases

| Company | Transformation |
|-------------------|---|
| A, B, C, D & E | Raw materials from suppliers are used to manufacture products |

Table 23 below depicts the worldview of the conceptual models identified for the five companies.

Table 23 : Worldview of the five cases

| Company | Worldview |
|---------|--|
| A | Supply customers with the highest quality products in a timely manner and at a competitive price |
| B | Provide quality products and excellent service to its customers |
| C | Deliver quality products and good service at all times |
| D | Provide products that are designed to meet customers' needs without ignoring safety requirements |
| E | Manufactures engineering products for its customers |

The worldviews of all the companies have customers in common.

4.6.3 Risk Areas

Table 24 below depicts the risk areas of the different companies.

Table 24 : Risk areas of the five cases

| | A | B | C | D | E |
|----------|---|----------------------------|---|---------------------|---|
| Supply | Disruptions to direct supply of raw materials | | | | |
| Internal | Disruption to resources | | | | |
| Demand | SHEQ, B-BBEE, price & delivery requirements | | | | |
| External | Strikes, power cuts | Crime, strikes, power cuts | | Strikes, power cuts | |

In the table above supply and internal risks are the same for all the companies while demand and external are also the same with the exception of one or two risks that differ from other companies.

CHAPTER 5. DISCUSSION

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|--|
| CHAPTER 1: Introduction |
| CHAPTER 2: Literature Review |
| CHAPTER 3: Research Methodology |
| CHAPTER 4: Results and Analysis |
| CHAPTER 5: Discussion |
| CHAPTER 6: Conclusions and Recommendations |

In the five cases studied, it was evident that SMEs follow risk management processes. While Company B followed a formal risk management process adopted from ISO standards, the rest of the cases followed an informal process. The owners of the four SMEs followed an informal risk management process that is based on the owners experience and their perception of the risks and their impact. Gilmore *et al.* (2004) found this perception of risks to be associated with any risk linked to cash flow, company size, entering a new market or area of business and entrusting staff with responsibilities. The perceived impact of the risks by the owner affected the risk treatment chosen for those risks. The five SMEs perceived supply chain risks as those that had an impact on their enterprises. This is in contrast to the literature, in which Jutter (2003) stated that supply chain risks are any risks from original supplier to the customer.

Learning from disasters in the supply chain has been critical to the advancement of risk management, especially in SMEs. Disruptions in the

supply chain have led to the manufacturing process being threatened and thus SMEs have had to come up with ways of dealing with these disruptions. An example is that of Company B and E, who have purchased generators to assist with power requirements during power cuts. The five SMEs have seemed to have not adopted normal SCM initiatives. These enterprises actually adopt the opposite of these initiatives. All five SMEs acquired non-specialised raw material from multiple suppliers, kept excess stock of fast-moving products (with the exception of Company E) and thus did not run lean processes. These enterprises have adopted a more resilience approach to managing risks within the supply chain. Supply chain resilience is an approach to SCRM that has been suggested by Chopra & Sodhi (2004) and Deloitte (2012), as discussed in the SCRM section of the literature review chapter.

The results also revealed how external risks (power issues, B-BBEE requirements and strikes) existed in all five SMEs, while internal risks (inefficient labour, skill's shortage, product quality and safety issues) only existed in not more than two SMEs. There were no major issues with internal risks and supply risks were dealt with. All the five SMEs had multiple suppliers to risks associated with single supplier. The area of concern were demand and external (or environmental) risks. Demand risks are those risks associated with customer requirements and these require resources to be dealt with. All five SMEs just complied with whatever requirements were imposed on them by customers. The external risks proved to have had more impact than the rest of the risks. This supports Gilaninia *et al.* (2013) statement about external risks having a greater impact on enterprises. These risks are out of the control of the SMEs but affect the running or operation of the SMEs. Most SMEs lose a substantial amount of money when they are affected by these risks, which is what happened to all five SMEs during the mining strike. Another issue that is external to SMEs but is imposed onto SMEs is B-BBEE requirements. There is constant pressure for SMEs to improve their B-BBEE levels.

Though some have tried to comply for fear of losing customers, some have decided not to comply or improve their levels.

The results and analysis of each case and the cross-analysis of these findings have proved to be insightful. This supports the case study design used in this research paper, which has proved to be ideal for evaluating SCRM in SMEs using SSM. The cross-analysis of the findings revealed similar results while rival results were minimal and these were discussed. The in-depth and insightful results have allowed this research paper to reveal what SCRM is to SMEs. These results have supported Ghadge et al. (2012), who found systems thinking to have provided a rich, unbiased and holistic picture of SCRM. The in-depth and insightful results were obtained by only applying the first five stages of SSM. This is how SSM was used to investigate SCRM in SMEs and thus answered the research question. SSM has thus been found to be an effective tool for the analysis of SCRM in SMEs.

CHAPTER 6. CONCLUSIONS

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| CHAPTER 1: Introduction |
| CHAPTER 2: Literature Review |
| CHAPTER 3: Research Methodology |
| CHAPTER 4: Results and Analysis |
| CHAPTER 5: Discussion |
| CHAPTER 6: Conclusions and Recommendations |

There are limited research frameworks of SCRM that are suitable for SMEs. The frameworks available have been found to be biased towards large enterprises that already have established systems. The existing frameworks also lacked a holistic approach to SCRM. Systems' thinking, which has provided a rich, unbiased and holistic view of SCRM, has proved to be a vital approach for this research report.

This research report has also managed to achieve its objectives by developing a theoretical framework for the research paper and investigating and discussing SCRM in SMEs. These objectives were achieved even though the research was only conducted on five SMEs in the manufacturing sector.

The utilisation of SSM to evaluate SCRM in SMEs in this research paper has revealed which supply chain risks were affecting these SMEs the most. The research paper also revealed how these SMEs dealt with supply chain risks and any gaps that existed in SCRM for SMEs.

Considering the persistent failure of most SMEs and their impact on the economy, the results of this research is vital for the development of frameworks to assist SMEs in their survival. The results can be used to conduct research on how to assist these SMEs with supply chain risks they are mostly exposed to. Even though some of these risks cannot be eliminated, their impact could be reduced. This research paper has supported some of the already existing literature and has a great impact in exploring SCRM for SMEs.

This paper therefore recommends the application of SSM in a larger sample than that presented in this research paper. The results obtained in that research could be used to develop frameworks to assist SMEs for their survival in supply chains. The methodology used in this research paper could be utilised in other sectors and also in larger organisations and compared with results obtained in this research paper.

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APPENDIX A – INTERVIEW QUESTIONNAIRE

The following is a guideline that was used for the interviews with the SMEs.

A. INTRODUCTION

The introduction explains the purpose of the study and the role of the participants. In addition, the aim is to assure the participants' confidentiality and request permission to use a tape recorder, if possible.

B. COMPANY PROFILE

The aim of this section is to gather information about the organisation.

1. Name of participant(s) :
2. Position :
3. Name of company :
4. Date company was established :
5. Product(s) and/or service(s) :
6. Production volume (per month)? :
7. Total number of employees :
8. Total annual turnover :

C. GENERAL

The aim of this section is to gather information about the organisation, supply chains and risk management from the perspective of the participant(s) or organisation(s).

1. Who are the owners the system?
2. What is the reporting structure?

3. Please give a brief account of your processes (transformation process)?
4. Are your processes based on a pull or push system?
5. Who are the actors (man, machine, methods, materials, money, and technology)?
6. Identify the physical structures (hardware/ software/ documentation/ people/ tools/ facilities)?
7. How do you maintain your structures?
8. How do you measure your performance?
9. Have you adopted any new technology (RFID, robots, etc.)? Issues?
10. How do handle research and development?
11. What are your main internal issues?
12. How do you assess, evaluate or treat internal issues?
13. Do you comply with any safety and health requirements?
14. Do you have any quality accreditations? If yes, reasons for acquiring accreditation?
15. Do you have any environmental accreditations? If yes, reasons for acquiring accreditation?
16. Do you comply with B-BBEE requirements? Do you have issues or concerns with this requirement?
17. Who are your suppliers? Domestic or international?
18. How do you select suppliers? How do you assess your suppliers?
19. Are your suppliers involved in the design and development processes?
20. How would you describe your relationship with your suppliers (traditional/ partnership/ collaborative)?
21. Which accreditation(s) do you expect your suppliers to have? Do they have it?
22. How do you handle non-conformance by suppliers (e.g., quality, specification & delivery)?
23. What amount of your total purchases is spent with B-BBEE suppliers?
24. What are your main supply issues?

25. How do you assess, evaluate or treat supply issues?
26. Who are your customer(s) (recipients of the system output)?
27. Do you have to comply with any requirements imposed by your customer(s)?
28. What are your main demand issues?
29. How do you assess, evaluate or treat demand issues?
30. Which modes of transport do your suppliers and/or customers use (sea/ air/ road/ rail)?
31. What challenges do you experience with transportation?
32. Who are your main competitors?
33. What are your main environmental or external issues (e.g. government legislation)?
34. How do you assess, evaluate or treat environmental or external issues?
35. What are the major supply chain problems you face?
36. What part of the SC are you mostly concerned about?
37. In what part of the SC do you feel improvement is possible?
38. Have you adopted any risk management model? If yes, when was it adopted?
39. Who are the main users of the risk management model in the organisation?
40. What are your top ten risks, in order?

APPENDIX B – COMPANY A

A. General Company Information

The following information represents general information gathered on Company A.

- | | |
|---------------------------------|--|
| 1. Name of company | : Company A |
| 2. Date company was established | : 1993 |
| 3. Product(s) and/or service(s) | : Drill bits and other engineering products |
| 4. Production volume (monthly)? | : 100 000 |
| 5. Total number of employees | : 17 |
| 6. Total annual turnover | : R13m < X < R51m |
| 7. Size of Class | : Very small (based on number of employees) and medium (based on turnover) |

B. Detailed Company Information

The following represents information gathered for company A from other sources. This information was gathered from the company website and from the management team through emails.

COMPANY PROFILE

██████████ pty ltd is a company founded in 2013 as the completely independent sales arm of ██████████ CC.

They were founded as a means to:

- Stop the high way robbery of paying for overpriced products that clients have become accustomed to.
- Supplying only top quality products that increase their client's profits.
- Being BEE compliant, assisting our fellow business people conform to local law.
- Be the First, top-of-mind, 100% South African Made rock drill bit company.

As ██████████ has continued to grow, it has included products from other manufacturers, but thanks to the consolidated volumes ██████████ purchases, they have negotiated amazing prices that few other companies can obtain.

The manufacturers that ██████████ accepts as their preferred procurement partners are held to the following standards in order of importance:

Quality: ██████████ tests and personally uses the products thoroughly before contemplating affiliation.

Price: Every company need to make profit ██████████ knows and understands this, however they feel that profit does not mean ridiculous over charging of products.

Ethical Behavior: ██████████ has vowed to do business in an ethical manner, and as such does not do underhanded deals, regardless of the benefits at stake. As such, they also do not procure from any business they feel does not share the same ethical values.

To truly understand ██████████ one must know about ██████████ CC as well:

██████████ CC is a company founded in 1993 to provide engineering services and engineered products by means of CNC manufacturing.

██████████ has made a name for itself through many years of service to a wide variety of fields. From the motor car industry, railways, Afrox tankers to mining components for Atlas Copco which makes up for 85% of their manufacturing capabilities.

They take pride in not just keeping up with the latest technology, but they have designed, built and implemented their own machines, tools and electronics to further become more efficient and cost saving towards their customers.

Their precision and quality speaks for itself. With requirements of the highest tolerances for safety, performance and longevity, they have a long history of satisfied and repeat customers.

Mission & Vision

██████████ seeks to supply all our customers with the highest quality products in a timely manner and at a very competitive price. Our commitment to our customers is reflected through being an honest and responsible business guided by adherence to ethical business practices.

██████████'s vision is to be the manufacturing entity that our customers always think of first due to our excellent quality, quick delivery and reduced price.

Objectives

██████████ will;

- Provide excellent quality machined products and excellent customer service to all current and prospective customers.
- Assist customers in scoring high points on Enterprise Development and Preferential Procurement categories of the BBBEE codes by remaining an empowered company.

Products

██████████ is geared to manufacture high precision components for the most demanding of customer requirements.

Products amongst others are the following:

- Bearing housings and linings
- Railways
- Rock drilling tools and exploration accessories
- Shafts, industrial pins, sleeves, couplings, bushings and a variety of tooling
- Automotive parts
- High precision, high safety tanker pumps
- Armourment
- 3D printing industry
- Solar power industry

C. Interview Session

The recording of the interview session has been attached to the digital Appendix.

APPENDIX C – COMPANY B

A. General Company Information

The following information represents general information gathered on Company B.

1. Name of company : Company B
2. Date company was established : 1992
3. Product(s) and/or service(s) : Conveyor belts and ancillary products
4. Production volume (monthly)? : Differs
5. Total number of employees : 52
6. Total annual turnover : X > R51m
7. Size of Class : Medium (based on number of employees) and large (based on turnover)

B. Detailed Company Information

The following represents information gathered for company B from other sources. This information was gathered from the company website and from the management team through emails.

- BEE ESTABLISHED COMPANY
- MANUFACTURER OF QUALITY PRODUCTS - SABS SPECIFICATIONS

Our South African factory and warehouse is situated in Brakpan, Gauteng just off the Secunda / Johannesburg N17 highway at Carnival City Casino. At this facility we manufacture a range of conveyor components to SABS specifications and house the largest range of heavy duty conveyor belting stock in South Africa.

[REDACTED] was established in 1992 and has built a reputation for quality products and service excellence which has resulted in the fact that we are approved suppliers to almost all the major mining companies in South Africa; [REDACTED] also exports product into Africa and the U.S.A.

Not only does [REDACTED] strive to be the market leader through product and service but also through its commitment to South African BEE standards.



C. Interview Session

The recording of the interview session has been attached to the digital Appendix.

APPENDIX D – COMPANY C

A. General Company Information

The following information represents general information gathered on Company C.

- | | |
|---------------------------------|---|
| 1. Name of company | : Company C |
| 2. Date company was established | : 1999 |
| 3. Product(s) and/or service(s) | : Fans and ancillary products |
| 4. Production volume (monthly)? | : 15 - 20 |
| 5. Total number of employees | : 20 |
| 6. Total annual turnover | : R5m < X < R13m |
| 7. Size of Class | : Small (based on number of employees and turnover) |

B. Detailed Company Information

The following represents information gathered for company C from other sources. This information was gathered from the company website and from the management team through emails.

Fan In Situ Balancing and Dynamic Maintenance

██████████ is situated in Springs, Gauteng and was established in December 1999. The majority of our staff has spent many years with Advent Field Services, a founder company and also with Airtec Davidson, a prominent Fan and Air Pre-Heater manufacturing company specialising in Fan balancing, manufacturing, supplying new fans and commissioning of "Pre-Heaters" and Fans.

We specialized in In-situ dynamic balancing, Laser Alignment on all types of couplings, hard roller dynamic balancing of all rotating machinery, commissioning and general fan maintenance. We also design, manufacture and erect all steel structures and ductings.

We are competent in aspects of fan design, installation of new dust plants and refurbishment of existing plants. ██████████ is basically a service organization to the major mining and industrial organizations.

Trouble Shooting:

24 hours call out for fan equipment and associated plant. We are capable of manufacturing and/or selecting new fan equipment, bearings, couplings and all fan components.

We Are Currently Servicing The Following Companies:

Impala and the general industrial environment e.g. Hartebeesfontein Goldmine, Sasko Bakeries, African Products, Greenside Collieries, Sappi, New Vaal Colliery (Anglo Operations Ltd) etc.

We have earned a reputation over the years for our quality service, administration and co-operation. We adhere strictly to safety requirements as stipulated by clients and industry. We are dedicated to deliver a high quality service at all times.

Assuring you of our best attention all the time.



Balancing Services and Troubleshooting

Services:

The company's industrial fan portfolio encompasses the following activities:

- In situ dynamic balancing.
- Dynamic balancing of loose rotating machinery.
- Dynamic balancing on site or in the workshop.
- Condition Monitoring.
- Laser alignment on all motor couplings and shafts.
- The supply of new fans and the upgrading of existing fans.
- On site installation of industrial fans and steel structures.
- Manufacturing of all types of fans, blowers in our workshop.
- Manufacturing of all ducting in the workshop.
- Manufacturing of Dust Extracting Units in our workshop.
- In House dynamic balancing of rotors, rollers, impellers and pumps.
- In House precision machining and milling.

In Situ Balancing:

This involves the on site dynamic balancing of all rotating machinery such as fans, drives, rollers and motors.

Dynamic Balancing In The Workshop:

Loose rotating machinery that is balanced dynamically at our factory in Springs. ██████████ collects and delivers machinery from site to its factory and vice versa.

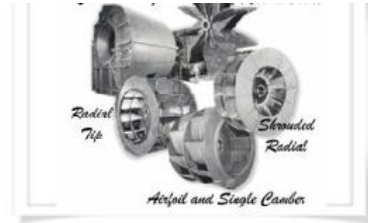
Refurbishment:

Fan refurbishment consists of dismantling, shot blasting, painting, repair and dynamic balancing of impellers, as well as supply of new bearings and dual bearing housings.



New Fan Supply:

Customer needs are accommodated by means of the new industrial and mining fans, and the upgrading of existing fans after conducting air flow tests.

**Erection:**

We specialise in on-site erection of small and large industrial fans, mining fans and the erection of steel structures, geared to specific customer needs.

**Precision Machining:**

All general machining, key ways, shafts and hubs are manufactured in our machine shop to perfection.

**New Ducting Supply:**

All general stainless steel, mild steel and galvanised customised ducting supplied. (Round, square and flexible)

**C. Interview Session**

The recording of the interview session has been attached to the digital Appendix.

APPENDIX E – COMPANY D

A. General Company Information

The following information represents general information gathered on Company D.

- | | |
|---------------------------------|---|
| 1. Name of company | : Company D |
| 2. Date company was established | : 1979 |
| 3. Product(s) and/or service(s) | : Locomotives and ancillary products |
| 4. Production volume (monthly)? | : 1 |
| 5. Total number of employees | : 42 |
| 6. Total annual turnover | : R5m < X < R13m |
| 7. Size of Class | : Small (based on number of employees and turnover) |

B. Detailed Company Information

The following represents information gathered for company D from other sources. This information was gathered from the company website and from the management team through emails.

Our Mission

Putting you first by saving you money and time. We are at your service 24-hours a day to keep your locomotives at their full potential.

Company Profile

Since our founding in 1979 by [REDACTED], herein after (ILS) has established itself as a leader in the supplying Diesel-Hydraulic and Diesel Electric Locomotives to the mining and industrial sectors throughout the Southern African markets. ILS and sister company Locomotive Industries CC, herein after (Loc Ind) has the facilities, extensive experience and technical expertise to design, manufacture, refurbish abovementioned locomotives.



Our products are designed to meet our customers needs, not ignoring our own stringent safety requirements. Work undertaken by our 40 strong highly experienced and qualified permanent staff complement.

C. Interview Session

The recording of the interview session has been attached to the digital Appendix.

APPENDIX F – COMPANY E

A. General Company Information

The following information represents general information gathered on Company E.

- | | |
|---------------------------------|--|
| 1. Name of company | : Company E |
| 2. Date company was established | : 1972 |
| 3. Product(s) and/or service(s) | : Engineering products |
| 4. Production volume (monthly)? | : 35 - 40 |
| 5. Total number of employees | : 34 |
| 6. Total annual turnover | : X < R5m |
| 7. Size of Class | : Very small (based on turnover) and small (based on number of employees) |

B. Detailed Company Information

No information was gathered for company E from other sources.

C. Interview Session

The recording of the interview session has been attached to the digital Appendix.

APPENDIX G – DIGITAL APPENDIX