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Supply chain risk mitigation through visibility and collaboration for SMEs in the South African manufacturing enviroment

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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF MECHANICAL, INDUSTRIAL AND AERONAUTICAL ENGINEERING



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Declaration

I, the undersigned, have registered for MECN7018 in the year of 2015. I herewith submit the following research report, "Supply Chain Risk Mitigation through Visibility and Collaboration for SMEs in the South African Manufacturing Environment." in partial fulfilment of the requirements of the above course.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong;
- I confirm that the work submitted herewith for assessment in the above course is my own unaided work except where I have explicitly indicated otherwise;
- This task has not been submitted before, either individually or jointly, for any course requirement, examination or degree at this or any other tertiary educational institution;
- I have followed the required conventions in referencing the thoughts and ideas of others;
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Signed this 18th day of February 2016.

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Abstract

Small and Medium Enterprises (SMEs) are the backbone of any economy and create the platform by which efficient and competitive markets are created. Having said this, SMEs are more vulnerable than bigger large enterprises to fluctuations and unexpected events, as they do not have the critical mass and economy of scales on which to compete. For this reason SMEs must use their flexibility and adaptability to manage their risks.

Risk is defined as the probability of a variance in an expected outcome. Two concepts that SMEs (and any size organisation) can use in order to manage risk in the supply chain are those of visibility and collaboration. These two concepts if managed correctly have the opportunity to mitigate risk and enhance competitiveness.

This research paper undertook the study of the supply chains of six SMEs, through the interview of their owner/managers, operating in the South African manufacturing environment. These interviews were conducted with the owner/managers as they were deemed the most knowledgeable person/people in the organisation. The results from the data collected showed that the concepts of visibility and collaboration are used in the operations of these businesses, but only informally. Nonetheless, it was also found to an intrinsic part of the decision making and planning processes and can be used on the demand side of the supply chain to manage and mitigate risk.

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Nomenclature

O/M	-	Owner/Manager
SC	-	Supply Chain
SCC	-	Supply Chain Collaboration
SCM	-	Supply Chain Management
SCRM	-	Supply Chain Risk Management
SCV	-	Supply Chain Visibility
SME(s)	-	Small and Medium Enterprise(s)

Chapter 1 - Introduction

1.1 Background

Small and Medium Enterprises (SMEs) are referred to as the economic engine of a country and are the platform by which efficient and competitive markets are created (Um Jwali Market Research, 2012). These enterprises play an important role in the development of countries and are the largest providers of employment (Um Jwali Market Research, 2012).

Unlike large enterprises SMEs, especially in developing countries, suffer from low levels of productivity and produce low to medium quality products, servicing localized markets. This is due to the capital required to invest in the technology and equipment needed to compete in the export market in both quantities produced, as well as quality of product produced (Kaya, 2012). A lack of funding will naturally steer this type of business into becoming a labour-intensive firm. Thus, staff will have limited training and this will, once again, add to their lack of competitiveness in international markets (Kaya, 2012). These factors limit the size of their operations (Um Jwali Market Research, 2012).

In the current economic conditions banks have tightened up on their lending criteria, thus making it increasingly difficult for SMEs to qualify for funding (Matsilele, 2014). Without certain levels of external funding with which to grow their business, SMEs are turning to alternative methods with which to better deploy their available funds. One of these methods is asset finance (Stephens, 2014). An internally focused method of redeploying funds in areas that may help to grow the business would involve analysing the business and its supply chain in order to free up resources and possibly free up cash flow. Following this steps could be implemented to mitigate supply chain risks and improve supply chain aspects that will help with resource planning and allocation.

The supply chain is defined as “the network used to deliver products and services from raw materials to the end user through an engineered flow of information, physical distribution and cash" (Ayers, 2006). Figure 1, below, depicts a supply chain in its simplest form:



Figure 1: Direct Supply Chain (Mentzer *et al*, 2001)

Researchers have argued that today’s fast paced environment has led to dramatic changes in customer expectations. This fact, coupled with market factors such as competition and technology, is increasing the uncertainty of the market place (Elangovan, 2010). These changes have brought about an increase in the complexity of supply chains (SC) as products

have to be delivered as cheaply as possible and on time. The more complex the SC becomes, the more difficult it is to manage and to manage the risks associated with the SC (Goldsby & Rao, 2009). Market factors that make SC risk more difficult to manage, include greater uncertainties in supply and demand, globalization of markets, shorter product and technology life cycles. On the SC side factors that make it more difficult to manage risks are the increased use of outsourced manufacturing, distribution and logistics, which result in complex international supply network and business relationships (Christopher & Towill, 2002).

This increase in complexity of supply chains has paved the way for new research that looks at supply chain management (SCM) (Goldsby & Rao, 2009). SCM is defined as "the systematic and strategic coordination of the traditional business functions and the tactics across these business functions, within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies" (Thakkar, 2008, pg 97). In order to manage the chain as effectively as possible the risks of the supply chain would need to be mapped and analysed. The reason for the focus on the management of the supply chain is due to the fact that, ultimately, uncertainties cause delays in the whole cycle (Elangovan, 2010). These delays can be costly and damage reputation as well as future business opportunities.

1.2 Motivation

Traditionally the focus of companies has been on the internal flows within an organisation, or flows over which the company has direct control (Sahay, 2003). Increasingly, companies recognise that in order to be successful they need to realise that they are one link in a chain (Sahay, 2003). Noting that disruptions ultimately cause time delays along the entire supply chain, it is in the best interests of enterprises to mitigate factors that could cause delays (Elangovan, 2010).

In today's environment market leaders will be organisations that can structure, co-ordinate and manage relationships with their partners in the supply chain in order to better serve their customers (Christopher, 1999). This collaborative approach will result in better information sharing between all players in the SC. This will, in turn, reduce the effects of information distortion which can result in inefficacies, excess inventories, a slower response and potentially lost profits (Lee *et al*, 2004). According to Harris (2014) the definition of true collaboration is the "true joint planning, process re-design across the trading partner interaction and, most importantly, sharing of risk and reward." This is a far more involved process than merely the automation of basic business processes (such as stock reordering), which are considered only integration and production forecasts – termed merely information sharing by Harris (2014). However, both integration and information sharing are important stepping stones to achieving SC collaboration (Harris, 2014).

Supply chain visibility has a number of definitions (Caridi, 2010) but the essence of these definitions include reliable and useful information that is shared timeously. These are the two most important aspects of visibility as the information received from entities within the SC needs to be both timeous – if the information comes after the fact it will not be of any use – and reliable, otherwise the information would turn into a nuisance as it would lead the planning process in the incorrect direction. Supply chains are evolving, as the global economy changes, and are becoming more similar to supply networks. This is due to the number of players that make up the supply chain – making timeous, reliable information even more critical (Caridi, 2010).

With business entities needing to become more streamlined, cost efficient and conscious of lead times, Supply Chain Risk Management (SCRM) has become an important area of study, especially considering the complex supply chains that make up today's global economy (Christopher & Towill, 2002). There has been an increasing amount of awareness as well as studies conducted in SCRM and SCM (Christopher & Towill, 2002), however, it should be noted that research is scarce on collaboration and visibility (Caridi, 2010). The purpose of this report will be to gain a better understanding of the effects of visibility and collaboration on supply chains.

1.3 Problem Statement

Due to the size of the business, it can be more difficult for an SME to be competitive. Listed below are a few of the main challenges encountered by SMEs:

1. Cash flow and funding (Matsilele, 2014)
2. High production costs due to lack of economies of scale (Olawale & Garwe, 2010)
3. Shortage of skills (BANKSETA, 2014)
4. Complying with legislative requirements (BANKSETA, 2014)

Due to a lack of funding (normally owing to the fact that loans from financial institutions come at an elevated rate due to the risk involved) it becomes imperative that SMEs stay liquid and always maintain a certain level of cash availability. This will give management the flexibility to pursue the objectives, i.e. managers are then able to spend the cash on hand, but would not necessarily be able to raise debt to spend it whenever they want to (Pastor, 2010).

Improved visibility and collaboration through the supply chain improve a number of operational aspects, including, but not limited to inventory cost, stock out cost, on time delivery, product mix flexibility, cycle time and responsiveness. These improvements work towards helping an entity to operate more efficiently and thus enhance competitiveness (Caridi, 2014).

1.4 Research Question

As stated above in the Section 1.2, the purpose of this report is to gain a better understanding of the effects of visibility and collaboration on supply chains. This has led to the central research question below:

Do visibility and collaboration play a role in how SMEs manage and mitigate risk within their supply chains?

1.5 Objectives

The objectives of this research are to:

- Understand the SC in which each SME operates and the impact the SME has on the SC in which it operates.
- Understand the risks in the SC experienced by SMEs.
- Determine whether collaboration and visibility currently exist in the SME SC.
- Determine whether collaboration and visibility assist with the mitigation of risk in the SC.
- Determine the structural and risk characteristics of supply chain management using a sample of SMEs in a particular sector of the South African economy.

The first two objectives will be covered through data gathering (interviews, visual sensemaking, etc.) and will outline the scenario in which the SME finds itself and, ultimately, provide context (along with the other objectives), which will allow the central research question to be answered.

1.6 Limitations and Assumptions

Limitations and assumptions for this research included the following:

Assumptions:

1. The O/M interviewed is the most knowledgeable person of the company's supply chain and operations and thus his/her perspective reflects reality.

Limitations:

1. Information about both upstream suppliers and downstream customers was deemed sensitive and thus no questions regarding names, contact details or figures/values were posed during the interview.
2. Based on assumption 1, above, the information given during the interview could have been somewhat altered due to protection of processes, procedures, relationships, etc.

3. Limited research has been conducted on visibility and collaboration in so far as SMEs are concerned.

1.7 Outline of Chapters

A brief summary of the Chapters that form part of this report are as follows:

- Chapter 2 contains the literature review - a collection of existing literature, which is pertinent to the research being conducted.
- Chapter 3 highlights the research method. This includes literature regarding the task of data collection and analysis, as well as ethical considerations while conducting research.
- Chapter 4 encapsulates the data collected during the course of the research and interviews, as well as the analysis thereof.
- Chapter 5 contains the discussion of the results and findings from the analysis of the collected data.
- Chapter 6 discusses the conclusions that can be drawn from the findings discussed the preceding chapter, Chapter 5.

Chapter 2 - Literature Review

The purpose of this section is to explore the relevant literature relating to SMEs, supply chain management, supply chain risk management and finally, collaboration and visibility within supply chains. The conceptual framework will finally be presented.

2.1 Small and Medium Enterprises

Small and Medium Enterprises (SMEs) are defined as enterprises that employ 200 people or less - depending on the sector in which the enterprise is categorised (National Small Business Act, 1996). The table below illustrates the breakdown based on employees, revenue and fixed assets, for the manufacturing sector.

Table 1: Small and Medium Business Classification – Manufacturing Sector (National Small Business Act, 1996)

Sector	Size or Class	Total full-time equivalent of paid employees	Total Annual Turnover	Total Fixed Asset Value
Manufacturing	Medium	200	R40M	R15M
	Small	50	R10M	R3.75M
	Very Small	20	R4M	R1.5M
	Micro	5	R0.15M	R0.1M

SMEs could be considered the backbone of economies the world over as they are estimated to make up 95% of all enterprises globally. This equates to approximately 60% of private sector employment (Edinburgh Group, 2013). A few global examples include first-world Japan, in which an estimated 99% of private enterprises are SMEs, with third world countries such as India and South Africa currently estimated to be at 80% and 91% respectively (Edinburgh Group, 2013). The major employer in the private sector in South Africa comes in the form of SMEs, with 70% of private employment in firms with fewer than 50 workers (SBP, 2011).

The SME sector, globally, plays an important role in that it has successfully nurtured entrepreneurial talent and, as stated above, provides higher levels of employment, as well as industrial development (Maurya, 2001). SMEs can be found in almost any sector from industrial manufacture to agriculture and livestock, small factories, small engineering workshops and service businesses. Fast moving consumer goods (FMCG) and the automobile industry have both traditionally been dependent on SMEs as they form part of the first tier suppliers (Thakkar *et al*, 2009). Effective supply chain management is a key to deliver competitive advantages, and these industries (FMCG and automobile) develop

programmes to assist their suppliers from which the SMEs are able to benefit (Hong & Jeong, 2006).

SMEs can improve their competitiveness, individually, but do not have capacity to be competitive in the ancillary activities such as branding, collective marketing, aggressive marketing, intensive promotional efforts in export markets and transport. However, leveraging these activities through domestic large enterprises can assist in making the SMEs more effective in these fields (Thakkar *et al*, 2009).

Individual SMEs often have trouble in achieving economies of scale in the purchase of inputs like equipment, raw materials, finance and consulting services and are often unable to take full advantage of market opportunities that require large production quantities, homogenous standards and regular supplies. Due to their size there are also constraints on activities such as training, market intelligence, logistics, technology and innovation. This lack of capacity limits the potential for an SME to take advantage of new and emerging opportunities in the market (Thakkar *et al*, 2009).

2.1.1 SMEs in the South African Manufacturing Sector & Greater Economy

According to Statistics South Africa (2015), the manufacturing sector occupies a significant share of the South Africa economy, even though its relative importance in relation to the economy as a whole has declined from 19 percent in 1993 to about 17 percent in 2012 in real terms. In contradiction to this, an SME specialist risk finance company that had recently launched a R300 million manufacturing fund to stimulate entrepreneurship in South African SMEs, stated that manufacturing SMEs in South Africa have the potential to accelerate the country's development and should be the focus of government (Thulo, 2014).

It is becoming increasingly difficult to operate an SME in South Africa and the expectation is that it will become more so in future (SA Environment not SME-friendly - Study, 2013). In a study conducted by SME Growth Project, SME manufacturing firms were found to be the most negative of industries, at 81%, about the increase in difficulty of doing business. The explanations given by those interviewed as to why the difficulty in doing business has increased ranged from political climate, poor governance factors, the overall state of the economy and the price of utilities. Further reasons were cited as issues of "red tape" (legislation and regulation), which include a resource heavy compliance burden, diverting focus away from the core business of the SME. Labour legislations make it more difficult to employ staff, made worse by the current union climate (SA Environment not SME-friendly - Study, 2013).

For South African SMEs the ability is present to be able to produce, for both local and international markets, high quality items at relatively low cost. This said, the sector's contribution towards the South Africa's GDP dropped from 19% in 2000 to 15.2% in 2013 (Thulo, 2014).

The explanations offered as to why the manufacturing environment is in a long term decline, are due to the nature of the SME business requiring specific fixed capital investment, which, in case of failure, would be difficult to dispose of. In addition, input prices continue to climb and the lack of skills - mainly on an artisan level - is also seen as a contributing factor (SA Environment not SME-friendly - Study, 2013).

It would also be pertinent to mention that the current power shortage affects South African SMEs operationally, as the power supply is switched off in certain areas in the country in order to keep the power system balanced and to avoid a nationwide blackout (Eskom, 2015). These power outages cease operations or, at the very least, increase the cost of doing business by forcing companies wishing to still operate to run a generator.

2.1.2 SME Survival

The problems encountered by SMEs and large enterprises in their daily operations, strategies and long term existence are vastly different and, thus, methods used to analyse any sort of problem will be different. The following aspects are central to the differences (Thakkar *et al*, 2009):

- The level of uncertainty,
- The nature of innovation, and
- The type of evolution

The generic model for SMEs assumes that it is a firm that has fewer products, fewer customers and lower volumes, which brings about the lack of economies of scale and lower capacity to learn. Further disadvantages occur in the form of higher transactional costs, normally, with weak marketing skills, but a higher technological focus. The fact that the O/M makes organisational choices and takes strategic decisions according to organisational skills and structures, as well as the field in which the firm operates, could also make the company both reactive and vulnerable to competitive markets (Thakkar *et al*, 2009).

SMEs have a fundamentally different competitive priority as they understand they cannot compete against large enterprises due to their limited resources. They therefore focus on their competitive priorities, protecting their niche market (from which they generate profits) irrespective of the market share (Hong & Jeong, 2006).

There are also differing key strategies between SMEs and large enterprises, in that large enterprises are flexible in forming strategic alliances with suppliers, while, in order to remain competitive and survive, SMEs focus on building their unique competencies and strive for effective customer and supplier management, again specializing in niche market strategy. (Hong & Jeong, 2006).

SMEs are unable to take full advantage of opportunities that come their way due to the reasons outlined above, as well as uncertainty of demand, low margins and higher working capital requirements. To survive, grow and build capabilities, it is normal for SMEs to

operate as ancillaries to large enterprises, providing outsourced functions, where they can compete by means of a lower cost in production, while, at the same time, producing a higher quality item/service. Traditionally, it has been the case for SMEs to be relied upon by the multinational large enterprises (Thakkar *et al*, 2009).

2.1.3 SME Company Structure

There are many types of organisational structures, which depend largely on the size and strategy of the business, namely (Khan, 2010):

- Simple – The company has no formal structure and the division of responsibilities is unclear. This type of structure occurs in small companies where there are only the O/M and a few employees.
- Functional – This structure is based on primary functions, i.e. production, finance, marketing, sales, etc. This structure is also suited to smaller companies.
- Multi-divisional – This structure is used in large companies, where the business is broken down into divisions. Usually in this case each division manages its own business.
- Holding Company – This replaces the need for business units as the controlling body comes in the form of a holding company.
- Matrix Structure – Suited to large, global organisations where there may be a need to combine dimensions of product, geography, function and division. An example of this would be international oil companies.
- Multinational Structure – Again, suited to bigger corporations, where overseas operations could be managed as branches, subsidiaries or affiliates reporting to control centres.

As indicated in the company structures above, SMEs usually adopt the simple and functional structures. This flatter structure (normally categorised by a larger number of subordinates that report directly to a manager) is characterised by a shorter chain of command and a wider span of managerial control. This reduced number of management layers is an advantage to smaller companies and allows smaller companies to get the most out of the structures by virtue of the following traits (Griffin, 2015):

- Communication – Flat structures generate a greater level of communication between employees and management. The communication is usually faster, more reliable and more effective than in taller structures. The general trend is for direct staff input that leads to more support for decisions and fewer behind the scenes power struggles and disagreements. As will be discussed further on in Section 2.3.4 better communication improves transparency and visibility as it encourages information sharing.

- Decision making – Flat structures are more flexible and adaptable. Decisions are made on an "as needed" basis, as compared to a taller structure where there is a higher level of bureaucracy and various levels of approval are needed before a decision can be made. A flatter structure makes it easier to serve clients as quicker decisions can be taken.
- Performance – Fully engaged, skilled work groups lead to happier staff and lower staff turnover. The happier the staff and the more empowered they feel tends to increase the pride they have in their job and company which, in turn, improves the company's chances of success.

There are also disadvantages to flat structures. These disadvantages include the limitation of the height of the structure, therefore hinder growth of employees within the organisation. Another disadvantage is due to the high overlap between departments there can be a blur between department's/employee's responsibility in flatter structures, which can lead to confusion (Griffin, 2015).

In conclusion, different structures are suited to different companies based on company size, geographical locations or large variations between offices. Small companies tend to be more innovative and flexible due to fewer levels of authorization. This also facilitates better information sharing and more collaborative relationships within the internal structures of the company and intra-company interactions, due to shorter lines of communication. These shorter lines of communication also assist with improved visibility and transparency internally (Griffin, 2015).

2.2 The Supply Chain

The direct supply chain, illustrated in Figure 1, found on page 1 of this report, is the simplest form of a supply chain with only three entities taking part in the transaction. An example of an extended supply chain is displayed in Figure 2. This refers to a supplier of the immediate supplier and customer of the immediate customer, essentially adding extra entities into the SC. All who are involved in the upstream and downstream flow of what is required to fulfil a value adding function to the product.



Figure 2: Extended Supply Chain (Mentzer *et al*, 2001)

The ultimate SC, Figure 3 on page 11, involves all organisations upstream and downstream that are involved in production and reception of a product (Mentzer *et al*, 2001). It is important to note that some of the functions of the SC do not relate directly to the product, but supply information or services relating to the product, i.e. market research and financial services.

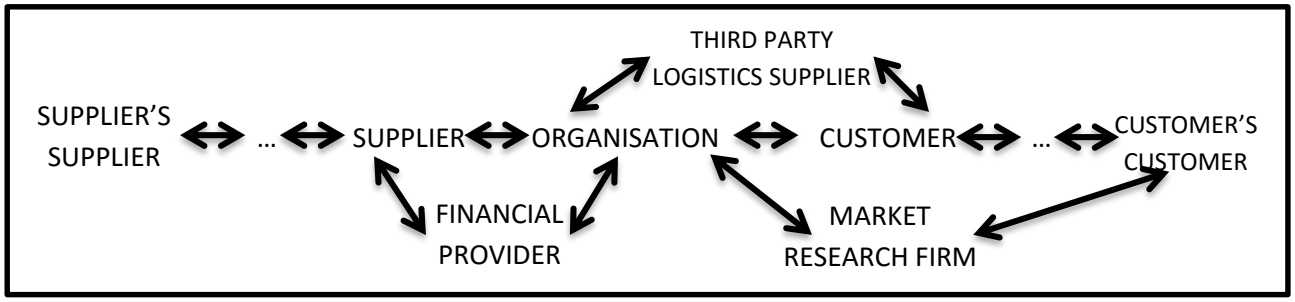

Figure 3: Ultimate Supply Chain (Mentzer *et al*, 2001)

Considering the complexity of the SC in Figure 3 above, it is possible that the further away from the end user the entities are in the SC, the more likely it will be that they are uninformed about what conditions are being experienced at the end of the SC, especially if the chain extends across borders.

The flow of information is thus critical to ensure that all entities in the SC are aware of developments and in order for this flow of information to occur efficiently. A collaborative approach and system will be needed for all to truly benefit from the joint planning and process re-design across the trading partner interactions (Harris, 2014).

Some of the issues, which particularly relate to SME SC's include:

- Sensitivity to supply – More sensitive to assurance of supply due to buying power and available resources (Morrissey & Pittaway, 2006)
- Organisational culture – The often informal coordination and adaptions can create relationship problems (Thakkar, 2009).
- Supplier selection – Fewer available resources means that it is not possible to conduct supplier evaluations in order to find a better suited supplier (Power, 2006).
- Nature of workflow – Workflows in SMEs tend to be less organised due to a lack of structure and unclear competencies (Hong & Jeong, 2006).

2.2.1 Supply Chain Management

Interest in SCM is ever increasing as firms within SC are fast realising that they can no longer effectively compete in isolation of their suppliers and other SC entities (Thakkar *et al*, 2009). The definition of SCM is the systematic, strategic coordination of traditional business functions and tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of each individual company (Thakkar, 2008).

Interest has increased to the level where the International Organisation for Standards (ISO) recently made available a new set of standards (ISO 28000-2007), which specifically deal with SCM (Rao & Goldsby, 2009). Aspects of this standard include all activities controlled or influenced by organisations that impact on supply chain security. This includes direct

security aspects, where and when they have an impact on security management, which also includes the transportation of these goods along the supply chain (ISO, 2014).

An inherent part of effective management is to develop more effective information links with trading partners. This leads to internal processes becoming interlinked and spans the traditional boundaries of firms (Thakkar, 2008).

2.2.2 Supply Chain Management in SMEs

In recent times the recognition of the supply chain as a vital focus area, for both public and private sectors, has led to a focus on its effectiveness. In a number of businesses a cost efficient and effective supply chain is a matter of survival (Quayle, 2003).

There is also a trend for larger firms to focus on core competencies, leading to the outsourcing of less vital competencies to smaller contractors, due to the fact that these activities can be completed by smaller firms at a lower cost, but still within the stipulated quality (Thakkar *et al*, 2009).

Currently, and especially in the case of SMEs' suppliers, much of the supply chain flexibility is the result of smart planners, assertive order chasers and powerful customers (Quayle, 2003). While these SMEs have a watchful eye cast over them from their customer firms, who will, by and large, have supplier development programmes and purchasing/supply chain management systems in place, the smaller firms still receive little attention (Quayle, 2003).

Supply Chain Management (SCM) in SMEs, currently, is seen as one of the applications of power from the customer and therefore only seen as a one way process. In the same light, as SMEs do not make use of SCM, transactions with large customers are conducted at an arm's length, from both parties (Quayle, 2003).

Effective SCM can be an important aspect for delivering a competitive advantage to SMEs (Hong & Jeong, 2006). This is due to the fact that these businesses often work with little capital invested and higher worker requirements. In certain instances, a number of links in the SC can fall in different countries. Many SMEs sell their products to firms with an established presence in the market, i.e. with little or no marketing funds, thus making it difficult for SMEs to break into new markets and products. This absence of a known brand also yields less control of the selling price of items and makes it difficult to implement sales terms such as exclusivity (Hong & Jeong, 2006). With the problems listed, growth and remaining competitive may remain elusive to many SMEs, unless they are able to improve on their operations in the areas of managing inventories, reducing lead times, coordinating with key raw material suppliers and workplace practices (Sastry, 1999).

In order to overcome these resource and size constraints, SCM and partnerships in the SC will assist as these will reduce costs, increase innovation and reduce uncertainty and therefore risk (Coviello & McAuley, 1999). While SCM may improve the chance of SMEs'

survival through the methods discussed above, it may be difficult for SMEs to implement and maintain such linkages due to the costs and resources involved. In certain instances, the increase in cost of the SCM system could increase the cost of doing business to the point where the large enterprise SC partner may require some form of compensation from the SMEs or a reduction of price in the products/goods supplied. While total quality management, just-in-time and total productive maintenance are available management tools for SMEs, in reality, very few firms actually put these into practice due to their financial positions, as well as a lack of professional managers to help implement and maintain the system (Thakkar *et al*, 2009). These constraints present survival risks for the SME and SC risks for large enterprises.

2.2.3 Supply Chain Structure

A basic supply chain structure is similar to that described in Figure 1 (Direct Supply Chain on page 1), where the lead company forms a series of relationships that operate on a basic buy and sell principle. This SC is considered unstructured and informal (Linton, 2015).

There are many variations in types of SC structures, but an example that is applicable to the topic of this research report is the instance in which certain components and/or services supplied are more critical or scarce. This allows the SC to be split into a tier type structure. This structure allows suppliers to carry different categorisations depending on the scarcity or complexity of the components supplied. These different categorizations of suppliers will allow the lead company to apply different rules and standards (as well as differing contractual arrangements and relationships) with different suppliers. Suppliers falling into more critical tiers would have a closer relationship, even collaborative in nature, as these would be viewed as strategic relationships (Linton, 2015).

Collaboration, a concept that will be further discussed later on in this research report, is a means to strengthen ties between partners in a SC, but will not necessarily change the structure thereof (Linton, 2015).

2.3 Supply Chain Risk

There exist two schools of thought regarding the definition of risk: one is that risk creates a downside possibility, while the other argues that risk should also include the possibility that performance may be higher than what it is currently. Risk is essentially an indicator of uncontrollability rather than merely a downside possibility (Christopher & Towill, 2002). Therefore, it can be concluded that risk can be defined as the probability of a variance in an expected outcome (Spekman & Davis, 2004).

Supply chain risks can be categorized into three broad risk categories, namely (Handfield & McCormack, 2007):

- Operational – defined as the risk resulting from poor or failed internal processes, people or systems. Examples include quality, delivery, and service problems.

- Network – broadly defined as risk resulting from the structure of the supplier network, such as ownership, individual supplier strategies and supply network agreements.
- External factors – defined as the risk of losses due to an event driven by external forces. Examples include weather, earthquakes, political, regulatory, and market forces.

Uncertainty, and therefore risk, may not be entirely eradicated (as is the case with most of the external factors), but can be mitigated through the deployment of risk reduction action steps (Slack & Lewis, 2001).

2.3.1 Supply Chain Risk Management

In order to manage risk, the extent of the network of which the entity forms part needs to be explored and vulnerabilities identified. One method of identifying risks is categorising them with a view to determining how they affect the SC. Christopher & Peck (2004) categorised risk into three different categories, namely: internal to the firm, external to the firm but internal to the SC, and external to the network.

Internal risk encompasses aspects such as processes and controls, while external risk covers demand and supply characteristics and finally external risk to the network considers the environment at large. Christopher & Peck (2004) state that creating a resilient supply chain echoes widely accepted principles of supply chain management and, therefore, supply chain risk management.

In most cases supply chains extend across many entities, so in order to manage and identify risks, a high level of collaboration between entities will be required. Further to this, agility will also be necessary to stay on top of unpredictable environmental events for which information is the best combat tool. Again, collaboration and visibility are key to remaining agile when these unpredictable events occur (Christopher & Peck, 2004).

Supply Chain Risk Management (SCRM) is the management of the risks, which occur in the supply chain. While the above discussion indicates the importance of SCRM, it is interesting to note that there appears to be no all-encompassing classification of exactly what constitutes supply chain risk. Juttner *et al* (2003) have argued that SCRM consists of four key management aspects:

(1) assessing the risk sources for the supply chain;

(2) defining the adverse consequences for the supply chain;

(3) identifying the risk drivers; and

(4) mitigating risks for the supply chain (Christopher & Towill, 2002).

A fundamental pre-requisite in being able to manage risk and making a supply chain more resilient, is supply chain understanding, which is the appreciation of how the company in question connects with its suppliers and how they, in turn, connect with their suppliers

(second tier suppliers). The same analysis would need to be completed on the demand side (customer). Supply chain mapping tools can be effectively utilized to analyse both sides of the supply chain and assist in determining critical paths and problems (Christopher & Peck, 2004).

The next section will cover the fourth aspect outlined above, namely mitigating risks for the supply chain, as this step is the focus of this research report.

2.3.2 Risk Mitigation in Supply Chains

It is important to note at this point that risk in supply chain is almost inevitable as there are various links in the chain and each SC link will have different objectives to the next (Sinha, Whitman, & Malzalm, 2004). If it is the case that any individual link forms part of two separate supply chains then the requirements of the one SC may conflict with the other, again imposing a risk on the supply system (Sinha, Whitman, & Malzalm, 2004).

In order to mitigate risks, the latter would first need to be analysed. Risk analysis is a practice of methods and tools for identifying risks which may occur within a system (Sinha, Whitman, & Malzalm, 2004). The purpose of the analysis is to develop a structured way of defining, identifying, assessing and, finally, mitigating the risk. (Sinha, Whitman, & Malzalm, 2004).

Sinha *et al* (2004) propose the generic methodological hierarchy in order to mitigate supplier risk in a SC, as seen in Figure 4 below.

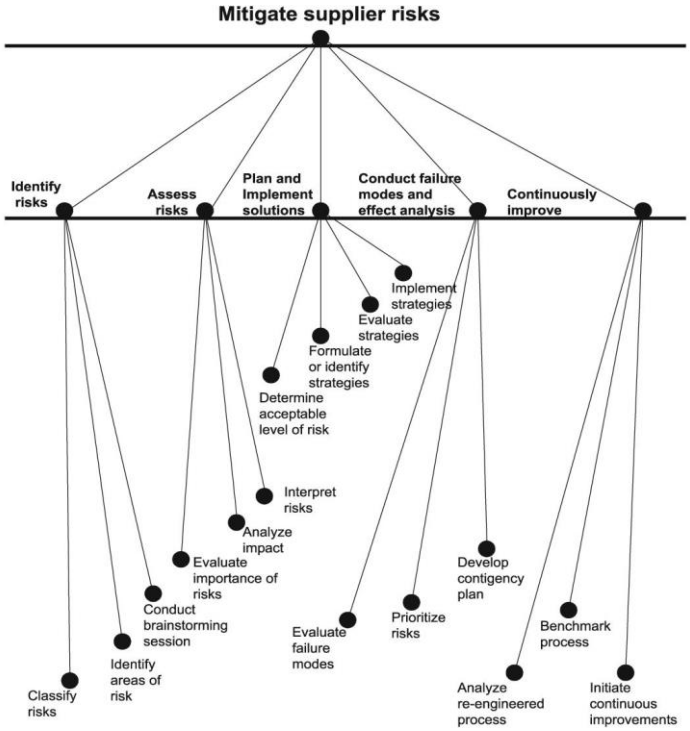

Figure 4: Hierarchy of Supplier Risk Mitigation (Sinha, Whitman, & Malzalm, 2004)

Figure 4 is a suggested framework for supplier risk (SC risk), but the same framework may also be used in evaluating risks internal to the firm. The first step "Identification of Risks" is an assessment of the business model and SC to determine which attributes will affect it. The ideal is to have cross-functional teams that have multi-facetted ability and knowledge of different areas in the SC. At this point there should be a classification of foreseen and perceived risks, where perceived risks are based on intuition and gut feel, foreseen risks are based on statistical data (Sinha, Whitman, & Malzalm, 2004).

"Assess risks" can be completed either analytically or intuitively, with the main purpose being to assess direct and indirect impacts through root cause investigations. From this analysis, risks can then be further categorised into controllable and uncontrollable, the latter being those which fall outside of the company's control. "Plan and Implement Solutions" are possible remedies to identified risks, which are implemented as a prototype in order to assess their value, either in the supply chain or internally. These risk solutions, before being implemented as prototypes, will be assessed through an 'advantages and disadvantages' type analysis, those relating to controllable risks can be implemented, while there is nothing that can be done about the uncontrollable risks (Sinha, Whitman, & Malzalm, 2004).

"Failure Mode and Effect Analysis" is a model that is used to identify, analyse and prioritize potential failures. It requires a cross-functional team and is used to predict and eliminate potential failure in a reliable design (Vanderbrande, 1998). This process is conducted during the prototype phase in order to evaluate possible failure modes, as well as allowing the identification of new risks that can occur in the prototype process. "Continuous Improvement" is imperative in order to stay up to date with any risks that occur after the whole process of risk analysis has been completed. Market fluctuations, customer demands and many other variables will mean that the SC is continuously changing. This will, in turn, introduce new risks. These can only be dealt with when changes occur and this is why it is imperative to look at existing plans to see if they are performing the functions that they were intended to, and, if any new risks have arisen in the interim, that these be dealt with (Sinha, Whitman, & Malzalm, 2004).

Christopher and Lee (2004), on the other hand, have a view that supply chain risk can be improved by merely increasing confidence in the supply chain (Christopher & Lee, 2004). The complexity and uncertainty within a modern day SC can also increase the "chaos" risks within the SC (Christopher & Lee, 2004). These chaos effects result from over-reactions, unnecessary interventions, second guessing, mistrust, and distorted information throughout a supply chain (Childerhouse *et al*, 2003).

The intangible lack of confidence in a supply chain leads to actions and interventions by supply chain managers throughout the supply chain that, collectively, could increase the risk exposure. This is referred to as the risk spiral (Christopher & Lee, 2004). This risk spiral exists everywhere, and the only way to break the spiral is to find ways to increase

confidence in the supply chain. According to Christopher *et al* (2004) the elements of the supply chain that enhance confidence are visibility and control.

The purpose of SC visibility is increasing shared information among SC members with a view to making each individual link significantly stronger. This is because shared information reduces uncertainty and, thus, reduces unnecessary wastage in the system, for example, safety stock (Christopher & Lee, 2004). Visibility in the SC is expanded upon in the next section: Section 4.2.

Control would need to work hand-in-hand with visibility. Most SCs do not have any influence once the order is released. If a supply chain manager were to have visibility of a part of the chain then he/she would not be able to make changes quickly. Control in the SC, however, would assist as different SC elements could influence other players in the SC in order to cater for changing circumstances (Christopher & Lee, 2004).

2.3.3 Supply Chain Risk Mitigation in SMEs

An investigation into risk approaches and risk management approaches in SMEs showed that the dominant areas in which risk was experienced were in activities and decisions relating to cash flow, company size (i.e. growth, expanding into a new market or new business area), and the delegation of responsibilities to staff. The study also showed that the O/Ms adopted various strategies to manage the risk associated with these activities, namely: networking (with a view to elicit advice or information) and managerial competencies (experiential knowledge built up over time). The O/M is the primary decision-maker within the small business, and it is important to understand his/her personal perceptions of risk and how he/she decides to manage these risks (Gilmore *et al*, 2004). This is best illustrated by Figure 5 below.

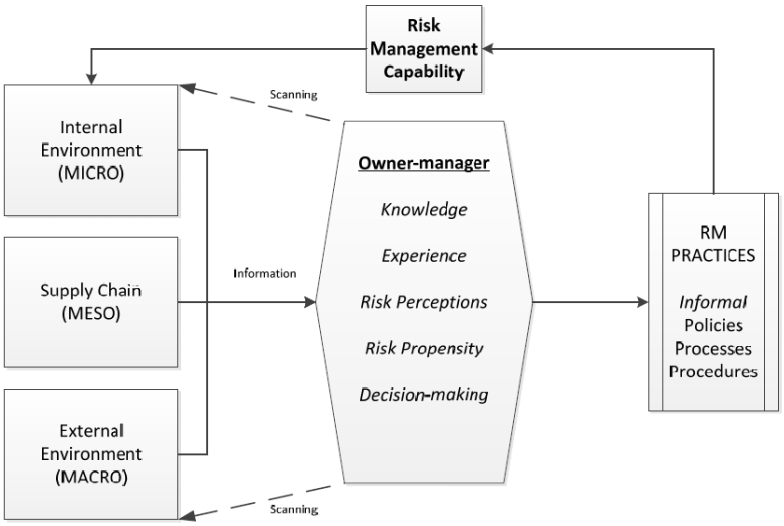

Figure 5: Owner/Manager Risk Management in SMEs (Sunjka & Emwanu, 2015)

It is important to note that SMEs do not, generally, have the required skills or resources to implement SCRM strategies, even though they may be part of complex SCs in which disruptions may be of greater consequence than they are for the larger partners in the same SC (Sunjka & Bindeman, 2011). A study by Henschel (2008) found that German SMEs conducted their risk management very informally/on a basic level with no link between risk management and business planning, which contributes to the perception that SMEs have limited skills and knowledge in the risk management field. However, a differing study proposes that risk management is implicit and is entrenched in the daily management activities that characterise the organisation's operations (Corvellec, 2009). It can thus be said that SMEs, although informally, do demonstrate risk management capability (Sunjka & Emwanu, 2015).

2.3.4 Supply Chain Risk Mitigation Enablers in SMEs

According to Faisal *et al* (2006), there are 11 variables that can impact on the management of risk in the supply chain that are particularly relevant to SMEs. These are as follows:

- Information sharing
  The sharing of business information is a mandatory element of building trust in a SC and enables the binding and tight coordination of the SC from end to end (Henriott, 1999). The continuous sharing of information between more SC partners increases visibility of demand data across the supply chain and reduces risk (Chopra & Sodhi, 2004). This summarizes the purpose of visibility in the SC, where more information allows for better coordination.

- Agility in the SC
  The benefits of agility are many, namely: minimizing inventory risks, increasing responsiveness to variations in market conditions, quicker response to consumer demand fluctuations and this also integrates the SC as a natural course of events. This agility is made possible by receiving the appropriate information timeously and thus links to visibility (Chopra & Sodhi, 2004).

- Trust among SC partners
  When trust is developed through effective communication, it can create additional resources that lead to a competitive advantage (Lengnick-Hall, 1998). Trust contributes to the long term stability of a SC and opens the door for collaboration (Spekman *et al*, 1998).

- Collaborative relationships among SC partners
  In recent times SC partners are moving to adopt closer, collaborative relationships with key suppliers (Giunipero & Eltantawy, 2004). Collaboration is said to reduce risk

in so far as it allows for SC partners to develop flexibility, responsiveness and improve operational manufacturing skills (Hoyt & Huq, 2000).

- Information security
  Information sharing, as discussed above, is the means to improving visibility and in so doing can become an asset to the business. As the level of information sharing increases, it is then also prudent to consider methods by which to reduce and prevent abuse from internal and external sources. This concept dovetails with that of trust between SC partners. (Faisal *et al*, 2006)

- Corporate social responsibility
  This aspect may not be apparent, but can form part of a risk across a SC, especially considering that in recent times there are many instances where SCs cross borders – "borderless organisations" (Speckman & Davis, 2004). SC partners would need to adhere to social responsibility criteria, whether these are policies, actions, ethical or environmental. SC partners need to balance the needs of the stakeholders, communities and the environment, with their need to reflect a profit (Doane, 2005).

- Aligning incentives and revenue sharing policies in the SC
  A concept that may not be widely accepted by individual SC partners is the concept of always acting in the interest of the SC and to maximise SC interest over each individual company's interest. A supply chain works at its best if incentives focus on the spread of risks, costs and rewards across the SC (Narayanan & Raman, 2004).

- Strategic risk planning
  Companies that can identify and develop actions plans for possible risks (both internally and externally) are the most successful (Zolkos, 2003). Formulating effective organisational strategies can assist with the mitigation of SC risks (Finch, 2004).

- Risk sharing in a supply chain
  As mentioned previously, risk and reward should be shared in SCs. Companies should not only focus on their risks and risks which directly affect their operations, but risks in other links along the SC should also be considered (Souter, 2000).

- Knowledge about supply chain risks
  The better a firm understands possible risks, the better the decisions that can be made in order to mitigate these potential risks (Hallikas *et al*, 2004). This type of knowledge and thus, informed decision making, is beneficial for all players in the SC and not just the firm that is making the decision. This again links to visibility through the SC.

- Continual risk analysis and assessment
  By identifying risk, decision makers are conscious of events that may turn into disturbance creators. This does not only pertain to direct risks, but also to political/economic and environmental factors, as well as mergers and acquisitions, to name a few. In order to manage these risks, it is necessary that a company identify risk indicators through which it can monitor and mitigate risk (Zolkos, 2003).

For the purpose of this research, visibility (information sharing) and collaboration (collaboration between SC partners, trust among supply chain partners, aligning incentives and revenue sharing policies in the SC) form the focus. These two concepts are explored in more detail in the next sections.

2.4 Visibility in the Supply Chain

Supply chain visibility (SCV) is a commonly used term in the SCM community (Francis, 2008), but its meaning is still somewhat vague and several definitions have been proposed (Caridi et. al., 2014). The concept of SC visibility is more complex than simple access to certain information flows related to SC processes.

As a matter of clarification, some characteristics that should be contained in the definition on SCV were outlined by Francis (2008) in order to ensure that the information contained in the definition, and thus, the information transferred be useful and relevant. Francis (2008), in his research, determined that the following attributes were relevant to the definition of SCV:

- Software, applications, information technology
- Track and trace
- Monitoring of events
- Estimates of future events
- Plan, deviations from plan
- Information: availability, capture, access or view
- Aids decision making
- Mitigation of risk
- Processes, focuses on processes, improvement of processes
- Status of orders, inventory
- Monitoring, controlling, changing strategy or operations

Taking these characteristics into account, it can be determined from this list that the most important points, in order for the concept of SCV to be beneficial, are linked to the usefulness of the exchanged information, which should be relevant, meaningful and timeous (Kaipia & Hartiala, 2006).

It would also be relevant to discuss the processes by which visibility would have the most substantial effect on each department within the organisation. This is due to the fact that many problems will be department specific and not common to every department. Lancioni *et al* (2000) suggest that visibility can assist with manufacturing, transaction activities, planning, supplying, and evaluation, while others suggest that it may be more relevant when applied to activities that are related to the planning phases of the operation, i.e. forecasting, planning, scheduling, and execution (Kulp *et al*, 2004).

The main objective of the improvement in SC visibility is to increase company performance through the support of the decision making processes (Kulp *et al*, 2004), i.e. being able to make the correct decision with all available information (or as much as possible). In some cases programmes where SC visibility has been implemented, have yielded improvements of which benefits include: cost, quality, service levels, flexibility and time (Caridi et. al., 2014).

One of the most common examples used to explain the effects of poor information flow and visibility in the SC, is the Bull Whip Effect. The Bull Whip is defined as "the phenomenon of variability magnification as one moves from the customer to the producer in the supply chain (Chase, 2006).

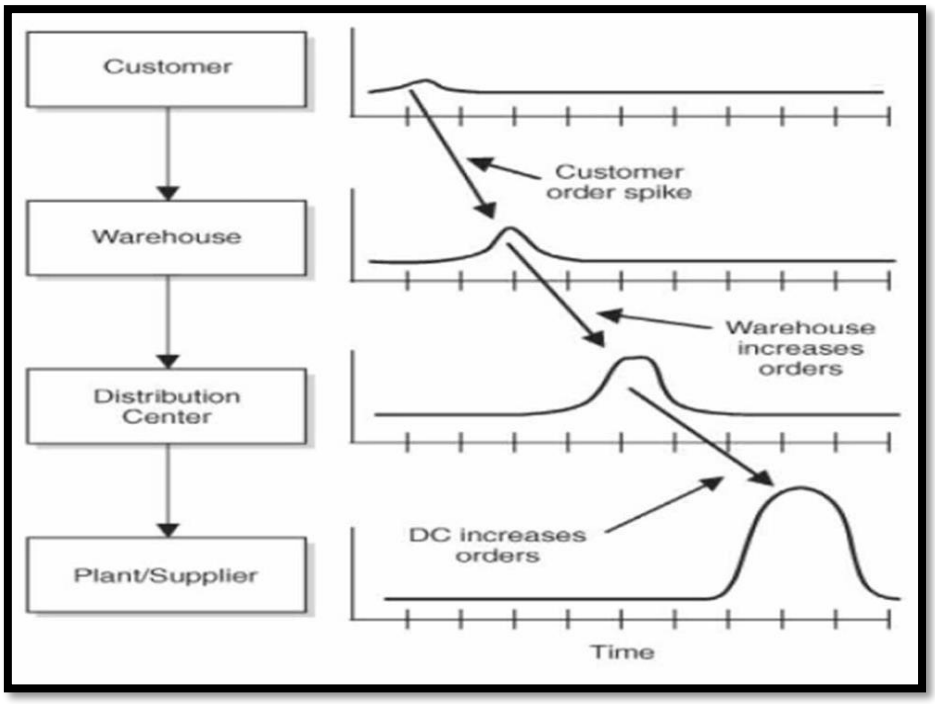

Figure 6: Increasing Variability of Orders up the Supply Chain (yGraph, 2014)

Simply stated, looking at Figure 6 above, it is clear that a spike in sales at the last step of the SC causes an amplification of demand variability up through the supply chain (Lee *et al*, 2004).

Lean production systems are defined as "an integrated set of activities designed to achieve high volume production using minimal inventories of raw materials, work in progress and finished goods" (Chase, 2006, p. 471). Visibility through the SC would help SMEs move toward a lean system of operation.

Holweg (2005) states that the idea of sharing information with suppliers in isolation will not make a responsive supply chain successful. In order to enhance supply chain visibility, supply chain collaboration should precede information sharing practices.

The measure used to determine the level of transparency in the SC, which was derived from the geological metaphor, are outlined as (Lamming *et al*, 2006):

- Opaqueness – For a number of possible reasons, information cannot be shared between the parties, with the constraint being acknowledged by both parties.
- Translucency – Restricted information is shared. This is positive although it is only considered to have limited collaboration.
- Clarity/Transparency – Information is shared candidly, on a selective and justified basis. This leads to a collaborative scenario.

2.5 Collaboration in Supply Chain Management

Collaborative relationships among supply chain partners are the adoption of closer relationships between firms within a supply chain in an effort to manage risk (Giunipero & Eltantawy, 2004).

There are various levels of partnership within a supply chain, starting with open-market negotiations, to cooperation, to coordination and finally to collaboration (Tyndall *et al*, 1998). While in the scenario of a collaborative relationship SC partners are highly dependent on one another, its aim is to develop flexibility, responsiveness, and low-cost/low-volume manufacturing skills and thereby reduce risk from the various SC partners (Hoyt and Huq, 2000).

Flint *et al* (2011) declare that the collaboration with suppliers deepens insights into customer value and allows for co-innovation in terms of components or parts. This can be taken one step further and sets the stage for the development of innovative products (Youn *et al*, 2012).

The benefits could ultimately lead to competitive advantages over other supply chains and suppliers (Poon & Swatman, 1998). When companies often struggle to come to terms with the concept of collaboration, it is due to the fact that this aspect is built on trust, commitment and long term cooperation and, probably the most difficult to come to terms with, is the willingness to share risks (Sahay & Maini, 2002).

While collaboration as a concept to SMEs may be deemed risky due to the level of information sharing, there are many success stories in bigger, multi-national enterprises, for example: Walmart and Proctor & Gamble who now readily use SCC in the areas of planning, forecasting and replenishment, which, in turn helps by reducing risks (Handfield & Nichols, 1999)

Trust is a large stepping stone on the way to achieving a partnering (or collaborative) relationship. The greater the amount of trust, the greater the willingness becomes to allow oneself to become vulnerable to the actions of the other (Slack & Lewis, 2011). If there were no risk involved in the transaction, then there would be no need for trust, but because the normal view is that all parties are in it for themselves, this makes for more difficulty in achieving a collaborative level (Slack & Lewis, 2011).

The change in mind-set takes the accumulation of positive relationship building experiences, which would build the relationship from (Slack & Lewis, 2011):

- A calculative trust relationship - the most basic of trust levels, where it is thought that the benefits of maintaining trust are greater than the disruption of it. This then moves to the second level;
- A cognitive trust - where previous interactions allow for the anticipation of the other partner's behaviour. This leads to no surprises and thus will not threaten the relationship. The level of trust will then move onto the third and final level;
- A bonding trust - which is based on holding common values, moral codes and a sense of obligation to one another. This is the collaborative level of trust where partners identify with each other at an emotional level and thus trust is based on the belief that each party is of the same thinking.

2.6 Risks with Collaboration and Visibility in Supply Chain

While this report has only sought to discuss the benefits of visibility and collaboration, there is also a downside to these concepts. Yuan & Qiong (2008) put forward the possible risks/downsides involved with information sharing across the SC, namely:

- Cost of system – In order to allow the flow of information at a predetermined frequency and have it be to a certain level of accuracy, this will require a dedicated system. This system will require both capital outlay to implement, and possibly interaction from resources which will add an operating cost to the system.
- Asset specificity & partnership termination – If a system were to be implemented the likelihood would be that it would be dedicated to the job of visibility in the supply chain. Should an agreement expire or be terminated, this system may not be usable for any other task and not compatible with any other systems, therefore becoming obsolete.
- Leaks of intellectual property/information – This could be considered the largest perceived risk of the system due to the fact that the other points covered could result in sunken costs or a negative impact, which is specific to the partnership of one supplier.

The leak of intellectual property could be detrimental to the future of the business. This risk can be mitigated, to a certain degree, by making use of both tangible means (contracts and non-disclosure agreements) and intangible means (relationship building and trust – already discussed in the previous section).

- Information advantage – Linking to the previous point, some companies may consider the information at hand to be a reason for them being market leaders and would be loath to share this with other members of the SC as it could make them vulnerable to the information being shared with competitors.
- Loss of bargaining power – Accessible information and transparency minimises the ability for SC partners to negotiate as there is very little that remains unknown to the partner with whom negotiations are being conducted.
- Altered information – SC partners could resort to editing information in order to hide potential or perceived problems, which could result in incorrect action being taken by other SC partners. This could be mitigated through periodic audits of information.
- Information security – In the situation where information is housed and shared on an electronic system, care would need to be taken to prevent viruses, etc. and illegal access, e.g. hackers, sabotage, etc. as these could render the SC partners paralysed if information were lost, or incur losses if the information were altered. This risk can be limited or mitigated by ensuring appropriate levels of security on the system and by ensuring that not only one system is relied upon, for example, a back-up system to corroborate that information received is correct.
- Timeous transmission – Information delays, for any reason, could result in SC partners having to play catch-up in order to fulfil orders if problems are experienced with transmission of data.

These possible risks that have been highlighted above can be mitigated through different means, but these mitigation measures would need to be put into place before embarking upon the agreement, and in certain cases, they would need to be audited periodically. With visibility and collaboration in a supply chain being specific to each set of circumstances, the risks (and the mitigation thereof) would need to be evaluated on a case by case basis to decide if the rewards of implementation outweigh the risks.

In summary, the key concepts that will be explored in this research are best explained by Figure 7, found on page 25. The functions of the supply chain can be split into three main functions, namely: planning, procurement and sourcing, and execution. Within these main functions, individual tasks need to take place in order for the entire supply chain to operate. The functions of supply chain visibility, collaboration and risk management are initiatives (and functions) that run alongside the supply chain function. This visibility into the extended supply chain enables organisations to manage supply chain risk, improve operational efficiency and the ability to overcome challenges in the way of customer supply (Cybage, 2015).

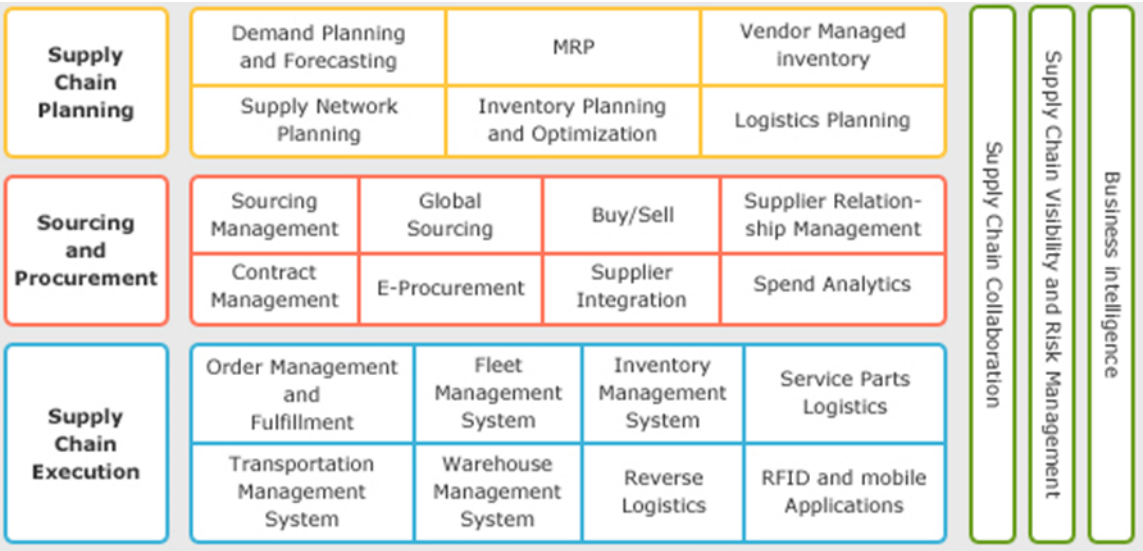

Figure 7: Supply Chain Overview (Cybage, 2015)

2.7 Previous Study Summary

It has been previously mentioned that this research expands on a previous study of risk mitigation in a supply chain through visibility and collaboration for an SME in the manufacturing sector of South Africa.

The findings of the previous report, although based on single case, are that visibility and collaboration, if used in the supply side of a supply chain, allow for mutually beneficial risk mitigation behaviour to take place. There exists an opportunity for managers to mitigate risks while increasing competitiveness, if these strategies are utilised effectively.

2.8 Conceptual Frameworks

It was found, in the previous research report, that there was “a definitive lack of evidence of supply chain risk management in small medium enterprises, particularly in South Africa”. This research made use of two frameworks with which to determine the level of visibility and collaboration, and how these were used to mitigate risk. The same conceptual frameworks will be utilized for this research report, as well as additional conceptual frameworks, which will be outlined below.

The first conceptual framework is that of SC risk mitigation enablers, which has been outlined and explained in Section 2.3.4 of this report. The purpose of this framework will be to evaluate how visibility and collaboration link to the mitigation of risk in the SC, based on the perception of the O/M on the level of visibility.

The second allows the level of transparency to be determined through the amount of information sharing that takes place. In order to conclude this, certain information would

have to be conveyed between supply chain partners (Bartlett *et al*, 2007). Table 2, on page 27, outlines the Transparency Decision Criteria as outlined by Bartlett *et al* (2007), accompanied by the definitions thereof. In order to determine the level of transparency, a determination of how much information is conveyed would objectively verify if the O/M's perception of how visible the firm is reflects the reality of the actual level of visibility.

Table 2: Parameters for measuring Transparency

	Type of information	Description
Transparency of Quality	**1. Scrap Levels**	The quantity or number of rejected goods or raw materials kept on the premises of a shop or business (Collins Dictionary, 2014).
	2. Rework Levels	The amount of error correction (Gryna *et al,* 2007).
	3. Process Repeatability	The extent to which a process does not vary, (Pycraft *et al*, 2010)
	4. Supplier Quality Issues	Issues associated with receipt and replacement of defective product received from suppliers (Gryna *et al*, 2007).
	5. Continuous Improvement	Strategies employed to ensure relatively small, incremental, improvements in operational performance (Pycraft *et al*, 2010).
Transparency of Costs	**6. Cost of Material**	The price paid or required for acquiring input material (Collins Dictionary, 2014).
	7. Overheads	Business expenses, such as rent, that are not directly attributable to any department or product (Collins Dictionary, 2014).
	8. Sub-Contract Costs	Costs associated with "*a subordinate contract under which the supply of materials, services, or labour is let out to someone other than a party to the main contract*" (Collins Dictionary, 2014).

Table 2 continued: Parameters for measuring Transparency		
	9. Factory Cost Rates	Cost of running the factory.
	10. Transportation Costs	Cost of transporting sold goods to customers.
Transparency of Delivery	**11. Order Receipt Process**	The information of the process of placing an order, following up on the order and how the incoming deliveries and dispatches are monitored and checked (Joyce, 2006).
	12. Capacity Planning	Process of determining the production capacity of an organisation to meet demand and product variability (Russel & Taylor, 2003).
	13. Shipment Process	Method of how the sold goods will be transported.
	14. Lean Manufacturing	Short lead times, minimization of waste, the practicality around customer order service and the incorporation of lean manufacturing principles (Gryna *et al*, 2007).
	15. Inventory Management	Management of buffer, cycle and anticipation stock levels (Pycraft *et al*, 2010).

The third conceptual framework is the level of transparency (the categorisation which has been previously described in Section 2.4), which will be characterised into one of the following (Lamming *et al*, 2006):

- Opaqueness (a low score for visibility)
- Translucency (a medium score for visibility)
- Clarity/Transparency (a high score for visibility)

Table 2, on page 27, and the third conceptual framework above have been combined, as a slightly modified framework set out by Lamming *et al* (2006) and Bartlett *et al* (2007) in order to determine the level of visibility inherent in the supply chain.

In this research report and the interview process these definitions will be used as a measure of how transparent and collaborative the relationship is between O/M's company and the customer.

The fourth conceptual framework is that of the company structure outlined in Section 2.1.3. The company structure, which will be evaluated by means of the company organogram, will be assessed in order to determine the ease with which information flows through the company. This flow supports quick decision making, which supports visibility and transparency in the organisation.

Frameworks two through to four were used to formulate the interview questionnaire which the participants answered as part of the interviews. This was used in conjunction with documentation received from the participants, including the organogram that formed part of the fourth framework, in order to determine which of the risk mitigation enablers (the first framework) were present in the SC. This allowed the central research question to be answered by linking collaboration, visibility and risk mitigation enablers.

Chapter 3 - Research Method

This chapter will elaborate on the methods used while the research was conducted, covering the type of data collection methodology and why it was selected as the method, through to data analysis and ethical considerations.

3.1 Development of Research Method

This research expands on previous research conducted by Darren Mansfield, student number 692962, entitled "To what extent does visibility and collaboration in the supply side of a Supply Chain assist in the mitigation of risk for an SME in the manufacturing sector of South Africa?"

The premise of the preceding research report was a case study on a single company. While this research yielded a result of visibility and collaboration successfully mitigating risk, this is a single data point and no patterns or trends can be drawn from it. The findings of the report confirmed that SMEs do employ risk mitigation techniques and, though these are not always identified, they are inherent in how operations are conducted.

This research report seeks to expand on the findings of the previous research in order to test the research question in different SCs. Information will be compiled from 6 SMEs, with the data collection being used to answer the central research question.

The research method adopted for this report will be a case study approach, consistent with the previous research methodology, but it will be a multiple case study approach as opposed to a single case study.

A multiple case study approach enables the researcher to explore differences within and between cases. The goal is to replicate findings across cases. Due to the fact that comparisons will be drawn, it is imperative that the cases are chosen carefully so that the researcher can predict similar results across cases, or predict contrasting results based on a theory (Yin, 2009).

3.2 Research Method

The research method used for this report included:

- Semi-structured interviews – as a primary source of data collection,
- Direct observations – of both the interviewee, the facility and personnel,
- The collection of documentation – the company organogram, and
- Visual sensemaking – the mapping of the SC with the Owner/Manager (O/M).

This research was conducted under the University Ethics Clearance obtained by B.P. Sunjka as part of her PhD research project. Ethical clearance was obtained under clearance number H14/04/29.

3.3 Qualitative Research Methods

When conducting qualitative research there are various methods available, namely: ethnography, phenomenology, field research and grounded theory (Trochim, 2015). Ethnography is extensively used in the field of anthropology, while phenomenology is more suited to the philosophical research field. Grounded theory was developed specifically to deal with research relating to theorising based on phenomena of interest. The approach that best suits the research method for this report is that of field research. This entails the researcher going into the field to observe and collecting field data through notes that are based on observations and interviews (structured and unstructured).

A qualitative research method was chosen for this research as it will provide insight into the intricacy of the unique situation in which each of the participants find themselves. Additionally, it will allow this exploration to develop theories and generate hypotheses, finally moving toward explanations of findings (Sofaer, 1999).

Outlined above in Section 3.2 are the methods for data collection.

The interviews were exploratory and thus the decision to select the format of a semi-structured interview was utilised. According to Richards & Morse (2013) when enough is known about a certain subject to formulate questions about a topic in advance of the actual interview, semi-structured interviewing is appropriate.

3.4 Case Study Methodology

One of the motivations behind the case study design is to assist in the identification of an extreme or unique case. Case studies can follow one of two types, i.e. a single case study or multiple case studies. In the instance of a single case study only one subject is analysed while in multiple, or comparative case studies, more than one subject is compared, which Yin (2009) describes as multiple experiments that follow “replication logic”.

Yin (2009) distinguishes between the two types of replication logic: literal replication and theoretical replication. This research report will follow the literal replication approach, which is designed for each of the cases to corroborate one another. This is in contrast with the theoretical replication, which makes use of cases that are designed to cover different theoretical conditions. Yin (2009) states that the same methods must be applied in each case so that the findings can be compared.

The conceptual framework, covered in Section 2.8, then becomes the vehicle for generalizing in future cases (Yin, 2009). This is particularly applicable to this research report as this is an extension of previous research conducted, with part of the conceptual framework also being derived from the previous research.

In the case of this research report, the case study design will take the form of single case studies so as to analyse each company individually (intra-case analysis) with respect to the

conceptual frameworks. Thereafter, the cases will be compared as multiple case studies (cross-case analysis).

The choice of a case study for the basis of this research can be explained by the following aspects that are typical results yielded by a case study. A case study can (Merriam, 1998):

- Examine a specific circumstance, but illuminate a general problem;
- Illustrate the complexities of the circumstances in which the participants find themselves in; and
- Explain reasons for the situation in which participants find themselves – the background, what happened and why.

These aspects will allow a cross case analysis to be conducted with a view to determining any patterns, trends or anomalies among the various participating companies. These results can then be used, as previously stated, as a vehicle for generalizing in future cases (Yin, 2009).

The first stage in the case study methodology recommended the development of the case study protocol (Yin, 2009). Case study protocol will be discussed in the following section.

The case study design must have five components (Yin, 2009):

- The central research question: do visibility and collaboration play a role in how SMEs manage and mitigate risk within their supply chains?
- Its propositions: visibility and collaboration are SC risk mitigation enablers for SMEs
- Its unit of analysis: the SME
- A determination of how the data are linked to the propositions: an example can be seen in Table 3, below, which makes use of the previously outlined conceptual framework.

Table 3: Linking Propositions: Risk Mitigation Enablers and Conceptual Framework

Proposition	**Operational Measure**	**Type of information**	**Data Source**
Applicable risk mitigation enablers:	Transparency of Quality	1. Scrap Levels	Interviews, observations
		2. Rework Levels	Interviews, observations
		3. Process Repeatability	Interviews
		4. Supplier Quality Issues	Interviews

Table 3 Cont.: Linking Propositions: Risk Mitigation Enablers and Conceptual Framework			
1. Visibility, 2. Information sharing, 3. Trust among SC partners, 4. Strategic risk planning, 5. Knowledge about supply chain risks		5. Continuous Improvement	Interviews
	Transparency of Costs	6. Cost of Material	Interviews
		7. Overheads	Interviews
		8. Sub-Contract Costs	Interviews
		9. Factory Cost Rates	Interviews
		10. Transportation Costs	Interviews
	Transparency of Delivery	11. Order Receipt Process	Interviews
		12. Capacity Planning	Interviews
		13. Shipment Process	Interviews
		14. Lean Manufacturing	Interviews, observations
		15. Inventory Management	Interviews, observations

- criteria to interpret the findings: the measures of how visible and collaborative the participants were was determined by scoring each based on the answers provided during the course of the interview and categorising them based on their total scores in the different sections of the interview. More detail of the scoring system is given in Section 4.9 of the report.

3.5 Company Selection

This project will focus on manufacturing SMEs with the following characteristics and these will form the rationale for selecting the cases:

- Independently owned, operated and financed, where one or very few people manage (five or less) the business without a formalised management structure, and does not form part of a large enterprise.
- Have a relatively small share of the marketplace or relatively little impact on the sector/industry in which it operates.
- Have been in operation for more than 10 years (have survived well past infancy).

- Are part of the Steel and Engineering Manufacturing sector (one of the largest manufacturing sectors in South Africa).
- Are small or medium in size according to the Small Business Act of South Africa.

Company selection was based on the willingness of companies to participate in the interviews. This research forms part of a greater research PhD thesis.

The leads for interviews were obtained through the PhD research and involved the contacting of the Steel and Engineering Industries Federation of Southern Africa (SEIFSA). This association distributed an email survey to its members. One question asked was whether the company would be interested in conducting a follow up interview. Companies that responded positively to this question were then interviewed and the latter were the basis for the interview process, data collection and research.

3.6 Case Study Protocol

A case study protocol outlines the entire set of procedures involved in data collection for a case study. This information includes (Yin, 2009):

- An overview of the case study. This will include objectives and presentations about the topic under study, including a full description of the case.
- Field procedures. This includes procedures for contacting informants, enforcing rules and ethics.
- A list of the case study detailed questions that are to be asked during the interview.
- A preliminary outline for the final case study report, including an analysis of findings based on the purpose, rationale and research questions.

Case study protocol is not only limited to the data collection in the form of questions, but also covers the behaviours and interactions of those being studied, if applicable. Developing a protocol will serve as a framework of operation and also include all the necessary elements in the proper conduct of research. Case study protocol allows for the establishment of rigour and repeatability in the case study data collection process (Yin, 2009).

The case study protocol used for the purposes of this research report is as follows:

- The case study objectives and description of the case are included in Chapter One of this report.
- The field procedures are outlined in Section 3.1 (Development of Research Method), Section 3.5 (Company Selection) and Section 3.10 (Ethical Considerations).

- The list of case study questions can be found in Appendix A, along with the transcripts of the interviews, which are contained on the accompanying Electronic Appendix.
- The analysis of findings can be found in Chapter 5 where a within case analysis, as well as a cross case analysis has been conducted.

3.7 Validity, Reliability and Repeatability

Qualitative research, by nature, is more susceptible to bias as it cannot be statistically analysed or empirically calculated. This allows room for the researcher's subjectivity to influence the interpretation of data. Thus, it is important to tackle issues of validity and reliability in order to ensure that data trustworthiness is not affected (Brink, 1993).

Yin (1994) describes trustworthiness as a criterion to test the quality of research design. Validity is concerned with the accuracy and truthfulness of findings (Le Comple and Goetz 1982: 32) Reliability, on the other hand, is the consistency, stability and repeatability of the informant's accounts, as well as the investigators' ability to collect and record information accurately (Selltiz *et al* 1976:182).

Error is inherent in all investigations. The greater the degree of error, the less accurate and truthful the results are. The major sources of error can be categorised as follows (Brink, 1993):

(1) the researcher

(2) the subjects participating in the project

(3) the situation or social context

(4) the methods of data collection and analysis.

A method used, among others, to ensure the research yields trustworthy findings will be triangulation. Triangulation is the use of two or more data sources, investigators and theoretical perspectives to analyse data. The main goal of using triangulation is to eliminate any sort of bias, which may arise in data collection, analysis and interpretation (Brink, 1993).

In particular validity was confirmed, within this research, by multiple sources of evidence (triangulation). Further data sources came in the form of the interview, a tour around the company's facility (observations) and documentation (where interviewees made these available).

When considering repeatability while conducting qualitative research, this refers to the reliability of the researcher's approach and ensures that it is consistent for different researchers, under different research settings (Li, 2014). As reliability entails a high level of repeatability, the procedures of the research and case study should be recorded in as much

detail as possible (Yin, 2009). The basic premise is to avoid inconsistency in the definitions/terms of the same research (Li, 2014).

The topic of repeatability for this research has been addressed in Section 3.6. Using this protocol as the guideline, future researchers will be able to utilize the same tools developed in this research, i.e. interview questions, scoring systems, data collection techniques, etc. as a method to draw conclusions from future research, ensuring that these future findings will be comparable to the findings of this research report.

3.8 Data Collection

This section will outline the various methods used in order to collect data from the participating companies.

The main method of data collection for this research was through interview questions. From the conceptual frameworks listed previously, questions were determined which, in turn, resulted in the generation of an interview questionnaire with the purpose of collecting the relevant information in order to draw conclusions on visibility and collaboration.

As stated previously, this report builds on previously conducted research. The same interview questions used for this research formed part of the previous research and thus are deemed to be tested.

3.8.1 Semi-Structured Interviews

The method by which data was collected was an in depth semi-structured interview with the O/M in order to determine the current level of visibility and collaboration adopted by the business in the supply chain.

A semi-structured format was used due to the nature of the research, as it was of an exploratory nature. This format makes use of a pre-determined set of open ended questions, which will prompt discussion. The need for discussion is owing to the fact that the SC for each business may vary significantly. Therefore, a structured interview (limiting respondents to answering the set of pre-determined questions only) may not be of significant value as it may not yield the information necessary to fully understand the SC layout of the SME in question.

Referring to Figure 8, on page 37, in order to formulate interview questions, the starting point would be defining the research purpose. From the research purpose, the central research question can be derived. This question has been previously outlined. The next step is the breaking down of the central research question into a series of smaller theory questions.

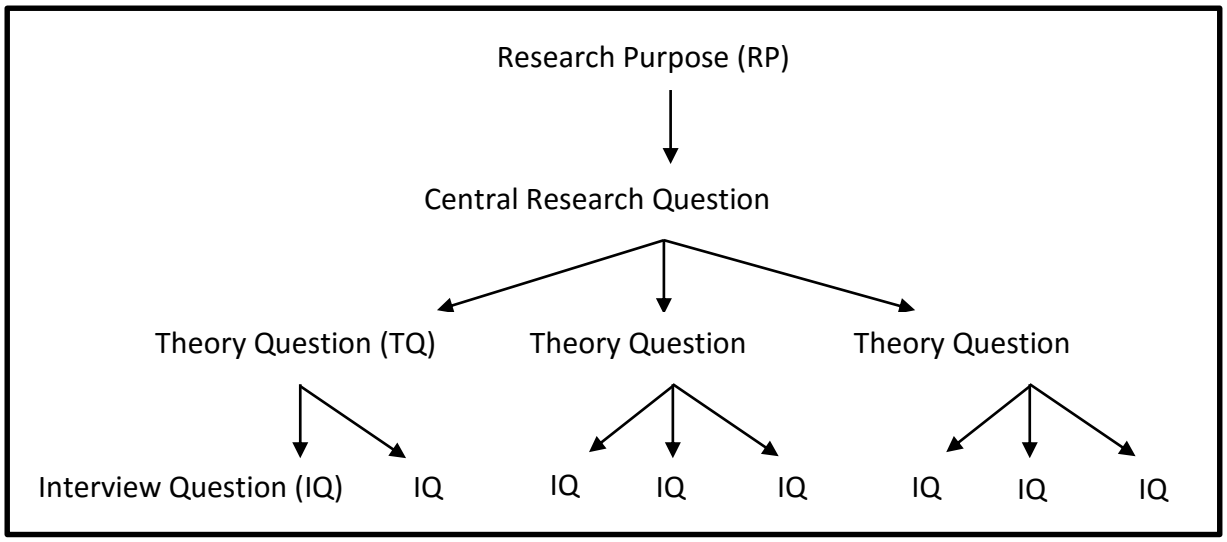

Figure 8: Interview Questions Development Pyramid Model (Wengraf, 2001a)

These theory questions were the basis for the different sections into which the interview was split. For this research report the interview sections were broken down into the following sections:

Section A: Demographic and Operational Data

Section B: Customer Background, Relationships and Level of Transparency

Section C: Level of Collaboration with Customer Base

Section D: Level of Visibility with Customer Base

Section E: Level of Visibility with Customer Base: Transparency Decision Criteria

These sections were then broken down further into suitable sets of interview questions that were designed to gather the relevant information from which to draw findings. A copy of the complete interview questions can be found in Appendix A.

A note on problems encountered, generally, in transcribing from interviews conducted: transcribing, in itself, introduces its own problems as it is incorrect to assume that the spoken word closely parallels the written one. In conversations and interviews subjects do not speak in paragraphs or signal punctuation, which leads to interpretation of where, for example, full stops and semi colons should go. This could change the intended meaning of the written interview and hence, the data. Similarly, visual cues are also lost when listening to a tape. These visual elements do assist in interpreting another's meaning; the transcriber no longer has access to those important paralinguistic clues about meaning (Tilley, 2003).

The implication is that the researcher needs to discuss the problematic nature of transcribing in the proposal and provide strategies for handling the judgments and interpretations inherent in such work.

3.8.2 Direct Observations

As part of the data collection methodology a tour of the company facility was also sought, with a view to corroborating information that was collected during the semi-structured interviews, as well as a means of probing further into the operations and layout in order to seek more clarity on the use of visibility and collaboration. Overt observations (the relevant personnel know that the observation is underway) are merely a method of validating data gathered during the interviews and a means of prompting questions that are particular to the facility.

Direct observations also provide the opportunity to document activities, behaviour and possibly physical attributes regardless of the interviewee's inclination or ability to respond to questions (Taylor-Powell & Steele, 1996).

In addition, according to Goodson (2002) there are eleven ways that one (just by walking through a production facility and picking up certain visual cues) can gauge much about how the facility is run and the level of visibility through the facility and its processes. Of the eleven cues, those which demonstrate visibility are as follows:

- Customer Satisfaction – the shop floor employees are aware of who their customers are. Paper work and production boards throughout the facility allow visibility for any person in the facility and indicate what jobs are at what stage of the production process.
- Safety, Environment, Cleanliness and Order – linked to the above point, visible labelling systems and clearly marked processes, inventory and tools allow for a good understanding of the flow of the plant, what jobs are currently in the process, and at what stage they are.

These two aspects are important as they assist with internal visibility of the production facility which, in turn, allows for the O/M of the business to keep a finger on the pulse of the business as well as on any internal challenges.

Observations of the production and business processes by means of a walk through the facility are also to be conducted. This will allow an understanding of the effects of visibility and collaboration on the processes and the planning thereof, as well as a means of data verification, previously discussed in Section 3.7 Validity, Reliability and Repeatability.

3.8.3 Documentation

Supply chain process mapping was also conducted in order to determine where the business falls in the supply chain. This map is further discussed in Section 3.8.5 Visual Sense Making, below. This SC map forms part of the documentation collected from each interview.

As part of the documentation requested the company organogram was also obtained from the interviewee. Organograms allow the type of company structure to be determined, which in turn allows a conclusion to be drawn regarding the level of internal visibility the

O/M has within the organisation. Added to this, the organogram will also shed some light on whether the O/M is up to date with what is happening in daily operations. The flatter the structure and the fewer the layers of management, the better the understanding of daily occurrences within the business.

3.8.4 Websites

In Section 3.7 of this report the reliability of data was covered. Company websites were used as a validation of the background company information questions that were asked during the interview. In some instances it also assisted with the validation of the organogram, as the management team was displayed on the website.

3.8.5 Visual Sensemaking

Another technique made use of in the interview was that of mapping the supply chain overview for each of the participants, with the O/M. These maps will be illustrated in Chapter 4. This process of visual sensemaking is displayed below in Figure 9.

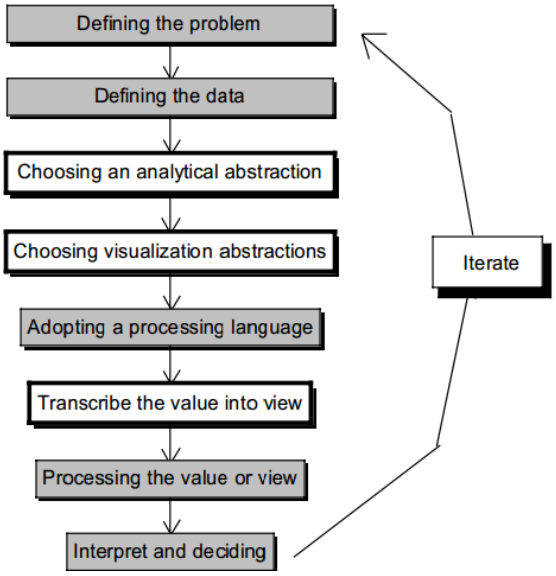

Figure 9: Visual Sensemaking Process (Govind & Sunjka, 2014)

The "Problem" in this instance was the mapping of the SC, which was drawn up in its current state with the O/M's input. This allowed the O/M to visually construct the SC map, which often prompted additional input into the map.

The above cycle was conducted by presenting a blank sheet of paper, putting the O/M's company in the middle, and giving the O/M an overall idea of what was required. Starting with the upstream supply side of SC, the O/M mapped as far down the SC as he/she was able to. Thereafter, the same was conducted for the downstream demand side. In both of these processes, any outsourced activities were noted in a separate section on the page and included in the overall SC map.

The purpose of the SC maps for this research was to visually determine where each of the participating companies fall within their SC, illustrating how well the O/Ms know their own business, as well as the SC in which they operate. These two factors indicate the level to which they understand SC effects on their business, as well as enabling the determination of the effects of visibility and collaboration on the business.

Table 4, below, indicates the summary of what information was collected, the means by which it was collected and the reason for the information being required.

Table 4: Summary of Data Collected and Means of Collection

Information	**Means of Collection**	**Reason information was requested**
Company History	Interview questions and websites	Establishing size of business, years of experience, market in which it operates and competiveness.
Organogram	Interview (requested supporting documentation)	Establishing company structure and the level of internal visibility.
Supply Chain Overview	Interview (Visual sensemaking), and Facility walk through	Establishing where the participants fall in their SC and to establish their level of visibility in SC.
Customer Background, Relationships, Level of Transparency	Interview	Establishing the extent of the relationship with the three biggest customers and transparency of this relationship.
Level of Collaboration with Customer Base	Interview	Establishing the level of collaboration with the customer base.
Level of Visibility with Customer Base	Interview	Establishing the level of visibility with the customer base.
Visibility – Transparency Decision Criteria	Interview	

Table 4 highlights the information collected, which is important because this information will, subsequently in this report, facilitate the drawing of conclusions.

3.9 Data and Content Analysis

Data analysis is synonymous with quantitative research, as the origin of quantitative research was the physical sciences, particularly physics and chemistry, where the researcher would use mathematical and statistical models to analyse findings that were typically numerical in nature (Creswell, 2002).

The analysis of qualitative research data involves attempting to understand the overall big picture by using the data to describe an aspect and what this means, or "a detailed and systematic examination of the contents of a particular body of materials for the purpose of identifying patterns, themes, or biases" (Leedy & Ormord, 2001, p155). Responses from semi-structured qualitative interviews can be compiled in order for these to be analysed somewhat differently from quantitative research, as the former cannot be analysed through numerical manipulation. The method used to analyse the data would be based on a content analysis (University of Surrey, 2014).

Before discussing content analysis it would be prudent to touch on issues relating to the quality of the data associated with conducting interviews, excluding those problems related to transcription and losses in visual cues (especially when interview data is the only means of data collection). Interviews, at first glance, seem so much like natural conversations that researchers could sometimes use them thoughtlessly. The purpose of the study is to uncover and describe the participants' perspectives on events—that is, that the subjective view is what matters. Studies making more objectivist assumptions would triangulate interview data with data gathered through other methods (Wengraf, 2001b).

Content analysis is characterised as a method of categorisation of data, verbal and behavioural, for the purposes of classification, summarisation and tabulation. This analysis can be done on two levels (University of Surrey, 2014):

- Basic level – a descriptive account of data, with no attempt to understand or comment on why or how.
- Higher level – with a view to interpret and analyse responses received in interviews.

This research will predominantly make use of the latter level of content analysis described above. The information gathered during interviews will be tabulated and scored for each participant (the scoring system is described in Section 4) and will be used to evaluate the current levels of visibility and collaboration within the SC of the participants, as well as their perception of the usefulness of these concepts in practice.

3.10 Ethical Considerations

In preparing for interviews, the University of Witwatersrand Guidelines for Human Research Ethics Clearance Application (non-medical) were considered when drawing up and scheduling interviews. This included:

- The relevant permission was gained prior to the time, in order to conduct interviews with owners and employees.
- Where interviews were conducted, a participant information sheet was made available.
- Relevant steps were taken to protect the information about the individuals and all sensitive company information that was collected during interviews.

This research was conducted under the University Ethics Clearance obtained by B.P. Sunjka as part of her PhD research project. Ethical clearance was obtained under clearance number H14/04/29.

Chapter 4 – Data and Analysis

The following section will outline the findings of the interviews and the analysis thereof. A copy of the interview questionnaire can be found in Appendix A. Copies of the transcripts for each interview can be found in Appendix B - an electronic appendix, which accompanies this report.

4.1 Company Demographic and Operational Information (Section A of the questionnaire)

As stated previously in Section 3.5 of this report, the company selection was based on the willingness of companies to participate a follow up interview, once they had completed the survey. Company names have been changed, as discussed in Section 3.10 Ethical Consideration.

The following table summarises the background information of the six participating companies. The information was derived through the interview process.

Table 5: Background Information Summary

Question	**Steel Company (STC)**	**Electro Plating Company (EPC)**	**Aluminium Casting Company (ACC)**	**Iron Casting Company (ICC)**	**Appliance Manufacturing Company (AMC)**	**Engineering Company (ENC)**
Age of Business	48 Years	37 Years	40 Years	64 Years	50 Years	48 Years
Size (Small or Medium)	Small (Based on Number of Employees)	Medium (Based on Number of Employees)	Medium (Based on Number of Employees)	Medium (Based on Revenue[1])	Medium (Based on Number of Employees)	Small (Based on Number of Employees)
Number of Employees	40	150	137	76	150	35

[1] Although all other participants have been assessed based on number of employees, ICC was ranked according to revenue as a categorisation by number of employees would not fairly represent the size of business nor the operation.

Table 5 continued: Background Information Summary						
Industry	Manufacturing – Sheet Metal Fabrication	Manufacturing – Metal Finishing	Manufacturing – Foundry	Manufacturing – Foundry	Manufacturing – Appliances	Manufacturing – Machining
Years trading in current product range	48 Years	37 Years	20 Years	27 Years	10 Years	35 Years
Structure (Determined through the organograms obtained during interviews)	Functional	Functional	Functional	Functional	Functional	Functional
Is company still looking to grow?	Yes	Yes	Yes	Yes	Yes	Yes
Levels of Market Competition (High, Low, Other)	High	High	High	Medium – many foundries but customers own patented patterns	High	High
What are competitors competing on? Price, quality, service, etc.	Price	Price	Price	Quality	Price	Price and Quality
Largest perceived risks?	Strike action, finances, material supply and competition	Electricity and Labour	Strike action, Finances	Expertise and disciplined labour force (prevent rework)	Labour	Labour force stability

4.2 Case Study Background Information

This section describes each of the six case studies in terms of the company history, supply chain and company structure. The SC and company structure are briefly analysed with respect to their impact on collaboration, visibility and transparency.

4.3 Steel Company

4.3.1 Company History

Steel Company (STC) is a well-established medium-sized firm, started in 1966, which competes in three different sectors, namely: sheet metal, construction and sundry manufacturing. In the sheet metal segment the company focuses on the supply of fire equipment for both industrial and residential applications. Steel Company management is also looking to expand this business into other segments as a means of ensuring that their machines are running at full capacity, at all times, in order to maximise revenue.

The second leg of business falls into the construction industry, where work is completed for large construction firms and contractors. All components manufactured in this part of the business are installed into newly constructed buildings.

The last leg is the sundry steel manufacture, which is a combination of both construction work and sheet metal work. This segment contains more job shopping work (low volumes and high variability from one job to the next), with the majority of work inquiries taking place for once-off fabrications.

4.3.2 Supply Chain Overview

Figure 10, page 46, outlines the supply chain of STC, illustrating the 1st Tier on the supply side (upstream) and the 1st and 2nd tier on the demand side (downstream). The four main supply inputs include steel, powder, paint and power/electricity. All of these items are sourced from private companies, excluding power as this can only be sourced from South Africa's monopoly power producer, Eskom. The STC SC map indicates a lack of visibility on the upstream side (supply side) as there was no information available past the 1st tier.

All operations are completed in-house, excluding laser cutting and galvanising, which are outsourced to companies that specialise in these functions. As a means of expanding the sheet metal business, STC has embarked on a collaborative relationship with their preferred laser cutter with a view to minimizing the cost of cutting for certain components. This will ensure a competitive advantage on a particular manufactured item, which would then lead to a new, continuous, revenue stream for STC and all the other links in the chain.

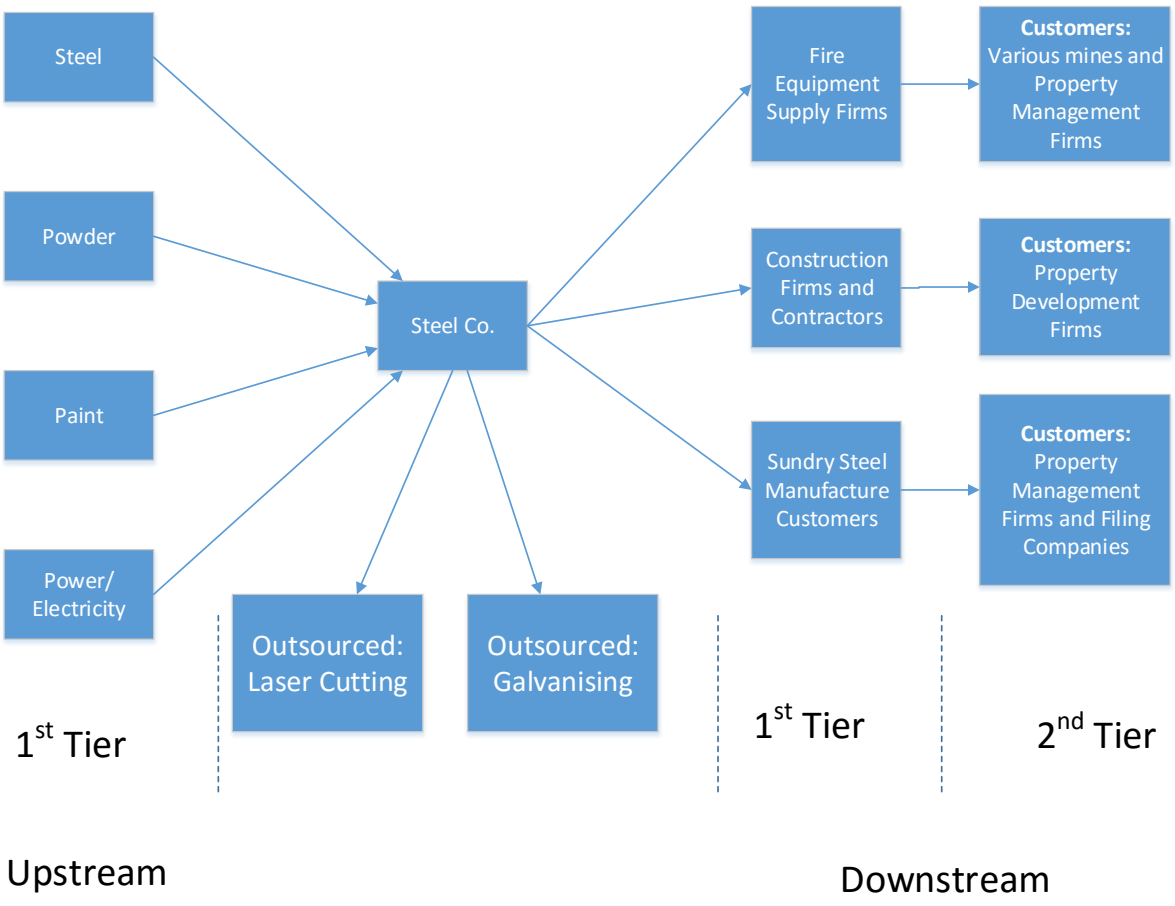

Figure 10: Supply Chain – Steel Company (Developed by Author)

The above scenario is an example of the attitude that the management at STC holds towards the value of visibility and collaboration in mitigating risks and gaining a competitive advantage through SC improvement initiatives. When answering questions relating to the level of transparency, the responses point overwhelmingly to the importance and value of information sharing between partners in the SC.

4.3.3 Company Organogram

Figure 11, page 47, illustrates the organogram of STC. STC is run by means of a functional company structure, which is characterised by each department having a head/manager and subordinates below this. The factory section is the only department that has an additional level of supervision for each function. The chain of command is short and all departments report directly into the managing director, giving the leader of the organisation visibility of operations and a view of the challenges faced on a daily basis.

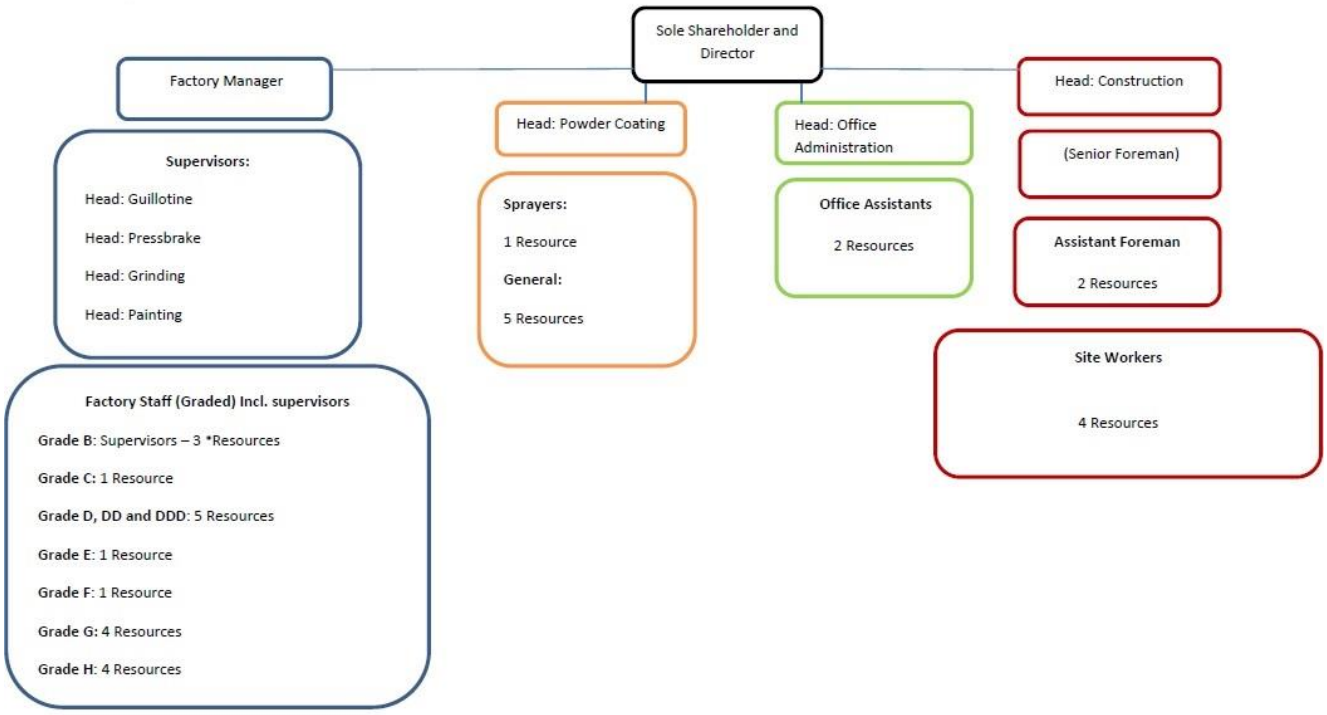

Figure 11: Company Organogram – Steel Company (Supplied by Company)

4.4 Electro Plating Company

4.4.1 Company History

Electro Plating Company (EPC) is a reputable medium-sized electro plating company that was established in 1978 and has a stable customer base. While EPC is still looking to grow, it is not looking to widen the product range, but rather only to focus on its current offering – electro plating.

The process of electroplating is the last step in the manufacturing process for the majority of its customers and thus there is much repeat business, as demand for EPC's customers' products increases. EPC is viewed as an outsourced function to their customer base due to the highly technical nature of the process. Aside from the high number of repeat customers that EPC has, other smaller elements termed "specials", which are walk-in business and vintage car & bike restoration that normally entail once off items, as opposed to a continuous revenue stream.

4.4.2 Supply Chain Overview

As can be seen in Figure 12, page 48, in the majority of cases on the demand side, EPC is dealing directly with the final customer. While it is possible to draw up a trend from the repeat customer side, it will be almost impossible to do any planning on the restoration and walk-in business side as this business comes in on an ad-hoc basis.

On the supply side, gas, water, power and chemicals are sourced from primary suppliers, while metals are sourced from agents who represent primary suppliers. This does not represent a lack of visibility on the supply side, as the majority of suppliers (80%) are primary and thus manufacturers. This scenario is in contrast to what was seen in the case of STC.

The only outsourced function is that of machining. Water and power both come from South African parastatals, while all other inputs are purchased from private companies.

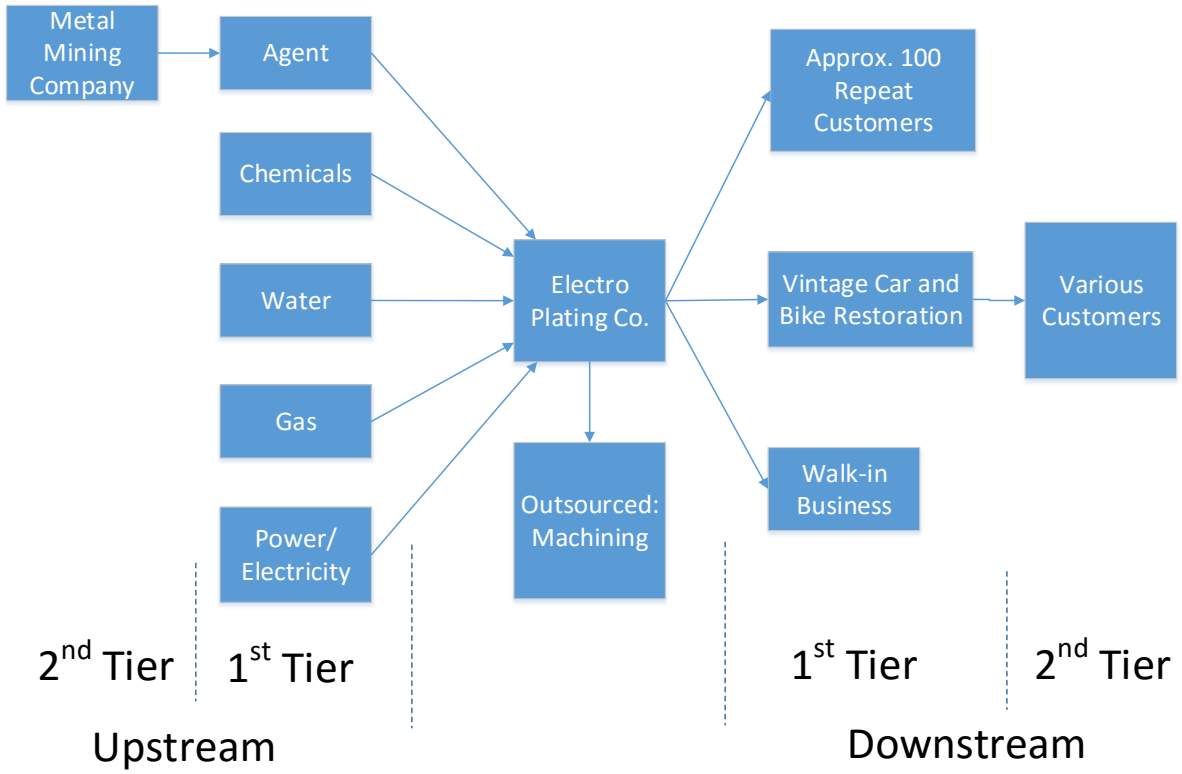

Figure 12: Supply Chain – Electro Plating Company (Developed by Author)

4.4.3 Company Organogram

EPC's company organogram is seen on page 49, in Figure 13. Although the organogram is not of the greatest clarity in terms of reporting lines, it is noted that the company structure is also classified as a functional structure, as is the case with STC, i.e. each department has its own manager and these managers in turn report to the managing director. Between the managing director and the floor staff there exists only one level of management, which means the O/M will have his ear on the ground regarding the operations of the business. This was also evident from the detail with which the interview questions were answered.

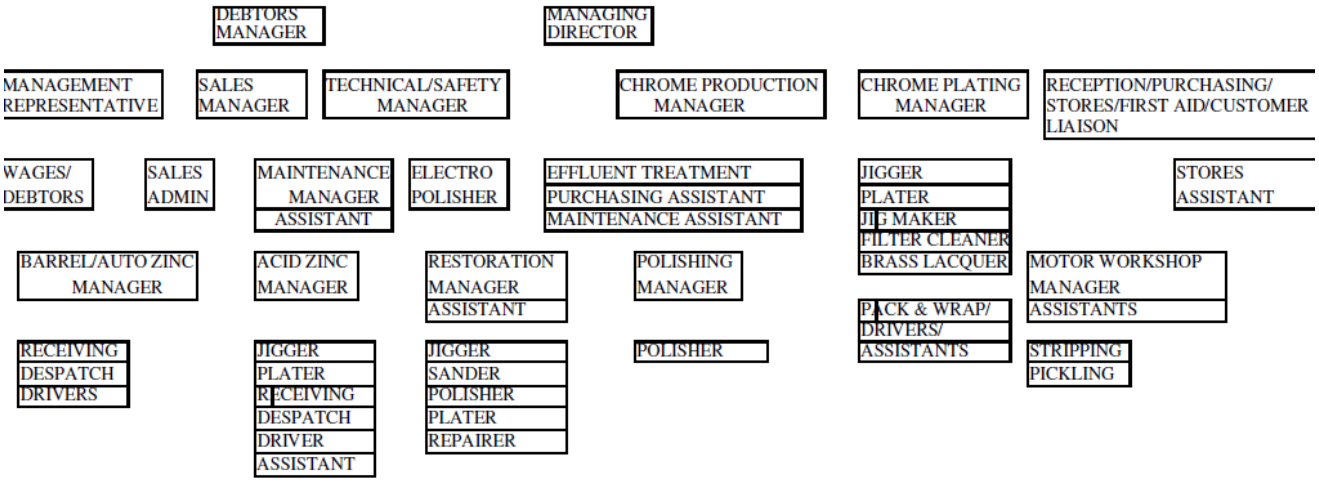

Figure 13: Company Organogram – Electro Plating Company (Supplied by Company)

4.5 Aluminium Casting Company

4.5.1 Company History

Aluminium Casting Company (ACC) is a medium-sized, recognised aluminium casting company that was established in 1975, forms part of an automotive industry supply chain, for which it is a 2nd tier supplier. While the automotive component manufacturing arm makes up the majority of revenue generated for ACC, the company has diversified in that it also has customers in lighting and electrical component manufacture, as well as in the mining industry.

4.5.2 Supply Chain Overview

Figure 14, found on page 50, illustrates that ACC completes all functions in house and only outsources two functions, namely: powder coating, done locally, and the outsourcing of tooling design and manufacture, which is done internationally.

On the supply side, power and gas come from primary suppliers, while the metal (sourced from scrap dealers) and die coat come from secondary suppliers. Unlike STC, ACC has an awareness of the supply side to the 2nd tier, excluding cases that involve primary suppliers.

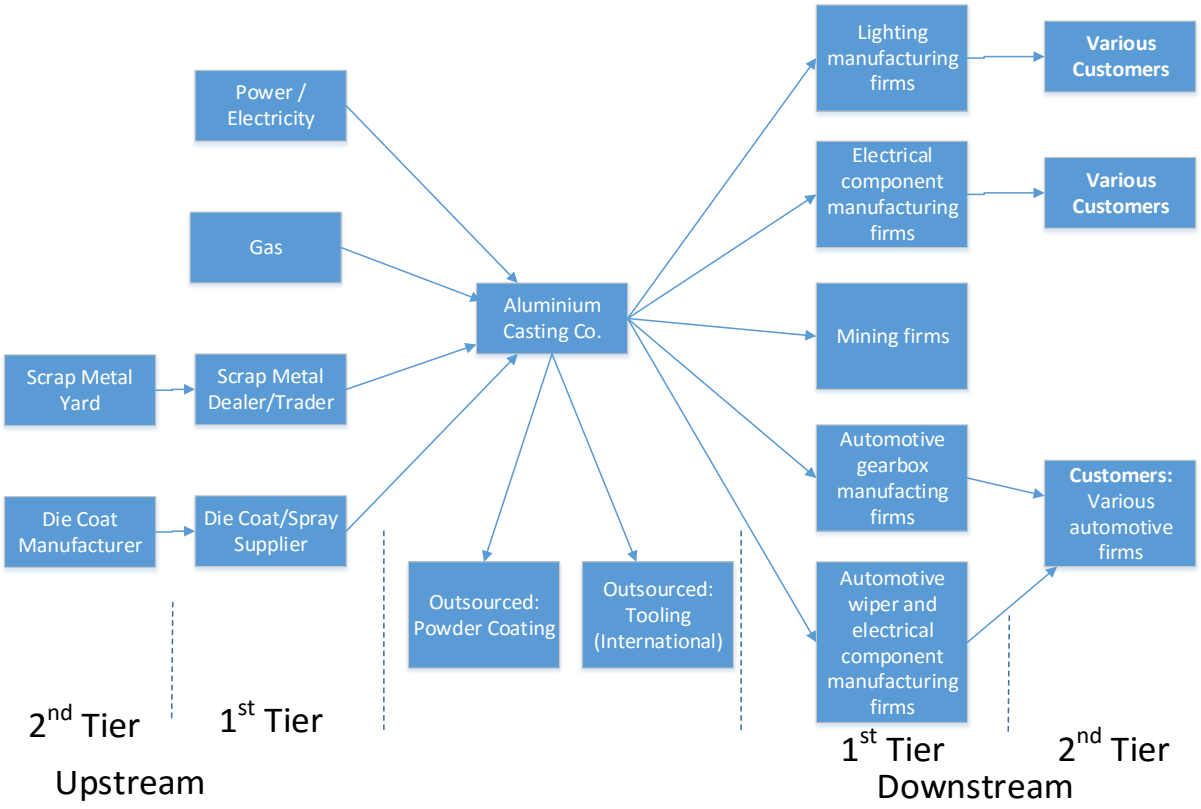

Figure 14: Supply Chain – Aluminium Casting Company (Developed by Author)

4.5.3 Company Organogram

Below, in Figure 15, the company organogram of ACC is displayed. This organogram has many similarities to those of the previous two companies in terms of flatness of the hierarchy and the company being of a functional structure. There are two directors, only one of whom actively manages ACC. The managing director has nine direct reports or heads of department. Production is the only department with a second level of management, in the form of supervisors in the departments of casting, gravity and finishing.

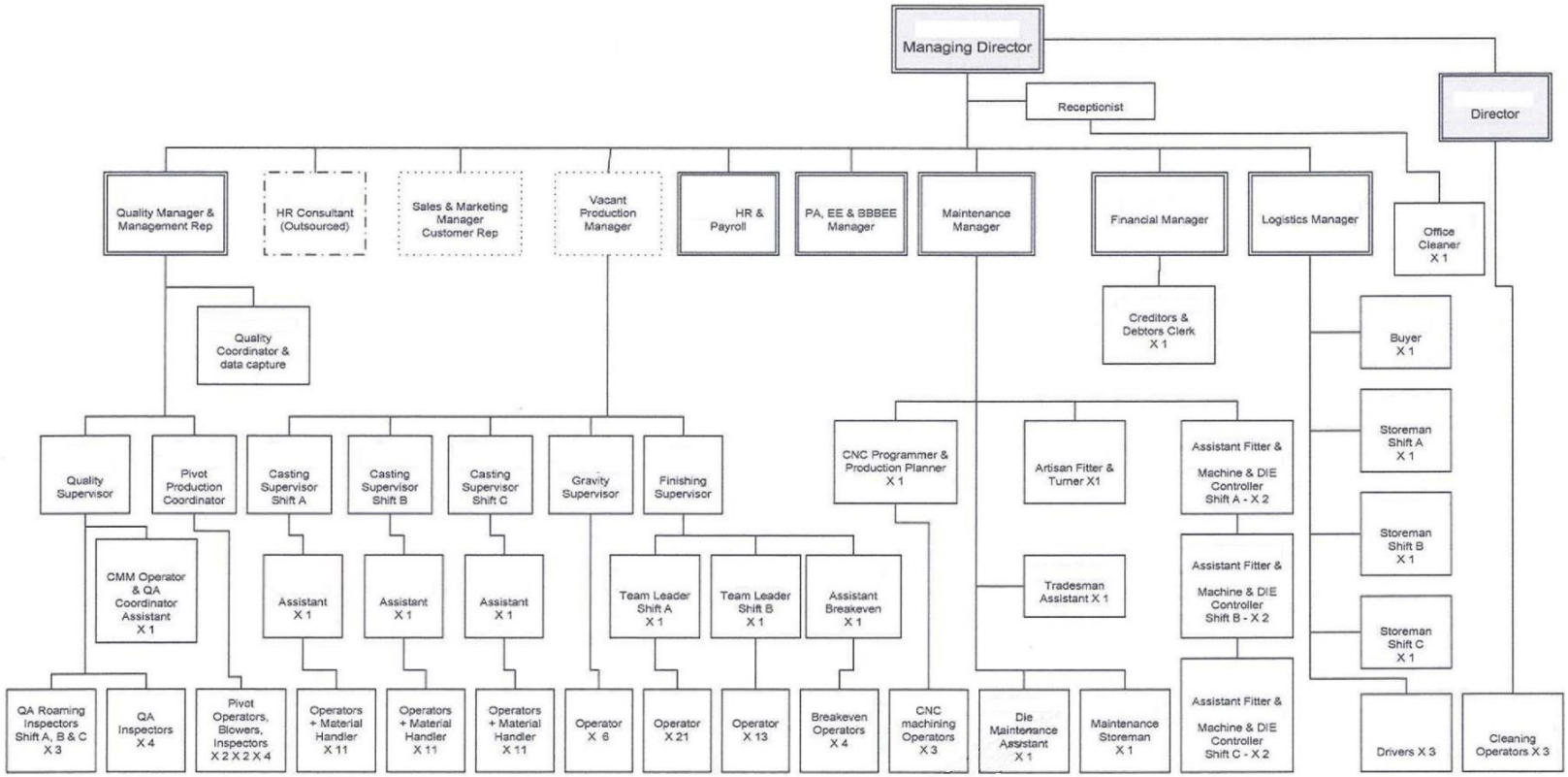

Figure 15: Company Organogram – Aluminium Casting Company (Supplied by Company)

4.6 Iron Casting Company

4.6.1 Company History

Iron Casting Company (ICC) is a medium-sized business that was established in 1951 and has a wide ranging customer base to which they provide iron and steel castings. ICC is a second tier supplier in most supply chains, except for the walk-in business that it receives, which makes up an extremely small percentage of revenue. The remainder (and majority of business) is split between large, well established manufacturing firms.

4.6.2 Supply Chain Overview

When considering Figure 16 below, it is apparent that ICC has many inputs. Power, water and sand are supplied via primary producers, while the rest of the inputs are through secondary suppliers of the products they sell. It is clear that the O/M of ICC has visibility both up and down the supply chain, which reaches to the 2nd tier in both cases.

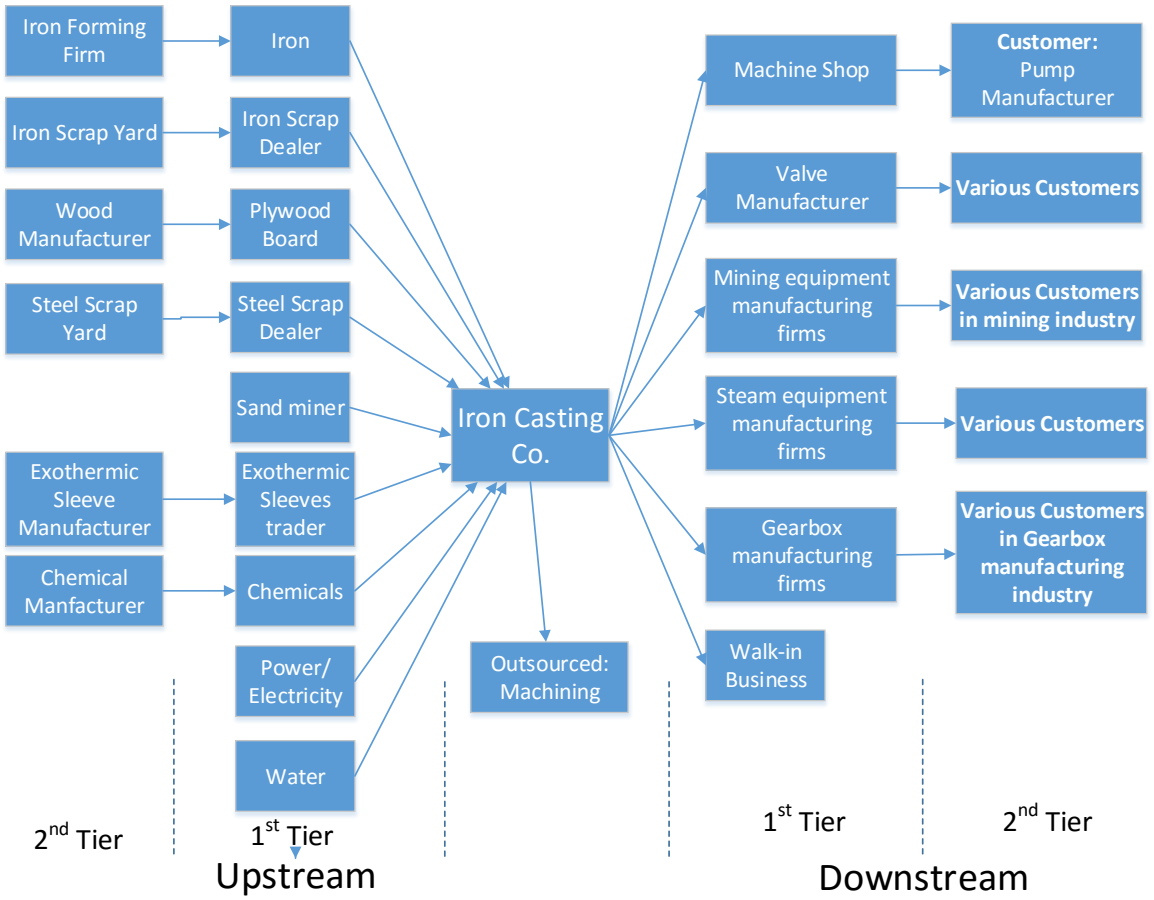

Figure 16: Supply Chain – Iron Casting Company (Developed by Author)

An important aspect of ICC, being a foundry, is that it does not have an in-house machine shop that is, as stated by the owner, a stumbling block. It is common practice and a better business model to have an in-house machine shop, as it improves lead times to customers, and also at a better price due to the elimination of the mark-up that an external machine shop would add to the service rendered.

4.6.3 Company Organogram

Below, in Figure 17, the company organogram for ICC is illustrated. Once again, the company structure is functional, with all departments housing only one level of management, asides from the quality department, which has a second level of management. Another characteristic of the structure that is similar to those of the other companies is the closeness of the O/M to the operational staff. During the interview the O/M stated that he spends most days inside the foundry, thus giving him a very clear understanding of daily operations and challenges faced by different facets of the business. This was corroborated by the depth of the answers given in the interview.

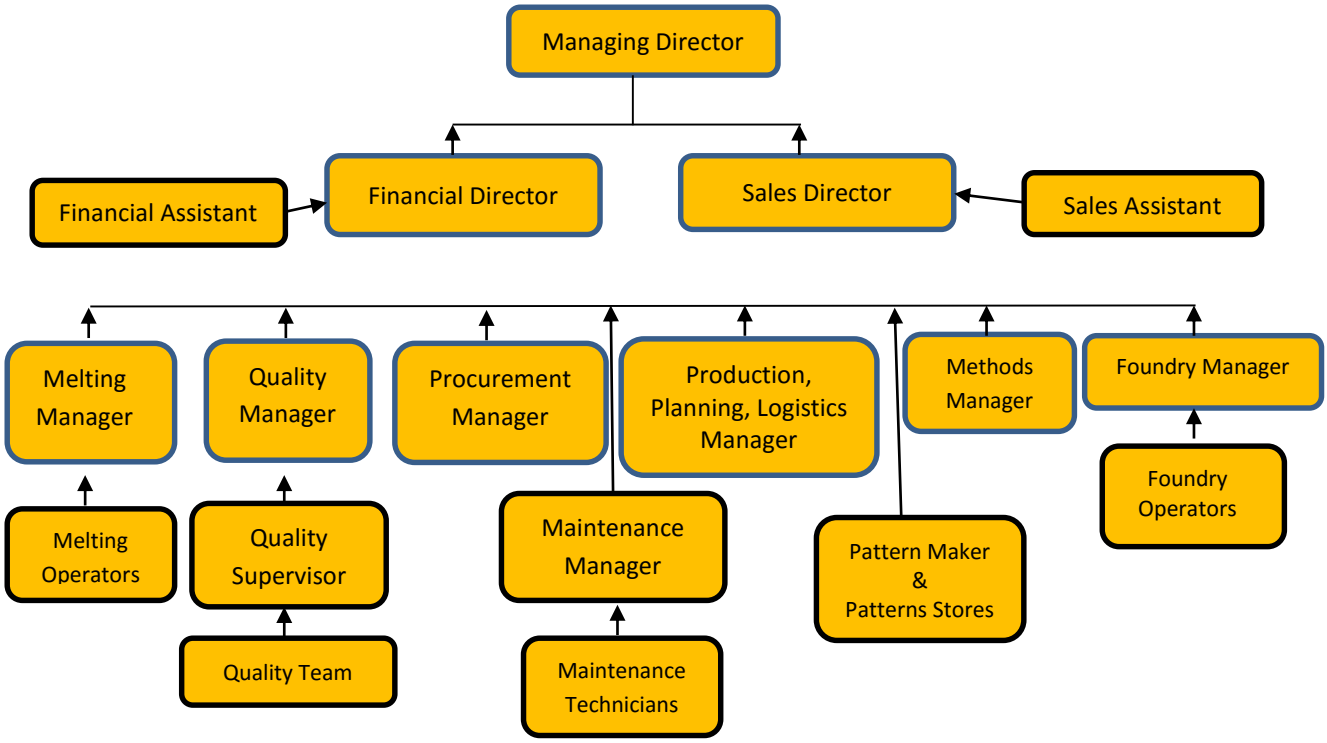

Figure 17: Company Organogram – Iron Casting Company (Supplied by Company)

4.7 Appliance Manufacturing Company

4.7.1 Company History

Appliance Manufacturing Company (AMC) is a medium-sized business that was established in 1965 and has a well-established customer base in the butchery, laboratory, welding and catering equipment industries. AMC is a second tier supplier in most instances of the supply chain in which it falls, working through agents, dealers and distributors as the route to market. The company is based in South Africa, but has a wholly owned subsidiary in Asia to source commodity items that go into certain products that are manufactured in South

Africa. The majority of revenue is generated through the sale of catering equipment, followed by butchery equipment, laboratory equipment and, finally, welding supplies.

4.7.2 Supply Chain Overview

AMC buys all input material from manufacturers, except for Stainless Steel (which is bought through merchants) and electrical components. Electrical components, as stated above, are bought through the wholly owned subsidiary, whose sole function is to source commodity items and components for AMC. All manufacturing, assembly and quality control is done in house, aside from certain sheet metal fabrication processes, which are outsourced. Figure 18, below, outlines the supply chain of AMC. It can be seen that none of the end users, on the demand side, are directly supplied by AMC, i.e. the distribution is done through agents, distributors and dealers.

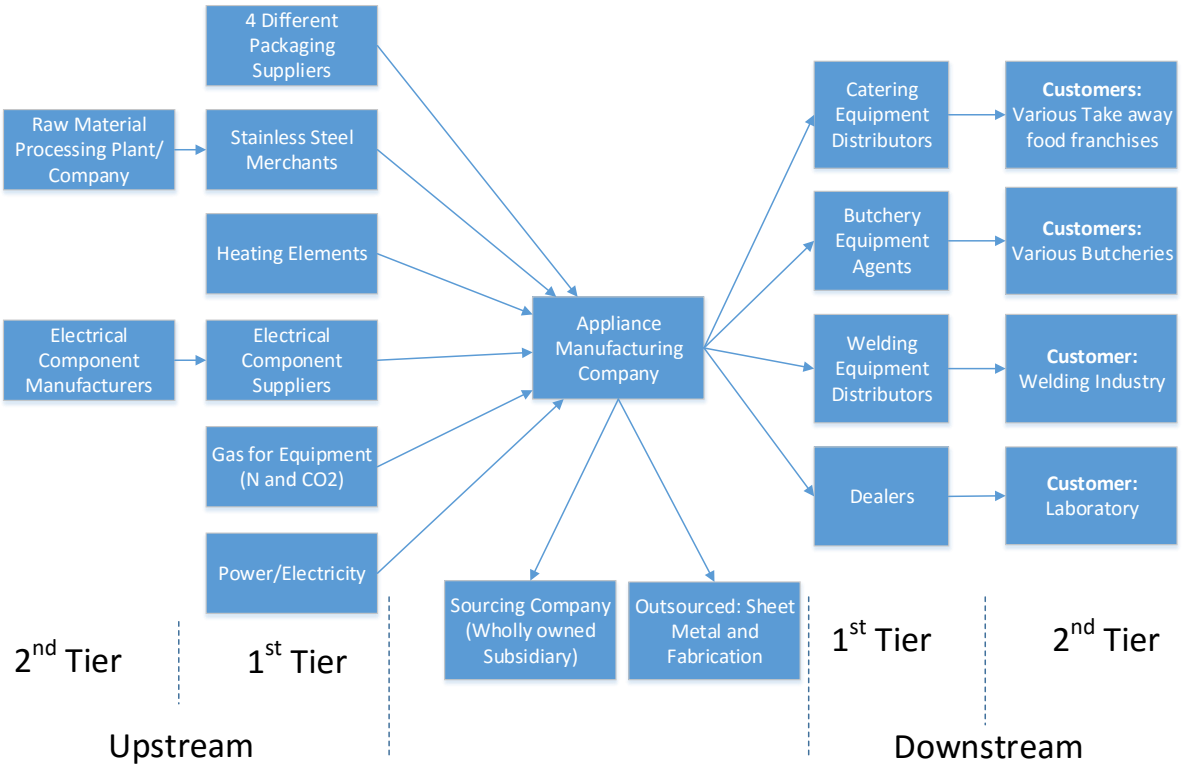

Figure 18: Supply Chain – Appliance Manufacturing Company (Developed by Author)

4.7.3 Company Organogram

In Figure 19, page 55, AMC's company organogram is displayed. Once again it is evident that the company structure is relatively flat and of a functional nature - with four heads of departments reporting to the Managing Director and only the production director having a

second level of management in the procurement and planning, fabrication and assembly departments.

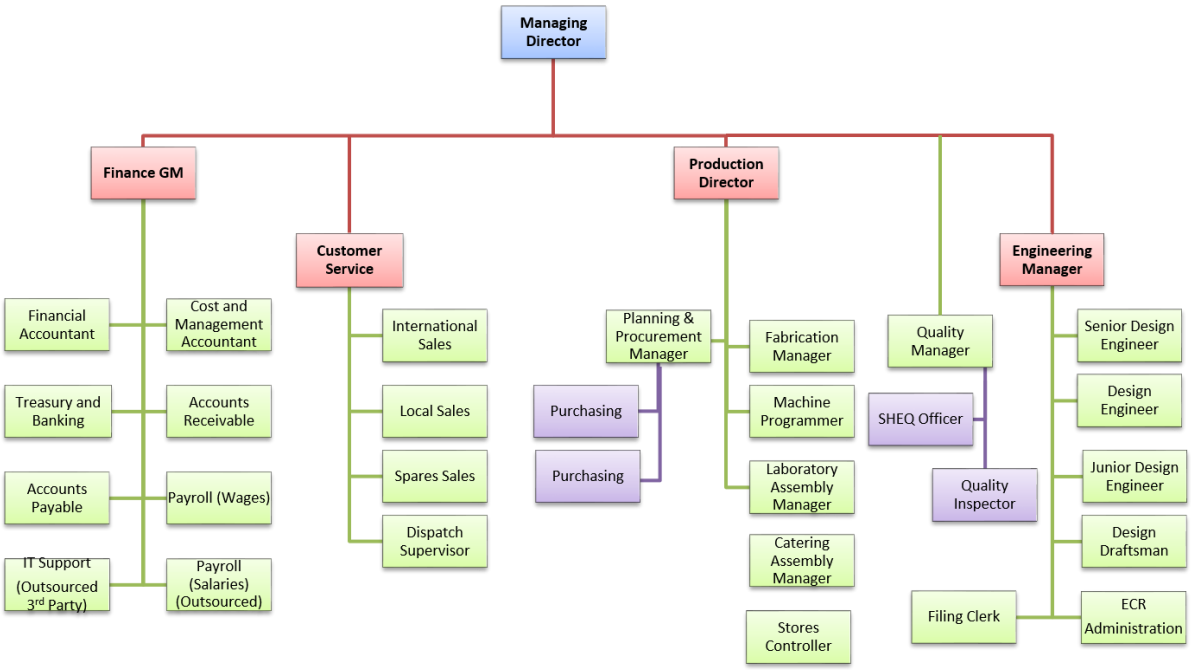

Figure 19: Company Organogram – Appliance Manufacturing Company (Supplied by Company)

4.8 Engineering Company

4.8.1 Company History

Engineering Company (ENC) produces vertical spindle pumps that are supplied to the mining industry for dewatering applications. This 48 year old, medium-sized company produces and machines all components necessary to manufacture these pumps in house. With a large variety of machines and excess machine capacity, ENC also undertakes contract machining for a variety of companies. In most cases ENC falls into the supply chain as a second tier supplier, although as a pump manufacturer they are classified as an Original Equipment Manufacturer (OEM).

4.8.2 Supply Chain Overview

In Figure 20, on page 56, ENC supply chain is illustrated. There are fewer different types of inputs into the business on the supply side (when compared to other companies in this research report), only one of which is a primary producer (power). This could indicate a limitation of the visibility of the upstream side as no information was given about the second tier.

Only the functions of welding, surface treatment and heat treatment are outsourced, with all other functions being completed in house.

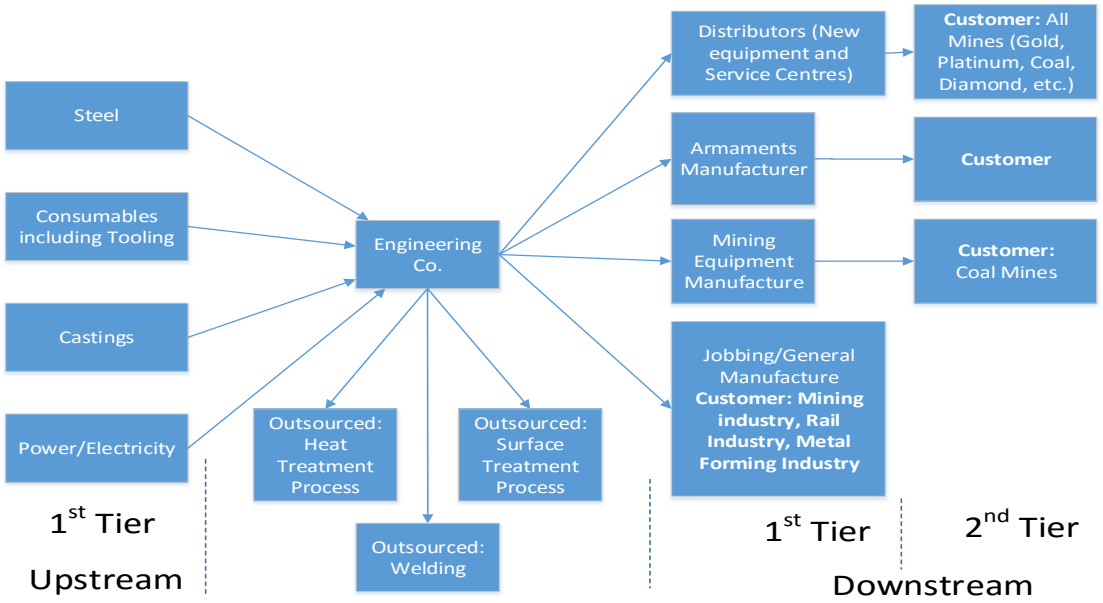

Figure 20: Supply Chain – Engineering Company (Developed by Author)

4.8.3 Company Organogram

The company structure of the ENC can be seen below in Figure 21. The structure is also a functional one, with a functional head for each department. The chain of command is short, with ENC limiting managers to one layer between the managing director and shop floor personnel. This, again, will give the managing director clear visibility of what is happening in all operations.

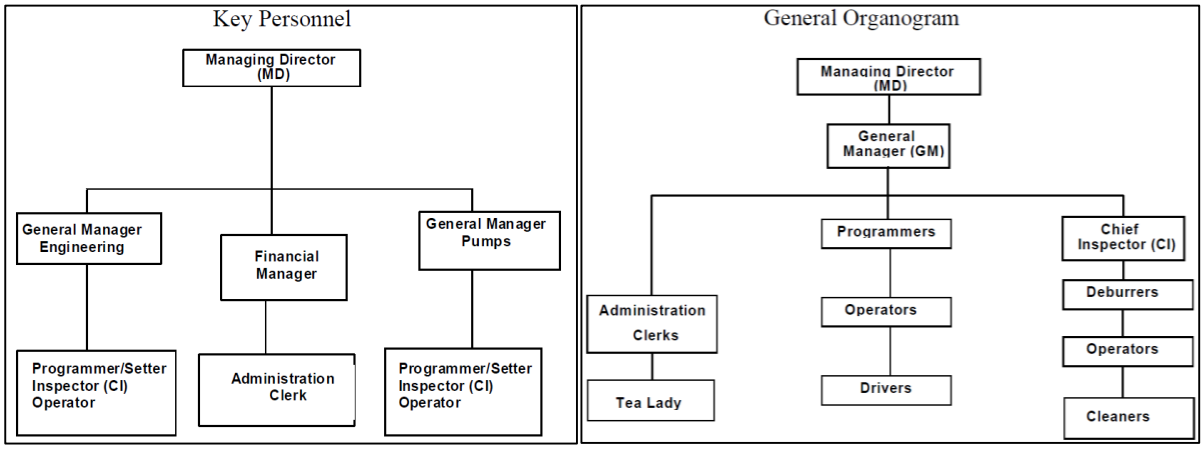

Figure 21: Company Organogram – Engineering Company (Supplied by Company)

4.9 Interview Data Analysis

The following section outlines the company information, the current state of visibility and collaboration in the SC, as well as the owner's view on how it could potentially make a positive difference in the manner in which the SC operates.

The method of evaluating and ranking the participants included tabulating the information gathered during the interview. Based on the answers given, a score was allocated. Table 6, below, indicates a tabulated version of the results. A score of one was allocated for a response that indicates the existence of visibility and collaboration, while an answer that indicates to the contrary received a zero score. The total is then calculated, based on the addition of the scores per question. These totals are then used to calculate a percentage score, upon which the participant is ranked. Questions with no adjacent score were not relevant to the determination of the existence of collaboration and visibility, but the information was necessary to draw other conclusions.

The ranking system was divided into three categories, namely: low, medium and high. These were split numerically into below 33%, 34% to 66% and above 67%, respectively. This information was then converted into a graphical format using these numerical ratings, as is illustrated in Figure 22, on page 60.

Table 6: Customer Background, Relationships, Level of Transparency

Question	STC		EPC		ACC		ICC		AMC		ENC	
1. How long have you been working with your three biggest customers?	20 Years	1	> 20 years	1	12 Years	1	27 Years	1	> 10 years	1	> 30 years	1
2. Do you have a good working relationship with these three customers?	Yes, although strained of late	1	Yes	1	No	0	Yes	1	Yes	1	Yes	1
3. Do they convey to you who their customers are for specific jobs?	Occasionally	0	No	0	Yes	1	No	0	No	0	No	0

Table 6 continued: Customer Background, Relationships, Level of Transparency

4. Do the three biggest customers receive beneficial pricing and credit terms? Is pricing based on a history and credit application?	Yes	1	Yes	1	Yes – based on contractual volumes	1	Yes	1	Yes	1	Yes	1
5. Are you aware of other products and services that are offered by your customers to their customer?	Yes	1	Not explicitly. Through conversation	0	To an extent	0	No	0	Yes	1	Yes	1
6. Further to the above, would this information be of use to you, i.e. knowing what other types of work your customers do?	Yes		No		No		No		Yes		No	
7. If large contracts to reputable companies were available, would a company such as your self be open to creating a fully transparent working relationship in order to better satisfy the needs of your customer's customer?	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1

Table 6 continued: Customer Background, Relationships, Level of Transparency

8. Further to the above, if there were no large contracts involved, would it be beneficial to have a more transparent level of communication as the normal course of business?	Yes	1	No	0	Yes	1	Yes	1	Yes	1	Yes	1
9. If one of your customers had a crisis of some sort would you try and help the company in any way possible, be it payment terms, discount, etc.	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
10. Further to the above, if it was proven that such an act would help sustain a supply chain and actually benefit your position in the market generally would you change your mind?	No	0	Yes	1	Yes	1	Yes	1	No, get involved to find out what is going wrong & fix it	0	Yes	1
Total	8/9		6/9		7/9		7/9		8/9		8/9	
Percentage	89%		67%		78%		78%		89%		89%	

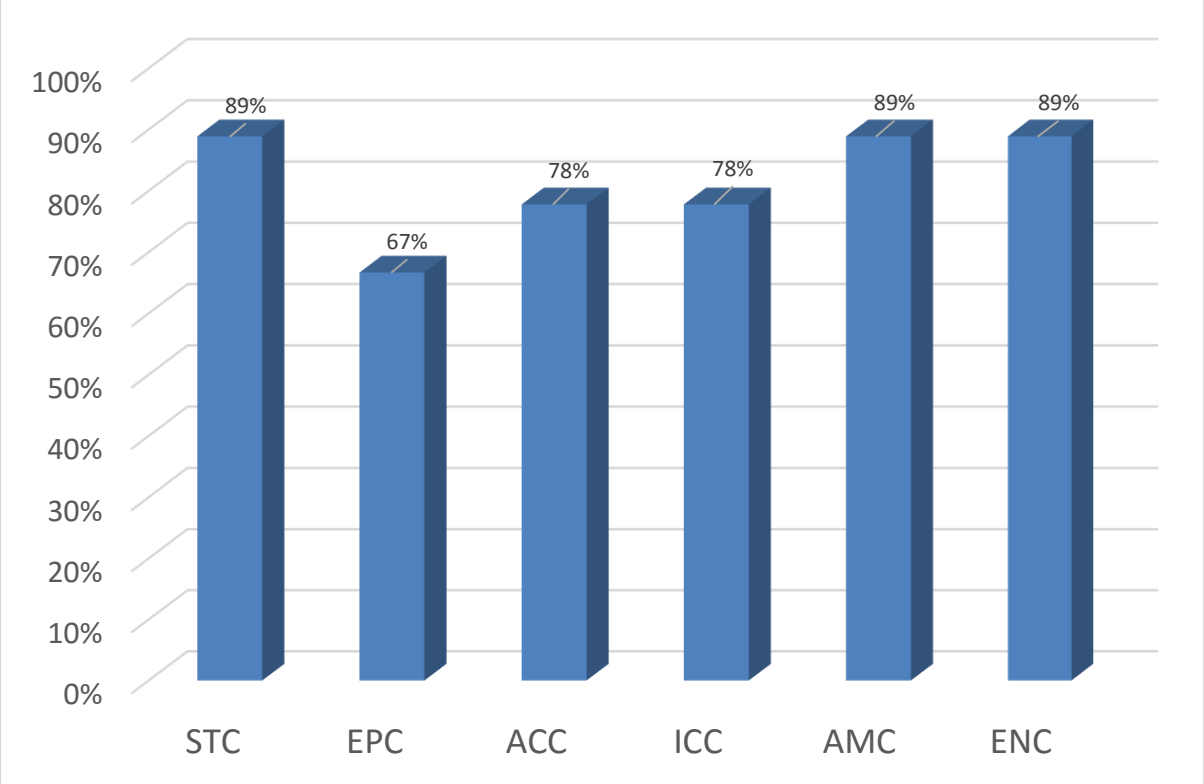

Figure 22: Customer Background, Relationships, Level of Transparency

Figure 22, above, contains the results for questions pertaining to customer background, relationships and transparency for which all participants scored in the high category.

The remainder of the tabulated summary data and rankings can be found in Appendix C.

Figure 23, on page 61, which highlights the results for the level of collaboration with the customer base, showed more variance with half the participants scoring a high and the other half scoring medium.

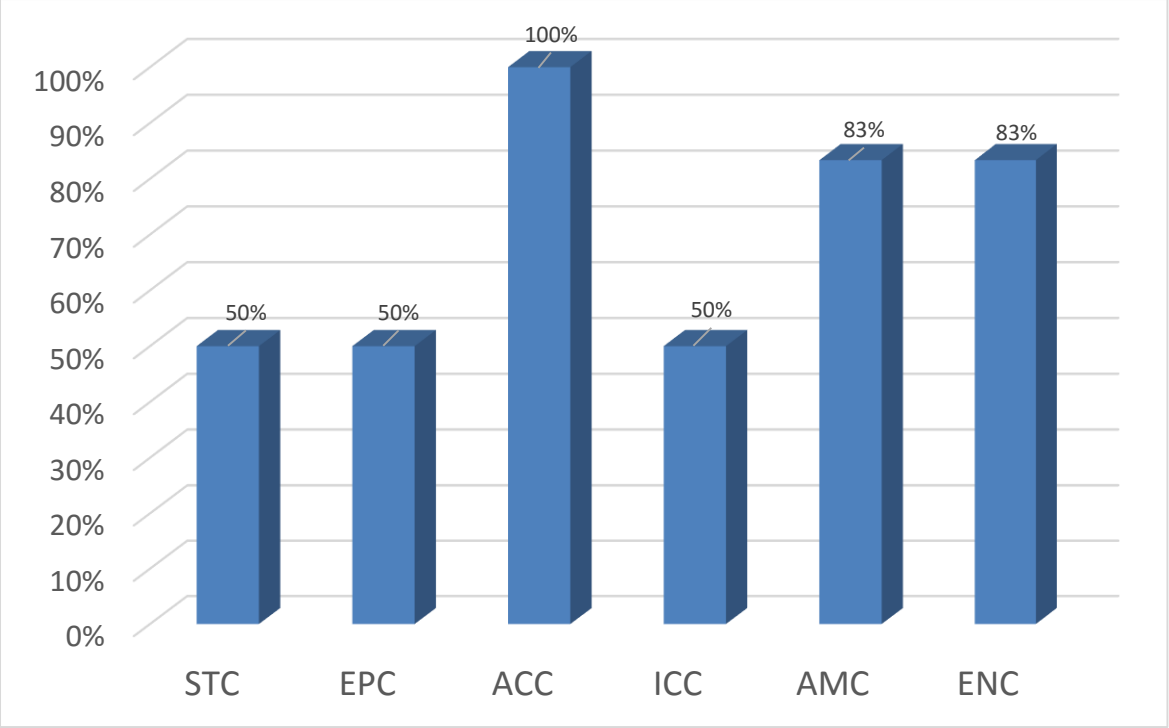

Figure 23: Level of Collaboration with Customer Base

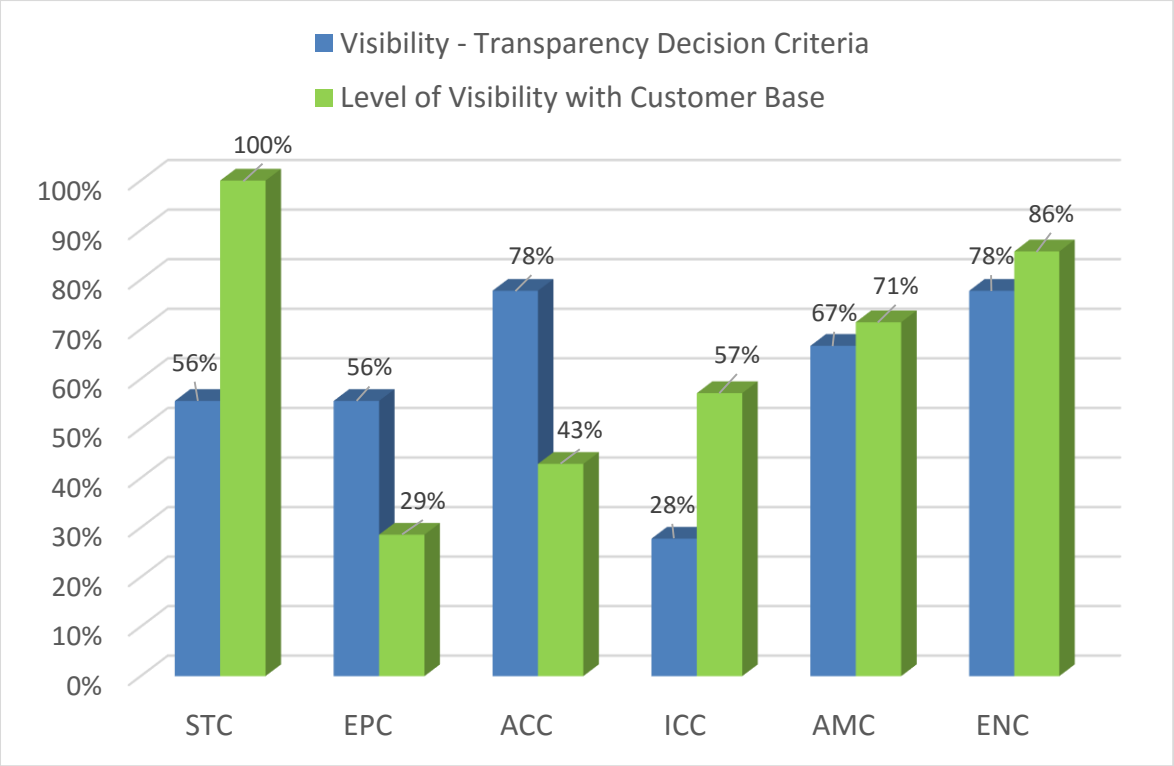

Figure 24: Level of Visibility with Customer Base

Figure 24, above, indicates the results of the visibility with the customer base that has been split into two parts. The first part is general questions regarding the current level of SC

visibility (green in the figure), while the other enquires as to which specific information is relayed down the SC (blue in the figure). This figure illustrates that while four participants scored high, one scored medium and one scored low for the current level of visibility, it does not correlate with the transparency decision criteria results (specific information shared) that include three high scores, two mediums and one low ranking score.

Drilling down further into transparency, Figure 25 below, illustrates the comparative results for each of the participants. This was determined by breaking down the Transparency – Decision Criteria from Figure 24 (page 61) into the three categories outlined in the conceptual frameworks in Section 2.8, i.e. Transparency of Quality, Transparency of Costs and Transparency of Delivery.

The results for Transparency of Quality yielded an equal split of two high rankings, two mediums and two low rankings. Transparency of Costs yielded one high ranking and the rest medium rankings. Transparency of Delivery was the overall best scoring (most transparent) with five high rankings and one low ranking.

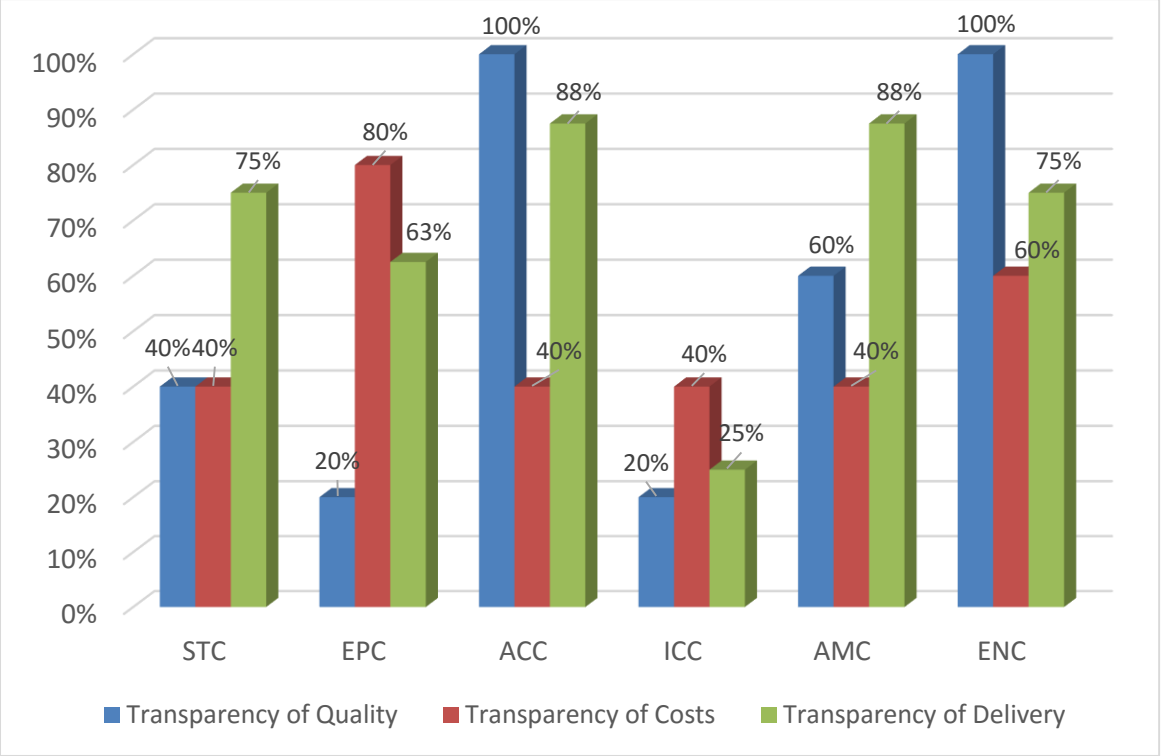

Figure 25: Level of Visibility with Customer Base: Transparency Decision Criteria

These results will be further discussed in Section 5.2, the cross-case analysis, where results will be compared across the various participating SMEs.

Chapter 5 – Results and Discussion

This chapter discusses the interview results with respect to the conceptual framework, presented earlier in this report. A within case analysis, which examines each company individually, is then conducted. Thereafter, a cross-case analysis will be undertaken to compare the data between the research participants.

5.1 Within Case Analysis

The following section seeks to analyse each company as a case study, focusing specifically on visibility and collaboration. Thereafter, Section 5.2 will examine a cross-case study comparing the different companies with a view to identifying similarities, common factors and trends.

5.1.1 Steel Company

Steel Company (STC) is a small sheet metal fabrication company, which employs 40 people and operates under a functional company structure. Although the market is described as highly competitive, STC is still looking to grow. It is said that the main factor that companies compete on is price (Steel Company, 2014), which indicates that companies in this sector would have to drive down operational and raw material costs in order to remain competitive. The largest perceived risks to the business include strike action, finances, material supply and competition.

The O/Ms of STC are convinced that the only way to properly leverage advantages in the SC is through visibility and collaboration. The answers recorded for STC point overwhelmingly to the fact that fostering relationships with suppliers, as well as a higher level of transparency, assists in satisfying customers, scoring 89% on Figure 22 (Customer Background, Relationships, Level of Transparency found on page 60). STC's three biggest customers have been working with them for over 20 years, which has resulted in these three customers receiving beneficial pricing. STC understands what other products are offered by these customers to their customers and indicated that STC understands (to an extent) the environment in which the end customer operates. STC is willing to negotiate when large contracts arise and is willing to assist with faster deliveries, payments and discounts in the event of a customer crisis, demonstrating collaboration. STC also stated that even when no large contracts are available, more transparency would be beneficial to the normal course of business. Customer assistance, as previously outlined, would be limited to a crisis situation and would not evolve into a permanent arrangement due to the fact that STC believes that if it were on a continuous basis, there would be a deeper problem that the customer is not addressing. For example, information flow bottle necks or disconnects between departments that hinder the flow of information and prevent timely action on incoming orders and thus result in orders becoming crises.

The responses for level of collaboration with the customer base, once again indicated that STC is pro collaboration (although only scoring 50% in the level of collaboration – Figure 23, page 61) in that they are willing to assist customers in their time of need, even though this

may put strain on STC itself, through loss of margins and increasing costs to manufacture. STC states that they believe there is currently a level of collaboration that exists with customers and that transactions are not just at arm's-length. This said, there is no formalised system or dedicated resource for collecting and compiling information that would pave the way for a more collaborative relationship and information sharing with customers, leading to increased visibility. Further to this, the relationship with the three biggest customers was described as translucent, which implies that the transparency that exists is limited.

The questions around the level of visibility with the customer base revealed that although STC are particularly in favour of the idea of visibility, scoring 100% on the visibility questions (which indicates transparency according to the conceptual framework), the actual information passed on to customers (Transparency Decision Criteria) is only 56%, visible in Figure 24, page 61. STC indicated that due to the fluctuations in production (i.e. not standard size production runs), knowing that their customer had received an order would assist with the decrease in stock holding and thus allow the business to earn a higher return by increasing working capital and improving cash flow. STC thus feels that knowing their customer's customer would help smooth demand. Further to this, STC also conveys additional information through to their customer, for example on the supply side of the SC, STC's supplier's ability to supply raw material. STC is of the opinion that transparency and collaborative working relationships would be beneficial and outweigh the risks of creating such a relationship.

STC, when asked what type of information was conveyed to their customers, revealed that the type of information was more related to operations, costs and deliveries: process repeatability, supplier quality issues, capacity planning, overheads, transportation costs, inventory, order receipt process, stock levels, other suppliers (in the case that the STC is running at capacity and cannot take on further work) and potential contracts. The information shared does not include improvement initiatives, nor does it include certain costs, indicated by the medium score attained in Figure 25 (page 62) for the Transparency of Cost. If STC were open and transparent with all information, as is the case for any company, this would not give the owners any flexibility to adjust prices dependent on their current situation, their current market standing and most likely on their competitiveness.

5.1.2 Electro Plating Company

Electro Plating Company (EPC) is a well-established company that employs 150 people and, as with STC, makes use of a functional company structure. EPC, as was the case of STC, also experiences high levels of competition in the industry within which it competes – the main area of competition falling on the price of product. The biggest threats to EPC are considered to be the security of electricity supply, as the absence of a generator results in

the operation coming to a halt when an outage occurs on the council supply, and that of the stability of the labour force, i.e. strike action.

EPC has been working with their three biggest customers for more than 20 years. It was said that there is a good relationship between them, with beneficial pricing and credit terms. This is illustrated by the high score in this area, illustrated in Figure 22 on page 60. Although there is a good working relationship, there is a limited level of visibility, described by the owner as translucent, as these three customers do not convey who their customers are for specific jobs. This said, EPC stated that knowing the customers would not add any advantage to their current position. EPC is also not completely aware of other products and services offered by customers, but has picked up some information regarding this through informal conversations with the customers. EPC is willing to collaborate on large contracts, as it was stated that they are willing to create a fully transparent relationship to better satisfy the needs of the second tier customer. The opportunity of this collaboration is generally not afforded to just any customer, but reserved for the biggest customers, corroborated by the 50% score in the area of collaboration (Figure 23, page 61) displayed limited/selective collaboration. EPC is unique in this research, as rushing to get the finished goods out the door does not place any strain on its business. This is due to the fact that their product is always at the end of the customer's supply chain, as it is a finishing process, which means that the faster that finished products go out, the sooner the payment is received, without putting any additional strain on the business. This is understood by paraphrasing a comment made by the O/M of EPC, i.e. all jobs in this business are a rush job. In the case of a customer crisis (financial, rush job or delivery) EPC would be willing to assist the customer, and if this were to benefit the customer's position in the market, which would, in turn, relate to higher sales for EPC, they would consider making this a fixed arrangement. However, EPC said that in terms of day to day business (where large contracts were not involved) there would be no benefit from a more transparent level of communication. EPC does not have a dedicated sales person/team to visit customers, nor a formalised system that compiles information from customers (based on current work/orders or new offerings) into something useable. The latter indicates that there is little visibility into the customer. EPC's O/M stated that there is, currently, a level of collaboration between themselves and the customer and that transactions are not just at arm's length.

When asked if EPC would like to know who the second tier customer was, the answer was no, as it would not assist in earning a higher return through the decrease of stock holding and increase in working capital. Knowing the customer's customer would also not assist with smoothing demand, in the ever fluctuating production volumes. In terms of visibility originating at EPC, it was deemed that there is no need to be transparent to the customer about the suppliers' ability to supply EPC. This is somewhat contradictory, as EPC stated that the rewards outweigh the risks in so far as the creation of a transparent, collaborative relationship is concerned.

When asked about what types of information was conveyed to customers, it was evident with a score of 29% in level of visibility and 56% in the Transparency Decision Criteria (displayed in Figure 24, on page 61), that EPC, in practise, is categorised as opaque or translucent at best and only conveyed certain facts to customers, many of which were associated with costs, i.e. being transparent about costs so that the price of the product was justified – information such as cost of materials, overheads, factory cost rates, transportation costs would be readily divulged. Other information that is shared includes production planning, capacity planning, inventory management and potential contracts. Knowledge about potential contracts is conveyed to the customer with the objective of notifying customers of possible delays associated with the completion of large orders. Figure 25, on page 62, best summarises this with a high score in the area of Transparency of Cost, a medium score for the Transparency of Delivery and a low score for Transparency of Quality.

5.1.3 Aluminium Casting Company

ACC is a medium-sized company that has been in existence for 40 years, although it has only competed in its current product range for half of that amount of time. The company forms part of the manufacturing sector, more specifically, it operates as a foundry, which employs approximately 140 people and is run by using a functional company structure. Although levels of competition in the market are high in respect of pricing, ACC is still looking to grow the company further. The largest perceived risks to the future of the business are strike action and finances.

ACC has been working with their three biggest customers in excess of a decade, but replied no when asked if there was a good working relationship with these customers. In spite of this, ACC scored 78% on their customer background, relationships and level of transparency. These customers receive beneficial pricing, but this is due to contracted take off volumes. Contracted take off volumes are agreed minimum volumes that will be bought from the supplier within a specified period of time, even if the market demand is less than the stipulated contractual volume. There is a level of transparency in that the end customer is revealed for specific jobs. This transparency was created by the necessity for scheduled audits by the end customer. ACC also stated that they have knowledge, although limited, about certain types of other products offered to the second tier customer, but that this information was not of use to them. The O/M of ACC said that the company was in favour of the idea of becoming more transparent where large contracts were available and stated that even with the absence of large contracts, more transparency and better levels of communication would be beneficial. This idea was developed further with ACC stating that they are willing to assist customers who find themselves in a crisis by offering better payment arrangements, and said they would be willing to amend the arrangements if assistance was seen to better their competitive position in the market. This illustrated the willingness of the ACC O/M to collaborate.

Continuing along the same line of thinking, ACC was asked if they would consider collaborating, i.e. faster delivery, if there was urgent attention placed on an order. The O/M responded yes. In terms of the answers recorded during the interview, ACC managed a 100% score on the customer collaboration score (Figure 23, page 61), for which the collaborative assistance in time of need by the customer would be extended to both large enterprises and SMEs alike. This form of assistance is considered to put strain on the business but, in the opinion of the O/M, only from a production planning perspective and not financially. There are dedicated resources and systems in place within ACC for collecting information from customers and compiling it into something useable for the organisation's benefit. ACC deems its relationship with its biggest customers to be transparent, with an existent level of collaboration.

ACC, when asked about visibility with the customer base, scored a high 78%, which can be seen in Figure 24 on page 61, categorising them as transparent. In particular, ACC does not consider the information of who the second tier customer is, nor the size of the order placed to be information that will assist with freeing up cash flow. Production runs fluctuate as a standard for ACC and the O/M deems knowing the second tier customer not to be of benefit in the smoothing of this demand. ACC is, however, transparent with their customers about the ability of their suppliers to supply. ACC does consider transparency and collaboration to be beneficial, even considering the possible risks involved – this was corroborated in the answer given by the O/M, who deems there to be a level of collaboration and visibility currently in place.

Reviewing the Transparency Decision Criteria for ACC (scoring 78%), it seems many aspects of information are shared, with only costs being the category not being conveyed, displayed by the medium score in Figure 25 (page 62) for Transparency of Costs, but a high score for both Transparency of Quality and Delivery.

5.1.4 Iron Casting Company

ICC is the oldest of the six businesses interviewed, at 64 years old, with 27 years of experience in their current field. ICC also falls into the manufacturing sector as a foundry and considered a medium-sized business based on the revenue generated, even though it only employs 76 people. ICC also operates by means of a functional company structure, as with the previous three participants. The market within which it competes, is described as medium in competitiveness by the O/M due to the fact that there are many foundries in South Africa. The foundry industry is somewhat different to the rest of the manufacturing sector, as the patterns used by the foundries during the casting process are owned by the customer. These patterns are manufactured by the customer and issued to the foundry for use in the casting of components. These patterns are often patented by the customer, so poor quality castings will result in the pattern being issued to another foundry for component manufacture. From this it can be seen that the main aspect of competition is the quality of the products manufactured by the foundry. ICC identified the discipline of the

labour force, as well as labour force expertise/skills, to be the main risks to the company. In the process of casting single or multiple components, there are many operations that lead up to the producing a finished component. A more disciplined labour force will result in minimised scrap rates and less rework, which are mostly attributable to fewer shortcuts taken in each of the operations and fewer mistakes being made.

ICC has been working with their largest customers for 27 years and considers this to be a good working relationship, with these customers receiving beneficial payment terms. ICC scored a high 78% in the customer relationships and level of transparency section of the interview questions. The customers do not convey who the second tier customer is for each individual job and ICC is not aware of the other products/services offered by their customers, although according to the O/M, this information is not deemed to be of any use, if it were available. ICC said they were open to the idea of creating transparent working relationships with customers in order to win large contracts, and said that the same would apply should the customer not be awarded large contracts. ICC stated that it would be willing to assist customers, and should a scenario arise in which the customer were to face a crisis, it would be willing to see the customer through. Further to this, if such an action would improve the customer's position in market, it would consider revising the terms with that supplier. These aspects indicate a willingness to collaborate.

In contrast to the above, when questioned regarding collaboration with customers, ICC scored an average 50% (Figure 23, page 61), with the O/M believing that ICC did assist clients in the case of emergencies with faster deliveries, and that this was applicable to all long standing customers, both large and small, even though this could possibly decrease profit margin. ICC does not have a formalised system or resources for collecting information from customers and stated that they relied largely upon reputation and historical dealings for existing customers. While the relationship with their customers was described as translucent, ICC stated that two of their three largest customers were dealt with at arm's length, while the third was described as a collaborative relationship. This was corroborated by the O/M, who stated that only limited transparency and collaboration were experienced - this with one of their three biggest customers, while with the other two customers, no collaboration is experienced.

When asked about visibility with their customer base, ICC reiterated that there was no need to know the second tier customer, but did state that knowing when their customer had received the order could assist with the production planning and decrease the holding of stock, which could yield a higher return. This was, however, still considered to have no impact on the smoothing of inconsistent production runs. ICC stated that they do communicate with their customers about their suppliers' ability to supply and service them. Although ICC stated that the advantages of a transparent and collaborative relationship make it worthwhile, they only scored a 28% on the visibility questions, ranking them as opaque according to the conceptual framework. ICC conveys limited information, evident

by this low score achieved (Figure 24, page 61). The only other information shared with customers, according to ICC, is continuous improvement initiatives – possibly in a bid to illustrate improvements in quality/price to customers. This lack of transparency is visible in Figure 25, on page 62, where low scores were attained for Transparency of Quality and Delivery, and a medium score for Transparency of Costs.

5.1.5 Appliance Manufacturing Company

AMC is a medium-sized manufacturing concern that produces niche appliances and, under a functional company structure, employs approximately 150 employees. The organisation, although 50 years old, is the youngest taking part in this study, in terms of the time trading their current product range - 10 years. The company is still looking to grow, in a market described as highly competitive and competes mainly on price. As with a number of other companies in this report, labour is perceived to be the biggest risk to AMC.

AMC has been working with their three biggest customers for a 10 year time span and has a good rapport with these customers, evident by the 89% scored in this section, which can be seen in Figure 22, page 60. It also receives beneficial pricing and credit terms (with these customers) due to the long standing relationship. These customers do not specifically convey who their clients are for orders. AMC is, however, aware of the other products offered by customers and deemed this information to be important. AMC would be open to creating a fully transparent relationship in order to satisfy the customer – this would also be applicable in the scenario where it is the normal course of business, i.e. AMC would not only assist in the case of big contracts. Further to this, AMC would also be willing to assist in the case of a crisis, by means of better terms, if the need arose with one of their customers. If AMC were to assist during a crisis they would, however, not make it a permanent arrangement, as the organisation would rather get involved with the customer to determine what is causing the crisis and fix the root cause.

Apart from financial difficulties that AMC's customer could be experiencing, AMC are willing to assist customers, based on existing relationships, in making delivery and production provisions at short notice. This type of flexibility is offered to customers that are both large enterprises and SMEs, even though it does cut margins through increased overtime and overheads. AMC describes its relationship with customers as translucent, as it also makes use of resources to collect information from customers, i.e. brand managers who would go to customers, maintain relationships and bring back information from the customers. AMC stated that their relationship with their three biggest customers is collaborative and by no means solely transactional; once again this is demonstrated by their high score of 83% in the collaboration with the customer base questions (Figure 23, page 61).

When questioned regarding the visibility of the customer base, AMC did state that it would be beneficial for them to know when their customer's customer had placed an order, as this

would allow for production planning, but this would not constitute a higher return, as AMC prefers to keep stock on hand and does not manufacture solely according to demand. It is apparent that visibility with the customer base is a strong aspect of AMC, as a very high 100% (Figure 24, page 61) in this section of the interview was achieved, ranking AMC as transparent. Production runs fluctuate in volume and, according to AMC, knowing the second tier customer would not assist in smoothing demand. AMC does provide transparency for their customer by informing them about whether their suppliers are capable of supplying them. AMC believes that the relationship with the three biggest customers is both transparent and collaborative.

When considering the level of transparency with the customer and what types of information are shared between AMC and their customers, it was understood that a range of information is shared, including process statistics, i.e. process repeatability, supplier quality issues, continuous improvement and lean manufacturing initiatives, capacity planning, inventory management and stock levels. AMC is transparent on their delivery with a high 88% score for this section of the transparency decision criteria, while scoring in the medium for Transparency in Cost and Quality, seen in Figure 25 on page 62.

5.1.6 Engineering Company

ENC is a small manufacturing concern that employs 35 people and specialises in machining and the manufacture of complete vertical spindle pumps. ENC also adopts a functional company structure. Although the company is 48 years old, it has been trading in its current product range for the last 35 years. ENC is still looking to grow, but levels of competition are high, with price and quality being the main factors for competition. The main concern for the O/M is that of labour force stability, in a highly unionised sector.

ENC's O/M highlighted that their customer relationships, which are well established with their three biggest customers and are described as good working relationships, have been developed over 30 years. ENC scored a high 89%, displayed in Figure 22 on page 60, for customer relationships and level of transparency. These customers receive beneficial pricing based on historic business. These customers do not, however, reveal which of their customers has placed the order, although ENC's O/M did not consider this to be pertinent information. ENC stated that they are aware of other products offered by their customers to the second tier customer, but affirmed that this information was not considered to be of any use for ENC. ENC stated that they would, in the case of both big contracts and normal course of business, be open to creating a fully transparent relationship with their customers. ENC indicated that it is open to assisting customers that find themselves in financial difficulty, and should this arrangement improve their position in the market, they would consider revising the current terms with that customer. This illustrates their willingness to collaborate.

In terms of collaboration with customers, ENC stated that they are willing to assist their customers in non-financial difficulty, i.e. faster delivery, or prioritising of the customer's

order in the production planning process. This does not put strain on the business, as ENC stated that they prefer to hold stock of components and operate with a Kanban style setup (hold stock and, once an order is placed for a certain component, a production run is made to replenish this item, i.e. a pull system) and thus interrupting the production plan will only halt replenishment of stock, which can be continued once the priority job has been completed. ENC does have a formalised system for collecting information from customers as part of their ISO certification. ENC's O/M describes their relationship with their three biggest customers as collaborative and transparent, which is visible from ENC's customer collaboration score which was a high 83%, as illustrated in Figure 23, on page 61.

ENC acknowledged that knowing their customer has received an order would be beneficial and could help improve profitability by decreasing stock holding. This is not currently done, as outlined above, in the pull system. ENC conducts standard sized production runs and feels that knowing the second tier customer will not help in the smoothing of demand. ENC scored a high score of 86% in the level of visibility with the customer base (Figure 24, page 61), which also ranked them as transparent. ENC stated that it is transparent with the customer about their suppliers' ability to supply them. When asked whether transparency and collaborative relationships were worth the risks inherent in sharing information, the O/M replied it was worth it and added that in their current situation, he believed that both transparency and collaboration did exist.

ENC, when asked what information was shared between themselves and their customers, reaffirmed through the O/M's answers that they are supporters of transparency (also scoring a high 78% in this section), as there was very little information that was not shared. Information not shared included overheads and factory cost rates. It was explained that the classification calculation of the latter became a matter of debate with the customer. Capacity planning and lean manufacturing initiative matters were also not shared. Figure 25 (on page 62) best summarises the level of transparency, with ENC scoring high in Transparency of Quality and Delivery and a medium in Transparency of Cost.

5.2 Cross-Case Analysis

All of the businesses forming part of this research are well established small or medium businesses with at least one decade's experience in the field of their current product offering. Further to this, all companies interviewed have a well-established customer base. The three largest customers (in all six cases) have had business links with these companies for over a decade. Each of the participating companies are still looking to grow in markets with medium to high levels of competition. With markets becoming more competitive in respect of price (only ICC stated that quality was the main area of competition), the O/Ms of these firms would need to find ways of making existing systems and procedures more efficient, whilst also minimising the level of uncontrollability (risk) in the environment in which they operate, in order to survive.

When comparing the relationships between the participants (referring to Figure 22, page 60) and their three biggest customers, all participants, except for ACC, responded that they had good working relationships with their three biggest customers. In addition to this, all three customers also received beneficial pricing and credit terms from the participants. The case for ACC should be explained as it is somewhat different. ACC is a supplier to the automotive industry, and their customer is an LE with very strict supply criteria (including pricing). This rigidity could lead to a strained relationship. ACC was the only participant who was informed about who the second tier customer was for particular orders. Three of the participants were informally aware of the other products offered by their customers, only two stated that this information was of use to them. All participants stated that they would be willing to work openly and transparently with the customer when large contracts were in question and five of the six responded that this open and transparent relationship would be beneficial in the normal course of business. All participants responded yes to assisting their customers in a time of crisis, with two responding no to making this crisis arrangement permanent if it improved overall market standing and competitiveness. Overall scores ranging from 67% to 89% were scored for the section relating to customer background, relationships and transparency. The high scores indicate that all participants view increased transparency and working relationships as beneficial to the normal course of business. These high scores also indicate a collaborative tendency in each participant.

Considering the level of collaboration with the customer base (referring to Figure 23, page 61), the results illustrated more of a spread with three of the participants scoring in the high category and three scoring in the medium category. All participants indicated that they would be willing to assist customers in faster deliveries based on an existing relationship, even considering that this would put strain on the margins of the business for most of the participants. Having said this, only half of the participants said they were willing to assist other customers (with less of an established relationship) in the same way. In terms of systems utilized to capture information passed from the customers to the participants, only half of the participants stated that they had systems in place for collecting and collating information, which was rather undertaken by personnel such as sales people and not via systems. It should be noted that none of the participants have invested in infrastructure or systems (such as information technology systems) that relay information between themselves and the customer automatically. The three participants who stated that they do not have a system in place would employ more of an informal or haphazard information collection system, based on the relationship between the O/M and the customer. It is interesting to note that participants who do not have a formal system to capture information (STC, EPC and ICC) all described the relationship with their customers as translucent, while those with formal systems described their relationships as transparent. Despite this, all described their transactions with their customers as collaborative. Only ICC affirmed that just one of the three relationships with their biggest customers was collaborative.

When comparing the level of visibility in the customer base (referring to Figure 24, page 61) the results are even more scattered, with three high, two medium and one low score. All participants answered that the benefits of a collaborative and transparent relationship outweighed the potential risks involved with information sharing. However, only three (STC, AMC and ENC) stated that they would like to know when their customer received the order. These three participants, as well as ICC, thought that knowing the size of the order placed with the customer would also assist in planning, by allowing the company to hold lower stock levels. Of these four, only three stated that this would be financially beneficial, as this decreases stock holding, whereas ENC stated that they preferred to hold stock in any event. Further to the inquiry about visibility of the customer base, only STC and EPC stated that knowing their second tier customer would help to smooth demand. When asked about the current level of collaboration and transparency with customers, all stated that it did exist, excluding ICC and EPC - the latter of the two said that it did exist but to a limited extent.

The second part of the visibility analysis includes the transparency decision criteria, which is particular information that is passed between the participants and their customers. As can be seen in Figure 24 (page 61), there seems to be no correlation between the two sets of information, - level of visibility and the transparency decision criteria, with only two participants (AMC and ENC) scoring the same for both categories, i.e. AMC and ENC scored high in both whereas, for example, EPC achieved a low score in the customer visibility and a medium score in transparency decision criteria. ENC and ACC scored high in information passed between themselves and the customer. ENC attributes this to the long standing and open relationship between themselves and their customers. ACC, on the other hand, stated that, as they are an automotive industry supplier, they are required to share information with their customers.

Figure 25, found on page 62, demonstrates the breakdown of the Transparency Decision Criteria into its three categories, namely: Transparency of Quality, Costs and Delivery. The results show that the participants are most likely to be transparent about delivery, with four of the participants achieving a high score, only one medium and one low score. It is natural that companies are transparent with their customers about deliveries, as this is part of the service that is offered to customers, i.e. this should not be a secret.

As expected, the cost category displayed the least amount of transparency with only one participant attaining a high ranking, while the rest of the participants ranked medium in their scores. The information that was least shared between participants and their customer base are sub-contract costs and factory cost rates. To an extent, not conveying information such as costs will assist businesses, and can be seen as risk mitigation, as it allows companies a buffer and room to manoeuvre when unforeseeable events arise or when operations deviate from the plan.

Quality had the biggest spread of the three categories, with two participants scoring high, two scoring medium and two scoring low. This is unexpected, as quality would be one of

the areas that serves as an advert to customers and thus the expectation would be more transparency around this information. For example, continuous improvement initiatives are a positive for customers, as it illustrates to the customer that the supplier is constantly findings ways to do things better (and cheaper).

In the literature review in Section 2, it was contextualised that risk is determined by the significance of a loss as well as the probability of a variance in an expected outcome (Spekman & Davis, 2004). Faisal *et al* (2006), as outlined previously in the literature review, explained that risk mitigation enablers had the opportunity to reduce risk, either by minimising the loss incurred or by reducing the probability of that loss occurring, which ultimately leads to the mitigation of risk. Below, each of the risk mitigation enablers is discussed according to the data collected for this research report.

- **Information Sharing**
  Information sharing takes place with all the participants. Four of the six participants stated that their relationship with their customers is translucent, and two stated that their relationship is transparent (ACC and ENC).

- **Agility in the SC**
  It is apparent that agility is visible with all participants. They all responded that they would assist customers with better financial terms in moments of crisis, as well as assisting with an urgent job – even though some participants stated that this does put strain on their own business.

- **Trust Among SC Partners**
  Trust is displayed most visibly through a willingness to assist with financial terms, as well as by conveying information to SC partners. This is also displayed by the results of the decision transparency criteria (where participants scored three high, two mediums and one low). This illustrates that participants are willing to share information, some to a greater extent. This also indicated the existence of trust in the relationship, as the opposite would mean minimal information shared (resulting in all participants scoring low scores).

- **Corporate social responsibility**
  This topic was not covered during the course of this research report largely due to the fact that the participants do not operate cross border and thus will only adhere to South Africa's laws and policies. The assumption made regarding this, is that all the participants conduct business ethically and responsibly.

- **Collaborative Relationships Among SC Partners**
  All respondents stated that they feel they have collaborative relationships with their customers. This is also illustrated by a willingness to help - displayed in the

explanation given in Agility in the SC, above. From the results in the collaboration section of the interview, it is visible that three participants do have collaborative relationships as they achieved high scores, and three participants achieved medium scores, which indicates some level of collaboration.

- **Information Security**
  This point is not a critical one due to the fact that none of the participants have interlinked systems with their customer base, and this eliminates the potential for information being misused. As discussed previously, Figure 25 (page 62) and Table C3 illustrate particular information that is shared between the participants and their customers. Only quality and costs could be considered sensitive in nature and thus only this will be considered for the information security point. When looking at Table C3, it is illustrated that only two participants score a high in the Transparency of Quality section (ACC and ENC), and only one scored a high in the Transparency of Costs section (EPC). This, again, links to the Trust Among SC Partners in the section above.

- **Aligning Incentives & Revenue Sharing Policies in the SC**
  This enabler is a result of collaboration, and all participants responded that their three biggest customers receive beneficial pricing, based on their history with the participant. This is further corroborated as all participants were willing to create a fully transparent working relationship if large contracts were available. In addition, five of the six respondents said that they would still be open to creating a fully transparent working relationship if large contracts were not available.

- **Risk Sharing in an SC**
  Evidence of risk sharing is apparent in the SC of the participants, as all stated that they would assist if one of their three largest customers found themselves in a situation that needed urgent attention and faster delivery. Three of the participants said they would extend this type of assistance to their 'run of the mill' customers, i.e. those not categorised as the three biggest customers. The risk sharing element is visible when considering that this assistance would be offered despite the fact that four of the participants responded that this type of assistance had a negative impact on them, as it resulted in increased overheads and overtime.

- **Knowledge About SC Risks**
  All participants interviewed are O/Ms of businesses that have been operational for in excess of 37 years (Table 5, page 43). This is coupled with the fact that the participants have been trading in their current product range for between 10 and 48 years, with five of the six participants having done so for more than 20 years. Further to this, participants stated that the time spent working with their three

biggest customers is in excess of 10 years - in the case of four participants, this is in excess of 20 years (Table 6, page 57). The prolonged period of time that these companies have spent in operation and working with their customers indicates an intrinsic knowledge and understanding of both the industry and customer requirements. This, over time, has allowed the participants to build up a résumé of SC risks through experience (or near misses) and, in turn, allows the knowledge around these risks to be built up. This stored knowledge will be useful in confronting any future risks that are similar or the same in nature.

- **Strategic Risk Planning and Continual Risk Analysis & Assessment**
  These two enablers, Strategic Risk Planning and Continual Risk Analysis and Assessment, have been combined into one for the purposes of this discussion. The planning, analysis and assessment of risk is considered a formal activity in large enterprises and, in firms of this magnitude, departments are created with the purpose of risk assessment. In SMEs, as stated previously in this report, a lack of resources dictates that this function is not formally tackled, but rather as an informal, but integral, part of the SC (and supplier) management process. Having said this, the participants have a sound understanding of where their biggest perceived risks are (seen in Table 5, page 43). There is a common thread through the experiences of all the participants relating to the stability of the labour force. The participants also have an understanding of what their competitors and the market focus on, in order to remain competitive. In most instances this focus falls on the price of the product being produced. Having an understanding of both the perceived risks and what market factors keep them competitive will allow the O/Ms to do the necessary planning and analysis to curb potential problems, before they arise.

It is indicative from the discussion above that all participants may not adopt or actively practise all of the risk mitigation enablers listed above, but it is abundantly clear that all of the participants do practise (even if informally) elements of these enablers in their daily dealings with customers in order to minimise possible risks.

Chapter 6 - Conclusions

The companies that took part in the interviews were small and medium in size. They were thus not able to dedicate resources for a formal risk management department. Having said this, all these companies were in operation during the 2009 global recession, a time in which the South African economy shed approximately one million jobs (Maswanganyi, 2013) and approximately four hundred and forty thousand businesses closed down (Mail and Guardian, 2012). The ongoing Eskom load shedding saga, which started in 2008 and severely affects all operations as well as the cost of doing business, is also part of their scenarios. Ongoing labour unrest caused by ever increasing wage demands and poor levels of productivity has also contributed to an increase in the cost of doing business at a time in which the main factor determining market competitiveness is price. These telling factors illustrate that in order for the participants to have survived through these historically tough periods, as well as some prevailing difficult conditions, there has to have been some measures of risk mitigation in place.

In Chapter Two (2.3.1 Supply Chain Risk Management) it was stated that a fundamental pre-requisite for being able to manage risk and making a supply chain more resilient is supply chain understanding. It is important to note that this is the reason why interviews were conducted with the O/Ms. These subjects were deemed to be the most equipped and most knowledgeable person/people in the company. They had the most complete understanding of the overall business, including its strengths and weaknesses. The O/Ms' strengths are visible:

- Operationally, due to the functional structure of the businesses and their hands-on approach, which exposes them to daily operations as a result of the short chain of command,
- Financially, as they are exposed to the financial status of the business and understand the financial ramifications of various factors,
- In terms of customers/relationships, as they are often the lead "sales" person with the most knowledge about the technical aspects as well as the business's capability and capacity,
- In terms of suppliers, as the O/Ms' hands-on approach will inevitably lead them to dealing with suppliers directly and also give them an intricate understanding of how the supply variables affect the operation.

The factors listed above give the O/M the required SC understanding and this, in turn, allows them to manage risk within the SC.

From the investigation undertaken, the following has been concluded:

- It is evident from the data gathered during interviews with the O/Ms that both visibility and collaboration will benefit the SC and it is clear in the research literature that both of the concepts are intrinsic to the risk mitigation enablers listed.

- While not all risk mitigation enablers are put into practise by all the participants, these enablers are without doubt a part of the risk mitigation process.
- As these companies are limited in size and resources, the practice of supply chain risk management is not formal but is absolutely integral to the daily operations, planning and decision making of the business.

The objectives of this report, listed in 1.5 Objectives, were all met during the course of the research and led to the resolution of the central research question: Do visibility and collaboration play a role in how SMEs manage and mitigate risk within their supply chains? The information collected showed that visibility and collaboration did, in fact play a role in how risk was managed within their SC. As these two concepts, visibility and collaboration, form part of the risk mitigation enablers and are formally and informally part of the management of these companies, they are, therefore, linked to the management of SC risk.

The results obtained from the analysis of the data are significant in that they prove that the visibility of the differing tiers of the SC and the collaboration with SC partners do help to mitigate risk within the SC.

While the objectives have been met and the central research question answered, the report did not manage to achieve a clear picture of the upstream facet of the SC (supply side). This would form part of recommendations for further research.

In conclusion, the benefits of visibility and collaboration have all been highlighted in this report as having the ability to benefit SMEs in the management of both their SC and the internal management of their operation through, mainly, information flow. Working towards greater levels of visibility and collaboration and formally incorporating them into daily processes would allow for consistency in information flow - compared to the informal option which may result information being passed on in some instances, and in other cases not. This reliable information can then be used to minimize disruptions caused by unforeseen risks both in the SC and internally.

6.1 Recommendations

In order to validate these findings, further investigations would need to take place. This further scrutiny would encompass a multiple case study approach, which includes upstream suppliers and the monitoring of visibility and collaboration that seemingly takes place, in order to quantify the effects of these enablers on the entire supply chain.

This research followed a purely qualitative approach and thus the impact of the risks and the quantifiable advantages of collaboration were not investigated. A quantitative multiple case study approach should be conducted to enable and facilitate a comparison between the qualitative and quantitative findings.

This research focused entirely on manufacturing SMEs. As such, a broader investigation could also be conducted on SMEs in different sectors of the economy. This could be undertaken in order to determine the possible quantitative benefits that risk mitigation techniques have on SMEs in other sectors.

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Appendices

Appendix A – Interview Questionnaire

Section A: Company background

1. For how long has your company been in existence?
2. What industry do you specifically consider yourself a part of?
3. For how long has your company been trading your current product range?
4. How many people are employed in the company?
5. Where do you fit according to the South African Business Act's definition of a business? i.e. Small or medium.
6. Into which sector do you fall? E.g. manufacturing, construction, etc.
7. Do you want to grow your company further?
8. If so, are the constraints for growth in house or outside factors?
9. Further to the above, would you prefer to increase net profit over market share and turnover? i.e. keep the company the same size yet increase its returns?
10. Are there numerous competitors who compete to supply the same products/product range as you supply currently?
11. What are your competitors competing on? Pricing, quality, service or anything else that may come to mind?
12. What are the main risks that your company experiences/could possibly experience? Strike action, financial, competition, service, expertise, information, or anything else that may come to mind?

Section B: Level of Transparency – Dissemination

1. How long have you been working with your three biggest customers?

2. Do you have a good working relationship with these three customers?
3. Do they convey to you who their customers are for specific jobs?
4. Are you aware of other products and services that are offered by your customers to their customer?
5. Further to the above, would this information be of use to you, i.e. knowing what other types of work your customers do?
6. If large contracts to reputable companies were available, would a company such as yours be open to creating a fully transparent working relationship in order to better satisfy the needs of your customer's customer?
7. Further to the above, if there were no large contracts involved, would it be beneficial to have a more transparent level of communication than the normal course of business?
8. If one of your customers had a crisis of some sort would you try and help the company in any way possible, be it by adjusting payment terms, or offering some form of discount.
9. Further to the above, if it was proven that such an act would help sustain a supply chain and actually benefit your position in the market, generally, would you change your mind?

Section C. Transparency Decision Criteria

Currently, which of the information below is passed between yourself and your customers? Please could you answer YES or NO for each:

1.1 Scrap Levels

1.2 Rework Levels

1.3 Process Repeatability

1.4 Supplier Quality Issues

1.5 Continuous Improvement Initiatives

1.6 Cost of Material

1.7 Overheads

1.8 Sub Contract Costs

1.9 Factory Cost Rates

1.10 Transportation Costs

1.11 Order Receipt Process

1.12 Capacity Planning

1.13 Shipment Process

1.14 Lean Manufacturing Initiatives

1.15 Inventory Management

1.16 Other Suppliers

1.17 Potential Suppliers

1.18 Stock Levels

Section D. Conveying Delivery information

1. Would you like to know who your customer's customer is? i.e. would you like to know that your customer has received the order?
2. Further to the above, if the size of order was conveyed to you do you think it would assist in freeing up your cash flow by allowing you to decrease stock holding and increase your lead time to manufacture?
3. Further to the above, would you foresee the visibility as a possibility to earn a return in the form of higher turnover, by decreasing stock levels and thus increasing working capital?

Section E. Reward

1. Do your three biggest customers receive beneficial pricing and credit terms or is pricing based on a history and credit application?

Section F. Support – Collaboration

1. If one of your three biggest customers finds itself needing urgent attention or help in the form of faster delivery would provisions be made for this based on the relationship that exists?

2. Does this happen with other customers and are they SMEs?

3. Does this put any sort of strain on your organisation through loss of gross margin through increased overheads and overtime?

4. Is there a formalised system with dedicated resources for collecting information from customers which then compiles it into something useable?

5. Would you describe your relationship with your three biggest customers as opaque, translucent or transparent?

6. In your view, is there a level of collaboration between you and your three biggest customers? The opposite would be arms-length transactions?

Section G. Visibility and the Bullwhip Effect

1. Do you have fluctuations in demand on your production, or do you manufacture according to standard production runs?

2. Do you feel that knowing your customer's customer will help in smoothing demand?

3. Are you transparent with your customers in terms of your supplier's ability to supply you?

The concept of visibility in the supply chain explained: The ability to see up and down the supply chain, sharing information about supply chain strategy and operations between supply chain partners.

4. Further to the definition of supply chain visibility above, do you think that a transparent and collaborative working relationship would be beneficial if managed correctly, i.e. the gains outweigh the risks involved in creating this relationship?

5. Do you think, given the above, that there is currently already a level of collaboration and transparency that exists? If so, how far up and down the supply chain can you see, i.e. do you have contact with your 2nd tier suppliers and customers?

Appendix B – Electronic Appendix

All transcripts of interviews conducted can be accessed on the DVD which accompanies this report.

Appendix C – Interview Summary Data and Scores

Table C1: Level of Collaboration with Customer Base

Question	STC		EPC		ACC		ICC		AMC		ENC	
1. If one of your three biggest customers finds itself needing urgent attention or help in the form of faster delivery would provisions be made for this based on the relationship that exists?	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
2. Does this happen with other customers and are they SMEs?	Generally not – depends on size of contract	0	No	0	Mixed, SME and LE	1	Yes	1	Yes	1	No	0
3. Does this put any sort of strain on your organisation through loss of gross margin through increased overheads and overtime?	Yes		No, Fast in and fast out means money in the bank sooner.		Yes, not financial. Only from a planning perspective.		Yes		Yes		No	

Table C1 continued: Level of Collaboration with Customer Base												
4. Is there a formalised system with dedicated resources for collecting information from customers and compiling it into something useable?	No	0	No	0	Yes	1	No	0	Yes	1	Yes	1
5. Would you describe your relationship with your three biggest customers as opaque, translucent or transparent?	Translucent	1	Translucent	1	Transparent	2	Translucent	1	Translucent	1	Transparent	2
Note: For the question above, scoring worked as follows: a zero score for Opaque, a score of one for translucent and a score of two for transparent.												
6. In your view, is there a level of collaboration between you and your three biggest customers? The opposite would be arms-length transactions?	Yes	1	Yes	1	Yes	1	2 at arm's length, 1 collaborative	0	Yes	1	Yes	1
Total	3/6		3/6		5/6		3/6		5/6		5/6	
Percentage	50%		50%		100%		50%		83%		83%	

Table C2: Level of Visibility with Customer Base

Question	STC		EPC		ACC		ICC		AMC		ENC	
1. Would you like to know that your customer has received the order?	Yes	1	No	0	No	0	No	0	Yes	1	Yes	1
2. Further to the above, if the size of order was conveyed to you do you think it would assist in freeing up your cash flow by allowing you to decrease stock holding and increase your lead time to manufacture?	Yes	1	No	0	No	0	Yes	1	Yes	1	Yes	1
3. Further to the above would, you foresee the visibility as a possibility to earn a return in the form of higher turnover, by decreasing stock levels and thus increasing working capital?	Yes	1	No	0	No	0	Yes	1	No, rather keep stock on hand	0	Yes	1
4. Do you have fluctuations in demand on your production, or do you manufacture according standard production runs?	Fluctuations		Fluctuations		Fluctuations		Fluctuations		Fluctuations		Standard	
5. Do you feel that knowing customer's customer will help in smoothing demand?	Yes	1	Yes	1	No	0	No	0	No	0	No	0
6. Are you transparent with your customers in terms of your supplier's ability to supply you?	Yes	1	No need to be.	0	Yes	1	Yes	1	Yes	1	Yes	1

Table C2 continued: Level of Visibility with Customer Base

7. Do you think that the transparency and collaborative working relationship would be beneficial if managed correctly, i.e. the gains outweigh the risks involved in creating this relationship?	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
8. Do you perhaps think that given the above, that there is currently already a level of collaboration and transparency that exists?	Yes	1	No – only to a limited extent	0	Yes	1	No	0	Yes	1	Yes	1
Total	7/7		2/7		3/7		4/7		5/7		6/7	
Percentage	100%		29%		43%		57%		71%		86%	

Table C3: Visibility – Transparency Decision Criteria

	Currently, which of the information below is passed between yourself and your customers? Please could you answer YES or NO for each one											
		STC		**EPC**		**ACC**		**ICC**		**AMC**		**ENC**	
Transparency of Quality	Scrap Levels	No	0	No	0	Yes	1	No	0	No	0	Yes	1
	Rework Levels	No	0	No	0	Yes	1	No	0	No	0	Yes	1
	Process Repeatability	Yes	1	No	0	Yes	1	No	0	Yes	1	Yes	1
	Supplier Quality Issues	Yes	1	No	0	Yes	1	No	0	Yes	1	Yes	1
	Continuous Improvement Initiatives	No	0	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
	Sub Total - Quality	2/5 (40%)		1/5 (20%)		5/5 (100%)		1/5 (20%)		3/5 (60%)		5/5 (100%)	
Transparency of Costs	Cost of Material	No	0	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
	Overheads	Yes	1	Yes	1	No	0	Yes	1	No	0	No	0
	Sub Contract Costs	No	0	No	0	No	0	No	0	Occasionally	1	Yes	1
	Factory Costs Rates	No	0	Yes	1	No	0	No	0	No	0	No	0
	Transportation Costs	Yes	1	Yes	1	Yes	1	No	0	No	0	Yes	1
	Sub Total - Costs	2/5 (40%)		4/5 (80%)		2/5 (40%)		2/5 (40%)		2/5 (40%)		3/5 (60%)	
Transparency of Delivery	Order Receipt Process	Yes	1	Yes	1	Yes	1	No	0	Yes	1	Yes	1
	Capacity Planning	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	No	0
	Shipment Process	No	0	Yes	1	Yes	1	Yes	1	When exporting	1	Yes	1
	Lean Manufacturing Initiatives	No	0	No	0	Yes	1	No	0	Yes	1	No	0
	Inventory Management	Yes	1	Yes	1	Yes	1	No	0	Yes	1	Yes	1
	Other Suppliers	Yes	1	No	0	Yes	1	No	0	Yes	1	Yes	1

Table C3 continued: Visibility – Transparency Decision Criteria

	Potential Contracts	Yes	1	Yes	1	No	0	No	0	No	0	Yes	1
	Stock Levels	Yes	1	No	0	Yes	1	No	0	Yes	1	Yes	1
	Sub Total - Delivery	6/8 (75%)		5/8 (63%)		7/8 (88%)		2/8 (25%)		7/8 (88%)		6/8 (75%)	
	Total		10/18		10/18		14/18		5/18		12/18		14/18
	Ranking	Translucent (56%)		Translucent (56%)		Transparent (78%)		Opaque (28%)		Transparent (67%)		Transparent (78%)	