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Analysis of Strategic Risk Management practices in the Gauteng automotive sector supply chain

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2017

MBA DESSERTATION DECLARATION:

I, **Simbarashe Stewart Kamwendo**, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

…….....

Signed at ……

On the …….. day of …… 20…..

ABSTRACT:

In the past, due to reactive planning, supply chain managers used to conventionally focus on cost reduction only, consequently becoming more exposed to risk and failing to achieve the desired continuity. More recently, proactive planning now mandates managers to investigate, identify and remedy the inherent risks which threaten the existence of their businesses to survive. The increased complexity of supply networks requires application of principles and techniques to re-engineer the chain to ensure that risk sources are identified and mitigated for minimum impact.

The purpose of the study is to understand and assess and analyse Strategic risk management practices in the Gauteng Automotive sector supply chain. The qualitative semi-structured interviews took place during the period 20 May 2017 to the 15th of July 2017. Participants involved in the interviews were supply chain and logistics professionals and procurement managers. The research findings and results were generated using qualitative thematic content analysis. The findings were comprised of: identified inherent risks, employed strategic risk management practices in the industry and further effort was invested in finding out whether some of these risk management strategies are reaping the intended benefits. The report drew to a conclusion that there is a fair level of applied strategic risk management across the sector which can, and should definitely be improved. Key recommendations are to implement more supplier development programs that aid in setting up integrated, resilient, green and strategic supply chains within the automotive sector, which are technically competent and foster full cross collaboration, on product and information flow, with all supply chain members.

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DEDICATION:

To my dear wife Sharon Zandile Kamwendo for her support and unwavering love during the time I could not be there, focusing on my studies. I could not have done it without you.

To my daughter, Natalie and son Christian, our future generation with audacious ambitions and dreams. Keep dreaming big and you will achieve it.

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LIST OF ACRONYMS:

AGOA	African Growth and Opportunity Act
AIEC	Automotive Industry Export Council
AIS	Automotive Investment Scheme
APDP	Automotive Production Development Program
BLNS	Botswana, Lesotho, Namibia and Swaziland
BRICS	Brazil, Russia, India, China and South Africa
CBU	Completely Built Up
CKD	Completely Knocked Down
COMESA	Common Market for Eastern and Southern Africa
CPI	Consumer Price Index
DTI	Department of Trade and Industry
EU	European Union
FDI	Foreign Direct Investment
FMEA	Failure Modes and Effects analysis
FOB	Free On Board
FTA	Free Trade Agreement
GDP	Gross Domestic Product
IDZ	Industrial Development Zone
MIDP	Motor Industry Development Zone
NAACAM	National Association of Automotive Component and Allied Manufacturers
NAAMSA	National Association of Automobile Manufacturers of South Africa
NAFTA	North American Free Trade Agreement
OEM	Original Equipment Manufacturer
OICA	Organisation Internationale des Constructeurs d'Automobiles
SA	South Africa
SACU	Southern African Customs Union
SADC	Southern African Development Community
SARS	South African Revenue Service
WTO	World Trade Organization

CHAPTER 1 INTRODUCTION

1.1 PURPOSE OF THE STUDY

The purpose of the study is to understand qualitatively assess and analyse Strategic risk management practices in the Gauteng Automotive sector supply chain. The emergence of advanced technologies, e-commerce, better transportation and state of the art production techniques have increase the efficiencies and added value in supply chain systems. However, all these accelerated changes also expose the incumbent Supply Chain systems to risks and makes them more fragile and vulnerable to multitudes of threats. Childerhouse, Hermiz, Mason-Jones, Popp, & Towill (2003) conformed In order to remain competitive, many companies in the automotive industry foster the streamlining of their supply chains by implementing concepts such as Just-in-Time and Just-in-Sequence Childerhouse, Hermiz, Mason-Jones, Popp, and Towill (2003). Developing a supply chain based on Lean principles gives the good result of low stock but however this has negative and unintended consequences such a high vulnerability and susceptibility to inherent risks for the network. The complexity of supply chains due to shear number of participants, the nature of the product being procured or international business links and procedures is also another reason bolstering the significance of supply chain management.

The existing literature reveals that there is need for such studies to be carried out in the South African space so that the geographical entities can benefit from more relevant and familiar studies done in this territory. This study focuses on two principal aspects, first by referring to written academic journals on which risk determinants are applied in similar supply chains similar to South Africa. Then, secondly carrying out research to understand if these determinants are also considered in the South African context. Accordingly, the purpose of this study is to determine which of these factors, whether internal or external are significant locally.

1.2 CONTEXT OF THE STUDY

In the past, due to reactive planning, supply chain managers used to conventionally focus on cost reduction only, consequently becoming more exposed to risk and failing to achieve the desired continuity. More recently, proactive planning now mandates managers to investigate, identify and remedy the inherent risks which threaten the existence of their businesses to survive. The increased complexity of supply networks requires application of principles and techniques to re-engineer the chain to ensure that risk sources are identified and mitigated for minimum impact. Since supplier insolvencies are a major source of supply chain disruptions, scholars have continuously suggested managing supply chain risk management, proactively in order to avoid their occurrence (Grötsch, Blome, & Schleper, 2013).

Based upon the theoretical lens of prior studies done in supply chain practices and strategic risk management, findings from Kırılmaz and Erol (2016) and other studies imply risks causing high vulnerability in companies are due to chronic fiscal imbalances, frequent striking by employees, immense volatility in fuel and electricity prices, persistent extreme weather, pervasive entrenched corruption, critical systems failure, inbred challenges for an emerging economy inbred challenges for an emerging economy, increase in raw material prices, quality problems, bankruptcy of supplier, machine breakdowns and transport failures. These will be introduced and researched in the context of the South African Automotive Manufacturing sector to establish the risk constructs aligning with global supply chains.

South Africa prides itself as one of the most successful economies in Africa, there is substantial investments and excellent performance in sectors such as mining, finance, retail and manufacturing. According to the World Bank, manufacturing value added percentage of Gross Domestic Product (GDP) measured in 2014 was 13.24% of total GDP. This manufacturing sector is diverse and established consisting of the following sub sectors: Agriprocessing, Automotive, ICT & Electronics, Metals, Textiles and Footwear and Chemicals (Statistics South Africa 2016).

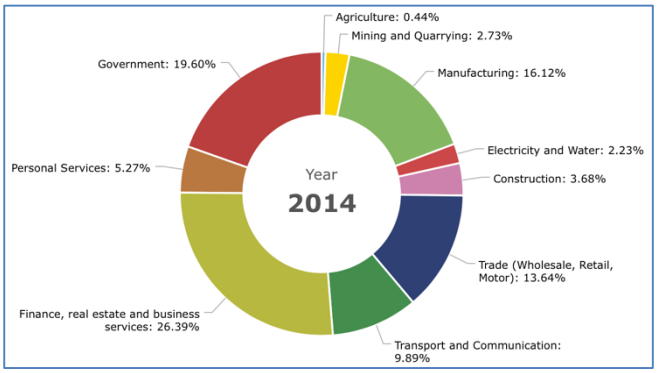


Fig 1: Image Source: http://www.southafricanmi.com

The automotive sector is diverse with various multinational corporations in Gauteng such as Nissan, BMW, Ford, IVECO Trucks and UD Trucks are manufacturing and assembling complete or knockdown (KD) vehicles and trucks for the local market and importation to foreign markets as well. According to www.iol.co.za (2016), BMW Rosslyn was awarded a new contract in 2016 to manufacture the next generation of the BMW X3, substituting its existing 3 series line-up and this has come with a 3 Billion rand investment to the plant. An additional 3 Billion rand has been set aside for upgrading suppliers, launch costs and training of associates. The Ford South Africa plant has also received R2.5 billion ($170 million U.S. dollars) in local production of the all-new Ford Everest seven-seat SUV and expansion of the new Ranger pickup program. Ford will export all-new Everest into Sub-Saharan Africa countries. This investment will create approximately 1,200 new jobs at Ford South Africa and within the South African supplier network.

Through a broad literature review the risk constructs will be researched more in depth to assess alignment with the South African automotive manufacturing sector and establishing how business sustainability is maintained through an efficient supply chain. As confirmed by Yu, Xiong, and Cao (2015), competition plus unexpected market changes make it necessary for firms to resort to supply chain to obtain complementary resources, capabilities and technology. Consequently, supply chain management is evolving into one of the principal disciplines and areas of focus on to gain a competitive advantage in Africa and also globally. One of the crucial strategies employed to reduce the effects on environmental risk is vertical integration which occurs when the supply chain network of a firm and its players are owned and controlled by that firm.

Vertical integration reduces uncertainty, improves information communication, relationship stabilization, inner control synergy and transactional cost reduction to stakeholders. However very few companies in South Africa are able to buy out smaller suppliers so that they can own the complete value chain network. Therefore, vertical Integration will be part of the delimitations of this study.

As researched by Hendricks & Singhal (2005), empirical studies also indicate that supply chain risk has a negative effect on company income. Therefore, risk management is evolving into a critical issue to sustain supply chain management. However, South African automotive companies also must accept some degree of risk and apply risk mitigation strategies to gain a competitive advantage and make profit. Culminating on the foundation of previous studies and insights from existing literature the perceived risks will be determined and used in the research design methodology furthermore highlighting implications and interdependencies of risk factors in promoting sustainable supplier-customer relationships.

1.3 PROBLEM STATEMENT

1.3.1 Main Problem

In South Africa, current business environment is full of uncertainties, including market demand, risk preference, lead times, price and Rand fluctuation, and aging transport infrastructure. These uncertainties entail new risks in matching supply and demand, and these risks inevitably lead to supply chain inefficiency and a less competitive South African manufacturing sector with high supply chain network costs.

Setting up a strategic supply chain management system in Gauteng is challenging due to certain significant supply chain risk factors inherent in the complex manufacturing sector.

1.3.2 Sub Problems

In South Africa supply chains are subject to numerous risks arising from communication, geopolitical, cultural, infrastructural and legal complexities. The emergence of any of these risks will result in costly business disruptions decreasing reliability, profitability and continuity.

The first sub problem is to: **Identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance?**

The second sub problem is: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**

The third sub problem is: **Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector?**

1.4 SIGNIFICANCE OF THE STUDY

South African automotive organizations need to know and understand the importance of understanding and prioritizing different risks in their supply chain due to the serious threat that they impose on the normal business operations. Being cognisant and adept at developing strategies to mitigate and counteract the impacts of these risks is key in fostering sustainability. Popular trends of our time such as lean manufacturing and JIT production, minimizing and altering of the product lifecycle, extension of transportation networks but shortening of lead times, utilizing optimization strategies ultimately expose Supply Chains to more risks. Because of these reasons, firms should put more emphasis on the risk management process and create their procurement and production plans in the light of their risk recognition and assessment (Kırılmaz & Erol, 2016).

However, there is a gap in terms of research pertaining to the South African landscape and the risks which are inherent in our geographical and socio-economic situation. This research intends to focus on recognizing significant supply chain risks and assessing their after-effects on firm performance in the South African context. Similar studies have been conducted in business value which is paramount for Entrepreneurs and investors and venture capitalists to make informed and critical decisions in other geographical areas. Each supply chain manager should consider every element of a Supply Chain while planning and executing Supply Chain Relationship Manager. From a supplier, manufacturer, warehouse, retailer, customer etc. all these stakeholders have goals and risks that contributing to the overall efficiency of the network. As supply chains become

more and more complex, their coordination is an increasingly significant challenge for supply chain agents in industry. With channel coordination, supply chain efficiency has been tremendously improved (Wang, Song, & Wu, 2016).

A lot of content has been researched and studied in the concerned subject in South Africa and surrounding regions. The contribution of this study lies in developing and validating multi-item risk categories for these constructs and establishing where the size or risk propensity of the automotive organization influences the categories chosen to mitigate risks in Gauteng. Furthermore, it will be investigated to determine between Exogenous and endogenous risks factors, which has more significant impact on operations for automotive companies in Gauteng. Risk criterion as well as cost criterion should be considered while making strategic decisions on significant issues regarding transportation routes, amount of production in each manufacturing facility, determination of risk attitude in case of a risk, and while choosing between two alternatives such as multiple versus single supplier, in-house versus global procurement (Kırılmaz & Erol, 2016).

This research study might also enhance South African managers' knowledge, awareness and understanding of indwelling and continuous risk factors and respective strategic solutions to mitigate, eliminate or control them. The managers will be able to take into account the main risk determinants for a supply chain network and avoid risky suppliers in their decision-making process. Procurement plans are usually based on purchasing and transport cost minimization and do usually not delve deeper to consider the identification and evaluation of risk impacts. By researching into the risk constructs, the aim is to contribute to total quality management of South African automotive supply chains by incorporating strategic risk management. There needs to be consolidated and intelligent way to deal with risks facing a manufacturing organization in Gauteng, and devise means and ways to come up with solutions and countermeasures that render the risks harmless to business.

One of the influential subjects in supply chain management is social consciousness in the context of global trade and global warming policies, regulations and best practices especially when deciding the trading partner selection(Desheng Wu, Olson, & Dolgui, 2015). The issue of multi-criteria analysis of trade-offs should also be considered

because it is momentous simultaneously for financial construct of trading off risk and return on investment, and in synergizing complex supply chain systems with many conflicting objectives. This study aims to unpack some of the trade-offs that are made in the South African context. Professionals who might benefit from this study include, supply chain managers and directors, entrepreneurs venturing in to the automotive sector in Gauteng, investors and consultants that are establishing new strategies or analysing investment portfolios in Gauteng. The management of supply chain risk is especially important in viewing the increase in outsourcing business, counteracting global competition, employing stricter requirements for timely delivery, initiating quick technological changes and short product life span (Trkman & McCormack, 2009). This research might allow or add value to managers to proactively engage and defeat automotive supply chain risks, whilst prioritising risk criteria and maximizing the resources to guarantee desired company performance.

In regards to data collection and analysis, this research is going to be qualitative in nature based on previous similar studies in the risk management of supply chain arena done by (Kırılmaz & Erol, 2016) and (Giannakis & Papadopoulos, 2016). The qualitative approach will be better suited for collecting data and analysis to generate insights on the sustainability related supply chance risks inherent in the Gauteng manufacturing environment.

1.5 DELIMITATIONS OF THE STUDY

- This study is not going to focus on the science or modelling of risk, or various dimensions of risk such as: probability of a risk event occurring, consequential probability and severity of the impact.
- Furthermore, this study will not attempt to pick out themes on issues affecting the organizational risk behaviours and security enforcement methods.
- Risks pertaining to natural disasters will not be covered, due to the low occurrence probability, regardless that natural disasters do occur and disrupt businesses.

- Vertical integration and its consequences will not be considered, rather each firm will be considered a single standing entity that creates value (or diminishes value) in the supply chain network.

- The interpretation of the organizational risk behaviour will be determined by the respondents on the data collection tool, although this might be exposed to prejudice and bias.

1.6 DEFINITION OF TERMS

- **Risk** – An incident or situation that promotes or catalyses a threat, danger or disruption to (In the context of this research) normal business operation.

- **Supply chain** - Encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, be they suppliers, intermediaries, third-party service providers or customers (Lavastre, Gunasekaran, & Spalanzani, 2014).

- **Risk Propensity** - Mainly referred to as the existence of risk and consequence that an organization is willing to bear, which includes a scope of range, from risk aversion (strong tendency to avoid uncertainty) to risk taking (strong tendency to explore uncertainty). It is also the likelihood of a firm's acceptance of less or riskier behaviour over time (Kocabasoglu, Prahinski, & Klassen, 2007).

- **Endogenous uncertainty** - As Lavastre et al. (2014) stated:
    - Market turbulence: new products, price sensitivity, level of competition, demand swings, new customers; and other factors that occur within the confines of organizations
    - Technology turbulence with rapid change and high-tech influences.

- **Exogenous uncertainty** - like interest rates, inflation, GDP, commodity prices, terrorism, disasters and strikes (Lavastre et al., 2014).

- **Positive Risk** – An uncertain event or risk that could occur resulting in favourable conditions or opportunities that can bring good fortune or performance.

1.7 ASSUMPTIONS

- Organizational Risk behaviour is considered to be directly related to the level of risk propensity that the organization perceives to have.
- Based upon prior studies done in supply chain management, it is assumed that there is a direct relationship between supply chain risk and firm performance.
- Situational exogenous characteristics to the focal organization but common in South Africa such as technological changes, turbulent and uncertain economic environments, labour strikes, energy outages and supplier defaults are considered to be uniform across all companies examined in this research. These are considered as environmental factors created by natural, political or social events in Gauteng
- However, the endogenous internal factors which are unique for each focal organization such as health and safety risks, demand forecasting errors, machine and information system efficiencies will be factored in the research based on the respective supply chain disruption that can emanate. The sensitivity of the internal factors is crucial.
- The risk propensity is also going to be assumed to be a direct motive and a direct relationship for an organization to develop risk mitigation plans. This study assumes risk taking propensity as a precursor to the initiation and implementation supply chain best practices.
- Risk is universal because it has multiple effects ranging from finance and production to accounting and marketing. The risk focus in on the supply chain activities only.
- Investment costs to mitigate, eliminate or control the associated risks will be externalised to the natural environment and society.
- The list of sustainability-related risks might not be considered as an exhaustive list. Its purpose is to illustrate the wide variety of different risks related to sustainability in the supply chain.

- In this research causal relationships between risk factors (or between the different risk categories) are not investigated in a systematic way. The occurrence of a risk event may be attributed to a number of potential causes. The actual cause might need other complex process like FMEA and root cause analysis (which are not in the scope of this research) and substantial resources to establish and conclude.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION TO LITERATURE REVIEW

The purpose of this section is to explore the relevant literature relating to strategic supply chain management in the automotive industry in Gauteng and provide a detailed analysis of classifications of types of risk and definitions with a comprehensive view of risk management, identification, management and mitigation.

2.2 DEFINITION OF TOPIC OR BACKGROUND DISCUSSION:

2.2.1 SUPPLY CHAIN DEFINITION:

The concept of a supply chain came into being when organizations started realizing immense value in collaborative relationships within and outside their boundaries of operation as single entities. Benefits include lead time reduction, more efficient procurement and logistics operations, efficient sourcing of raw materials, manufacturing and assembly, increased delivery and warehouse and inventory tracking.

According to Tan, Kannan, and Handfield (1998) supply chain management encompasses materials/supply management from the supply of basic raw materials to the final delivery of product (and possible recycling and re-use). Supply chain management focuses on how firms utilise their suppliers' processes, technology and capability to enhance competitive advantage. It is a management philosophy that extends traditional intra-enterprise activities by bringing trading partners together with the common goal of optimisation and efficiency. The nature and concepts show that there are various definitions of supply chain management due to the way it has evolved over the past years. S Croom and Saunders (1995) warn that pursuit of a universal definition may lead to frustration, conflict and highlights the fragmented nature of the field of supply chain management, drawing from various antecedents including industrial economics, systems dynamics, marketing, purchasing and inter-organisational behaviour.

It does not matter whether organizations call it a value chain or logistics chain, the essential functionality of the chains is to ensure that production or service delivery processes in organizations are expedited by material, information and capital flows. An

Integrated supply chain aims to provide and increase value from the multi-tier supplier to the main supplier and finally to the customer.

Furthermore, another summary definition from (Lummus & Vokurka, 1999), of the supply chain can be stated as:

> All the activities involved in delivering a product from raw material through to the customer including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all these activities. Supply chain management coordinates and integrates all these activities into a seamless process (p.11).

It links all the partners in the chain including departments within an organization and the external partners including suppliers, carriers, third-party companies, and information systems providers. Partners benefitting and having vested interests in the supply chain develop interests to improve each other and outperform their competitors through coordinating efforts in continual improvement and aligning their processes with those of their trading partners. Inefficiencies that are observed in individual processes are viewed to affect the whole system and are assessed to ensure sustainable solutions.

2.2.2 WHAT IS SUPPLY CHAIN MANAGEMENT (SCM):

In order to ensure successful supply chain management, all cross functional activities and their intricate business relationships should be integrated. (Lambert & Cooper, 2000) suggest that one of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. The SC is not comprised of firms or entities with one-to-one relationships, or similarly business-to-business relationships, but an interrelated web of numerous relationships and businesses. This definition of supply chain management which is detailed further below is the one that will be full used and integrated into this research study.

Lambert and Cooper (2000) give the following definition of supply chain management:

> Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders.

The tier one and tier two suppliers are member firms (which are all Tier members of the supply chain) which make up the supply chain network structure. There is often confusion in that logistics is the same as supply chain management. They are definitely not the same. However as Lambert and Cooper (2000, p. 66) also agreed with the definition that: "Logistics is basically described as a supply chain orientation meaning from point of origin to point of consumption." Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements (Bowersox, 1997, p. 5).

The supply chain network structure itself is crucial in matching supply with demand and ensuring that the end-product or service reaches the customer in the most efficient way possible. In the current environment, the supply chain has been exposed to numerous paradigm shifts due to the advent of technology and telecommunications networks. As various processes run between the firms through the infrastructure of the supply chain network they need to be managed at appropriate levels of partnership and collaboration. As proposed by Lambert and Cooper (2000) the supply chain structure depends on numerous factors including: The complexity of the product, the number of available suppliers, and the availability of raw materials.

2.2.3 OVERVIEW OF THE AUTOMOTIVE INDUSTRY IN SOUTH AFRICA:

The automotive manufacturing sector is diverse in Gauteng. It ranges from Original Equipment Manufacturers (OEMs) and component manufacturers, to dealerships and commercial vehicle manufacturers. Industry restructuring, fluctuating fuel prices, financial pressures, changing consumer preferences, regulating issues, and the growing demand for more environmentally friendly vehicles are transforming the world's automotive industry and ours closer to home, in Gauteng.

All the factors above create risks that threaten the sustainability, viability and long-term survival of the Gauteng automotive manufacturing sector. Infrastructure costs growing beyond the rate of inflation, a degree of political and policy uncertainty based on the ability to provide consistent electrical, water and human resources - all contribute toward an atmosphere of economic pressure (Mollink & Maile, 2016). Most importers and manufacturers are worried about the value of the Rand and the impact it will have on the South African automotive market.

The automotive industry is the biggest contributor to manufacturing GDP and one of the most dynamic parts of the segment. While other industries are struggling, automotive OEMS have proven resilient, due to the segment's strong degree of integration, with flourishing domestic component suppliers, a solid policy framework and export diversification.

The (Oxford Business Group, 2017) reported that:

> The broader automotive sector contributed 7.2% to GDP in 2014, according to the Automotive Industry Export Council. The sector accounted for 30.2% of manufacturing output and 11.7% of export earnings, some R115.7bn ($10bn), a record, and up 12.7% in 2013.

National Association of Automobile Manufacturers of South Africa (2015, p. 15) reported that, South Africa produced 566,083 vehicles (ranking it the 24th-biggest vehicle manufacturer in the world and accounting for more than two-thirds of Africa's total), exporting 276,873 vehicles. Major international companies manufacturing in South Africa include Toyota, BMW, Mercedes Benz, Volkswagen, Ford, Nissan South Africa Industry and General Motors. The 7 major vehicle producers in South Africa depend on some 400 component manufacturers producing a wide range of parts – catalytic converters, exhaust systems, trim, harnesses, electronics, just-in-time assemblies, bearings, shocks, filters, machined and plastic components, tyres and glass.

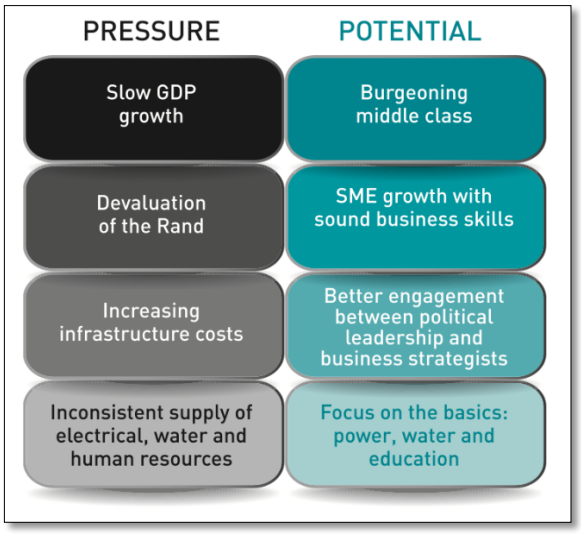


Fig 3: Image extracted from (Mollink & Maile, 2016) Automotive Future Now Report for SA Automotive Sector.

The vehicle and component manufacturing industries represent a key driver of economic growth and employment creation. According to Vermeulen (2016)

> The SA auto industry in 2015 contributed 7.5% to South Africa's Gross Domestic Product, up from 7.2% in 2014. The industry contributed 33.5% of South Africa's manufacturing output in 2016, up from 30.2% in 2015. South Africa is ranked internationally as 21st in terms of production and comprises about 0.7% of global production of 90 million vehicles. The aim is to grow SA vehicle production, principally through exports to at least 1.0% of global production by 2020 as reported and presented by Vermeulen (2016).

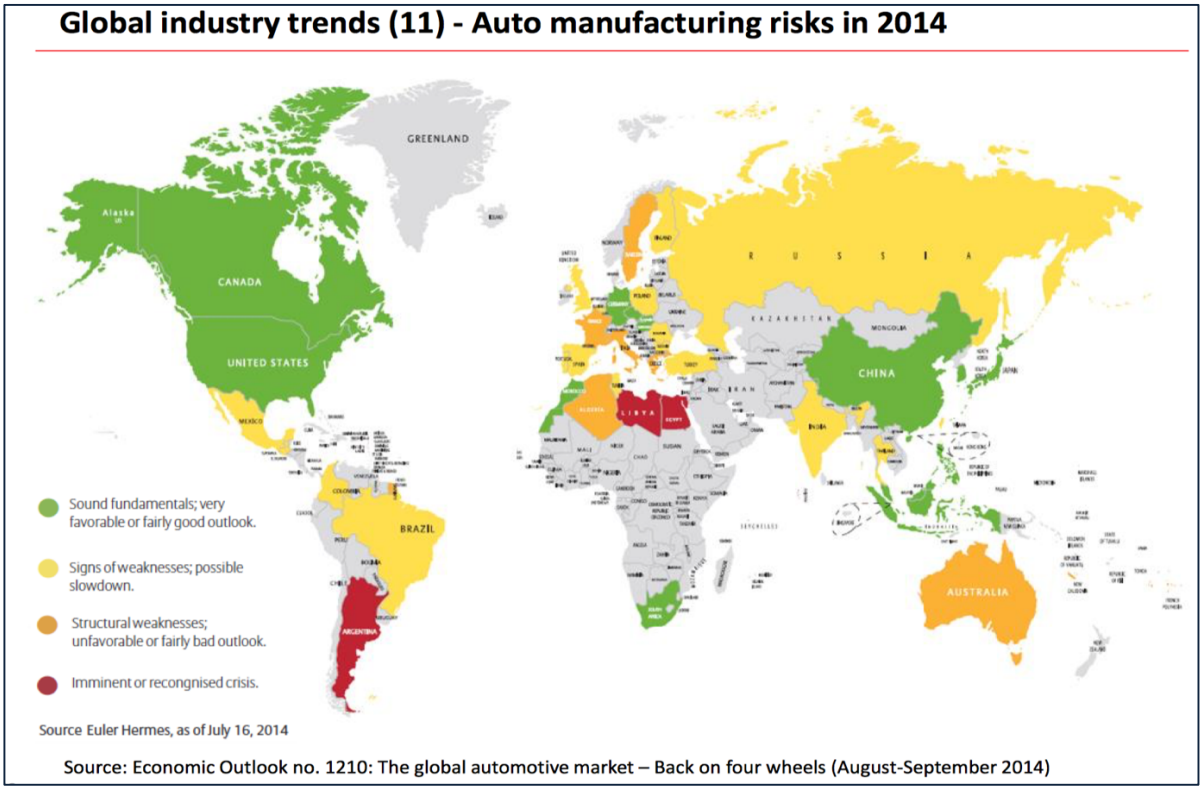


Fig 4: Image extracted from (Mollink & Maile, 2016) Automotive Manufacturing Risks in 2014.

Mollink and Maile (2016) reported that The Automotive Production and Development Plan (APDP) programme that was implemented in 2013 is seen as an essential and necessary step in the right direction, without which the automotive industry in South Africa would barely exist. The benefits of the APDP programme are based on export volumes and at volumes of 50 000 and above, the APDP incentives kick-in for Gauteng automotive manufacturers. There are, however, several smaller manufacturers who cannot reach these volumes. Employment in the vehicle and component manufacturing sectors has been consistent and held up well. Employment by vehicle manufacturers, on the back of higher production numbers, has increased by 1 200 to over 31 000 jobs over the past 15 months currently, 83 000 people are employed in the component industry.

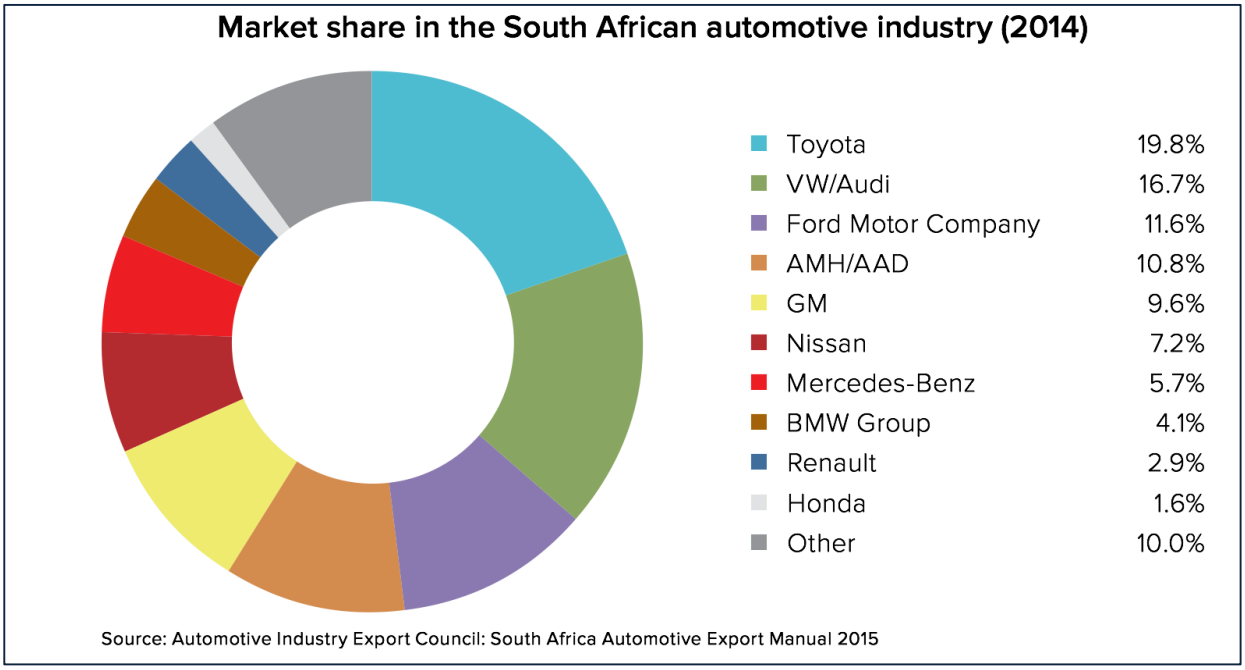


Fig 5: Image extracted from (The Department of Trade and Industry, 2015) market share

The introduction of the Automotive Production and Development Programme (APDP) has bolstered the automotive sector's performance. Government's bold step to provide policy certainty in this sector is bearing fruit. The year 2015 was notable for a steady stream of new investments by automotive original equipment manufacturers (OEMs) in their South African plants according to The Department of Trade and Industry (2016). The industry saw its export earnings significantly increasing by 30.9%, from R115 billion in 2014 to R151.5 billion in 2015, accounting for 14.6% of total export earnings. In addition, vehicle production increased by more than 49 000 units, from 566 131 in 2014 to 615 658 in 2015, and South Africa now accounts for 68% of vehicle production in Africa as reported by the The Department of Trade and Industry (2016).

Vermeulen (2016) discussed that significant model rationalisation has resulted in a reduction from 42 platforms produced in South Africa 20 years ago to 12 platforms today. This in turn has contributed to substantially higher volumes per model produced and has generated economies of scale benefits and reduced complexity for suppliers. Stability in the automotive industry developmental policy framework is a key imperative to drive industry investment and future growth and development. In the final analysis, strong global linkages, supplier development and competitiveness improvement will remain critically important to support sustainable future development of the SA automotive industry Automotive Industry Export Council (2016).

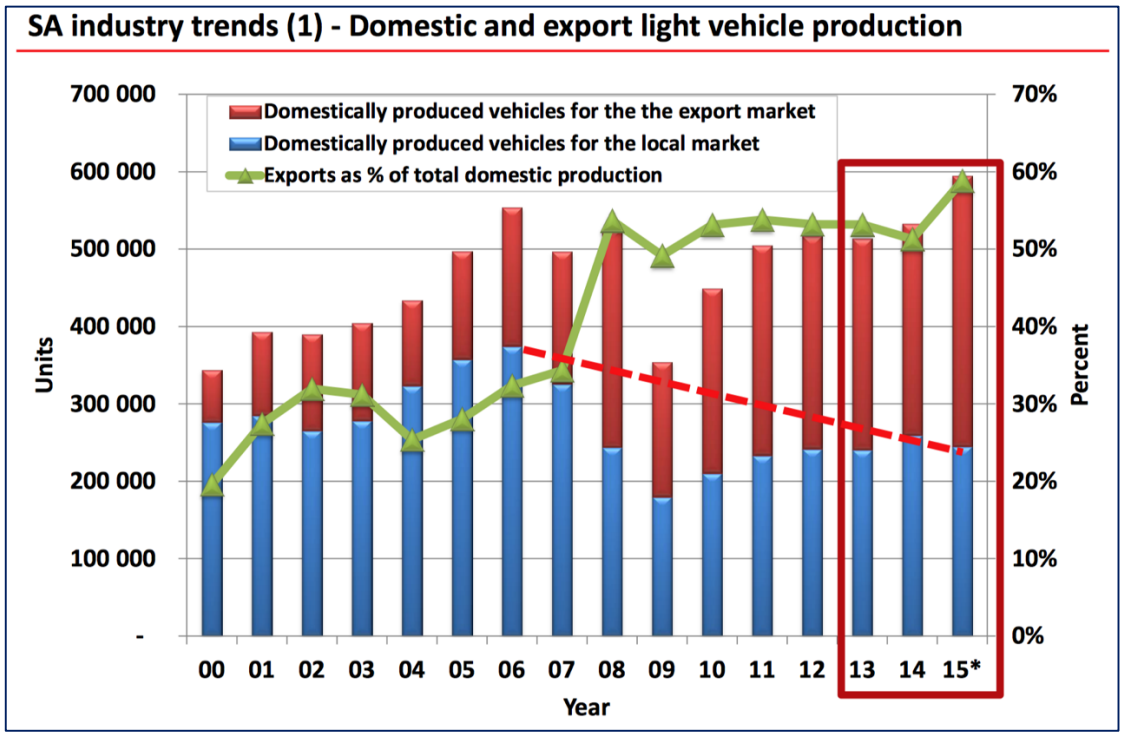


Fig 6: Image extracted from (National Association of Automobile Manufacturers of South Africa, 2015)

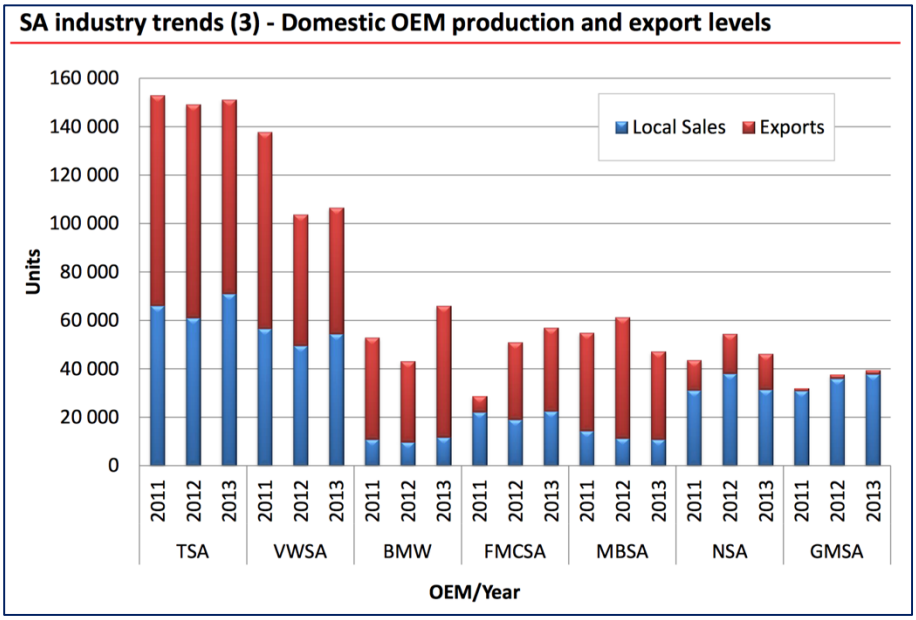


Fig 7: Image extracted from (National Association of Automobile Manufacturers of South Africa, 2015)

Competitive suppliers are and will remain strategically important to the future of the industry. In this regard, NAAMSA (National Association of Automobile Manufacturers of South Africa) initiated the Automotive Supply Chain Competitiveness Improvement (ASCCI) Programme. National Association of Automobile Manufacturers of South Africa

(2015) acknowledged that the programme is aimed at deepening the local component supply chain, growing local value addition and specific interventions such as the pooling of manufacturer's volumes to enhance localisation opportunities and supplier competitiveness improvement initiatives.

2.2.4 FOCUS ON THE GAUTENG AUTOMOTIVE SECTOR:

Gauteng occupies a pre-eminent position in the SA Auto Industry with the largest concentration of automotive manufacturing companies in the country. Three large OEMs (BMW, Ford, Nissan) and around 40% of national component manufacturing operations are located in the Province. Gauteng accounts for about 24% (13 million people) of South Africa's population but accounts for 39% of all vehicles in the country, 35.5% of new car sales, 31.2% of light commercial sales, 36% of truck sales and 43.2% of vehicle exports as specified by National Association of Automobile Manufacturers of South Africa (2015).

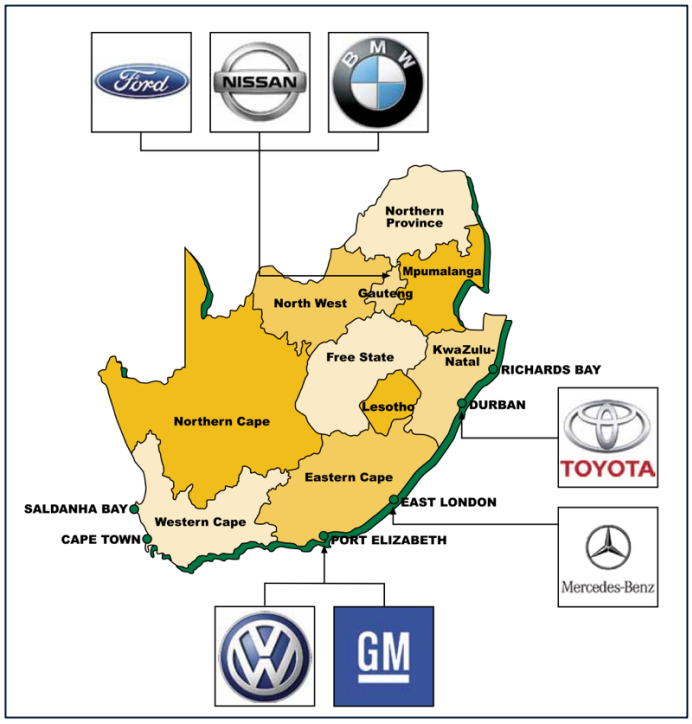


Fig 8: Image extracted from (National Association of Automobile Manufacturers of South Africa, 2015)

The Gauteng Growth and Development Agency (GGDA) is responsible for the promotion of trade and investment and project implementation in the province, and via its two

automotive specific subsidiaries, the Automotive Industry Development Centre (AIDC) and the Automotive Supplier Park (ASP), provides support to the automotive industry.

The med-term future of the Gauteng Automotive Industry is closely linked to the performance of the 3 main vehicle manufacturers and their component suppliers. Whilst significant opportunities for critical economies of scale for component manufacturers exist, the Gauteng Automotive Industry, dependent on increasing levels of exports.

The major limitation for Gauteng is the disadvantage of lack of proximity to a port. Whilst Gauteng is close to South Africa's main market, is an advantage, the cost of logistics/transport in respect of exports represents an impediment. Improving logistics and supply chain processes and reducing costs is a key competitiveness imperative. Improved levels of competition amongst component suppliers is crucial to the success of the broader automotive industry, particularly in Gauteng.

The minimum objective of the Provincial Government should be to maintain Gauteng's contribution to the National Automotive Industry around 36% of production and to facilitate further growth to 40% plus by 2020 as indicated by Vermeulen (2016). Gauteng's automotive sector has long received a substantial measure of state support and has gained global recognition for the build quality of its vehicles (Industrial Development Corporation, 2016). The export market for the Gauteng automotive manufacturers is proving to be vital in sustaining the industry. In addition, the amount of products and components that are still being imported from overseas is a big cost impact and also supply chain performance driver that is constantly scrutinized for cost reduction opportunities. If more localization of these components can be achieved, then this will drastically reduce the ex-works cost of the model derivatives manufactured.

Gauteng – key automotive features – 2015

Key automotive features	Gauteng
OEMs (manufacturing plants)	BMW SA Nissan SA Ford Motor Company of Southern Africa
Medium, heavy, extra heavy commercial vehicle and bus companies	Associated Motor Holdings (AMH), Babcock, Busmark 2000, Fiat Group, Ford, Freightliner, Fuso, Iveco SA, JMC SA, MAN Truck & Bus, MarcoPolo, NC 2 Trucks Southern Africa, Peugeot Citroen SA, Powerstar SA, Renault Trucks, Scania, TATA Motors, VDL Bus & Coach and Volvo Group Southern Africa
Number of automotive component companies	200
Motor vehicle parc as % of South Africa's total vehicle parc of 11,71 million vehicles	38,6%
Passenger car sales as % of total 2015 passenger car sales of 412 670 units	35,3%
LCV sales as % of total 2015 LCV sales of 174 544 units	31,2%
MCV/HCV sales as % of total 2015 MCV/HCV sales of 30 535 units	36,2%
Light vehicle production by OEMs in the province as % of total 2015 light vehicle production of 583 999 units	30,9%
Light vehicle exports by OEMs in the province as % of total 2015 exports of 333 802 units	33,3%

Source: NAACAM, NAAMSA/Lightstone Auto

Table 1: Image extracted from (Mollink & Maile, 2016) Automotive Future Now Report

Despite the absence of a port, Gauteng offers an excellent manufacturing base with access to various logistics corridors linking it to various distribution networks. It has a well-developed road, rail and air infrastructure for the efficient export and import of goods Automotive Industry Development Centre (2015). A key drive for the AIDC is to promote Gauteng as an attractive automotive destination. Gauteng, although landlocked, is close to the Northern borders of South Africa, making it an ideal gateway to sub-Saharan Africa. The Provincial Government, the DTI and the Industry continue to focus on competitiveness improvement initiatives in the Automotive Value Chain – particularly component manufacturers and logistics. There is a focus on expanding existing support through the Automotive Industry Development Centre (AIDC) and the Automotive Supply Chain Competitiveness Initiative (ASCCI).

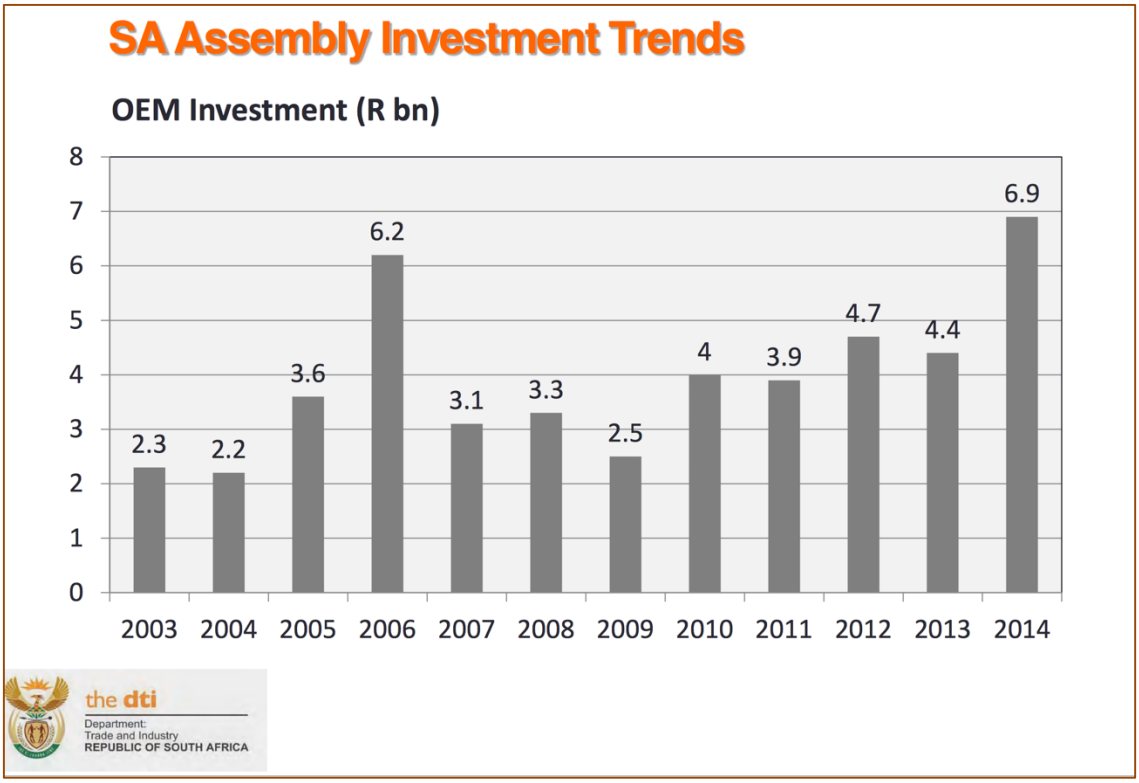


Fig 9: Image extracted from (The Department of Trade and Industry, 2015)

The AIDC has contributed positively in Gauteng with several areas including enterprise development (incubation projects), supplier development, skills development, supplier parks and supporting empowerment projects. ASCCI (Automotive Soppy Chain Competitiveness Initiative) has contributed positively in supplier competitiveness improvement projects, introduction of world class manufacturing initiatives and localisation projects. The growth potential of the SA Automotive Industry (including Gauteng) remains above average and with the right policies, interventions and goodwill by all auto industry stakeholders – the industry can go from strength to strength and, in the process, realize the objective of higher vehicle production in South Africa, making a positive contribution to the future growth and development of the country and creating sustainable employment as claimed by National Association of Automobile Manufacturers of South Africa (2015).

Continued strategic alignment between Gauteng Municipalities, Provincial and National Government, the Unions, Suppliers and vehicle manufacturers requires ongoing focused attention and monitoring to realize the full intended benefits.

2.2.5 ORIGINAL EQUIPMENT MANUFACTURES IN GAUTENG:

The automotive industry is central to the South African government's efforts to industrialise the country's economy, as South Africa is increasingly being recognised as a world class manufacturer of vehicles and automotive components. Gauteng is South Africa's economic powerhouse and is regarded as the preferred destination for international investors wishing to establish a springboard into Africa. Gauteng houses three main OEMs and the highest number of the country's automotive component suppliers. Details of each one follows below:

BMW SOUTH AFRICA

The automotive industry report by Barradas, David, and Theron (2015) contained the following in information in the OEM:

> BMW South Africa (SA), a subsidiary of German automaker BMW, operates a production facility in Rosslyn, Gauteng, where it produces BMW 3 Series vehicles for the local and export market. The plant, which entered production in 1973, was BMW's first production facility outside Germany, and now forms part of BMW's global production network that spans 30 sites in 14 countries.
>
> In 2014, the BMW SA plant produced 68 771 BMW 3-Series vehicles, and in March 2015 the plant celebrated the production of its one-millionth 3-Series vehicle. BMW SA exported 60 234 vehicles in 2014, which were delivered to countries including China, the US, South Korea, Australia, Japan and Canada. This was a record number of exports for the company, and a 17% increase on the number of vehicles it exported in 2013. The company expects its 2015 production to be linked to demand in its export markets, and it expects local sales of BMW vehicles to remain stable for the year.
>
> With regard to labour disruptions, BMW SA recorded 13 000 vehicles in lost production during the strike action that affected the automotive industry in 2013. In late 2013, the company reported that it had missed out on an opportunity to

possibly produce a second model at its Rosslyn plant, owing to the labour turmoil. It has warned that labour instability poses a threat to South Africa's international reputation.

BMW SA directly and indirectly employs more than 43 000 people – 3 737 employees at the plant and at the national sales organisation, 3 780 dealer staff and more than 36 000 first-tier supplier employees.

NISSAN SOUTH AFRICA

The automotive industry report by Barradas et al. (2015) contained the following in information in the OEM:

Nissan South Africa (SA), the local arm of Japan-based Nissan, has a manufacturing facility based in Rosslyn, Gauteng. The plant currently produces the NP200 half- ton pick-up and the NP300 Hardbody one-tonner. The plant also previously produced the Renault Sandero, owing to the global alliance between Nissan and Renault, but production of this vehicle in South Africa has ceased, as the updated Sandero model no longer shares a platform with the NP200. Nissan SA has the capacity to produce about 100 000 vehicles a year, but is operating at about half of its capacity.

Local production of a new pick-up, to replace the assembly of the NP300, was expected to start in early 2015, but has been deferred, according to Nissan SA MD Mike Whitfield. The company has suffered several delays to the global introduction of the new model, set to replace the Hardbody and Navara.

Nissan SA remains a possible production location for Nissan's revived, lower-cost Datsun brand. However, the company will first seek to re-establish the Datsun brand in South Africa, and will then consider local assembly. The other brand sold by Nissan in South Africa is Infiniti – a premium vehicle badge.

Meanwhile, Nissan SA is shipping semi-knocked-down kits of the NP300 to Nigeria for assembly at Nissan's new plant there.

FORD MOTOR COMPANY OF SOUTHERN AFRICA:

The automotive industry report by Barradas et al. (2015) contained the following in information on the OEM:

> Ford Motor Company of Southern Africa (FMCSA), which is a wholly owned subsidiary of US-based Ford Motor Company, operates two manufacturing plants in South Africa – a vehicle plant in Silverton, Gauteng, and an engine plant in Struandale, in the Eastern Cape. Ford has a market share of about 13% in South Africa.
>
> In 2014, FMCSA produced 76 373 vehicles at its Silverton plant, with one of the key vehicles produced by the plant being the Ford Ranger vehicle. The Ford Ranger was the fourth-highest selling vehicle in South Africa in 2014, with 28 723 units being sold in the year. The vehicle is also extremely popular in international markets. About two-thirds of FMCSA's production is exported, to about 150 countries.
>
> The capacity of Ford's Silverton plant has doubled over the past three years, with this growth facilitated by a substantial investment in the company's manufacturing and assembly operations. It is feasible for the firm to double its capacity again over the next three years. However, this would require that the challenges facing the company in South Africa – such as power shortages, labour instability, and the absence of affordable, efficient logistics – be resolved. It has been reported that Ford is mulling vehicle assembly in Nigeria. However, the company has noted that it would like to see the Silverton plant operating at capacity before any new capacity is installed elsewhere on the continent.
>
> Ford's engine plant celebrated the production of its three-millionth engine in mid-2014. The facility, which was established in 1964 and which employs about 600 people, received a major boost in 2010 when it was awarded the export contract to manufacture machine components. Until recently, FMCSA also distributed Mazda vehicles. However, as of October 2014, Mazda has been distributed through Mazda Southern Africa. This followed an announcement by Ford in 2013 that it would return the Southern African distribution rights to the Mazda Motor

Corporation. FMCSA will continue to assemble the Mazda BT-50 pick-up at its Silverton plant. However, this will not necessarily be the case for Mazda's next generation pick-up. South Africa could, however, be considered as a future Mazda assembly destination.

IVECO SOUTH AFRICA:

The summary below was extracted from the IVECO SA website (IVECO South Africa, 2016):

> IVECO was founded in 1975 and is a world leader in road transport. Today, the Company is present in over 160 countries. IVECO has a long history with South Africa. The company first commenced with the import, sales and distribution of its vehicles in South Africa over 20 years ago in 1993. Now IVECO has 18 sales and service dealers, 11 service dealers and 4 authorised repairers to provide transport to professionals with nationwide coverage of 29 points located from the North to the South of the country.
>
> In France, IVECO owns two manufacturing sites: In Annonay (more than 1200 employees) and Rorthais (450 employees). In 2013, both of the production sites winning the label "French origin guaranteed".
>
> As of July this year, production at the new Rosslyn plant started on the assembly of medium, heavy and extra-heavy duty commercial vehicles, in addition to front engine and low floor city buses. This new plant will be supplied by the Annonay production site.

UD TRUCKS SOUTHERN AFRICA:

The summary below was extracted from the UD Trucks SA website (UD Trucks Southern Africa, 2016):

> Throughout its rich and diverse history in South Africa, UD Trucks has produced legendary vehicles that have built an outstanding reputation in the local transport industry. This is mainly due to their unrelenting reliability, versatile performance and suitability to South African road and operating conditions. It all began in 1962, when the first UD Trucks vehicles were imported into the country by Stanley

Motors in Johannesburg. This model series was originally known as the T80 and T81, both 4x2 units."

From 1998 to 1999, Nissan Diesel also launched its Extra Heavy Vehicle range with OE engines namely the PF6 series, and in the process became the first manufacturer to complete the transition back to Original Equipment. The company also embarked on its first venture into the 6x4 high-end truck-tractor market segment with the UD 430 WT featuring a RF8 engine. In 2002, Nissan Diesel South Africa formally separated from the passenger car operations to become a dedicated trucking company, with 80% of the company owned by Nissan Diesel Motor Corporation in Japan and the balance held by Mitsui.

In 2012, UD Trucks Southern Africa once again moved the benchmark higher with the launch of the new generation Quon extra heavy range. The range consisting of 14 model derivatives was launched in the local market in March 2012.

UD Trucks assemble its range of medium, heavy and extra heavy commercial vehicles according to world-class quality standards at its plant in Rosslyn, Pretoria. The company's team of engineers are continuously researching, developing and testing the UD Trucks product range to ensure they are suited to Southern African road and operating conditions. UD Trucks is also constantly developing, strengthening and training its already comprehensive regional dealer network. The 64 UD Trucks dealers across Southern and Eastern Africa are always ready to support customers with manufacturer-endorsed sales, service, parts, as well as financial and fleet solutions.

South Africa remains the automotive powerhouse of the continent, but manufacturers in this market will shift their production lines to cater for the export market as local demand in South Africa will remain subdued in the next 5 years Parker, Byron, and Ryan (2016).

2.2.6 CONCEPTUAL FRAMEWORK OF SUPPLY CHAIN MANAGEMENT (SCM):

Like any other interconnected and interrelated management structure, the success of the SCM framework requires careful planning, design-work and practicality that delivers distribution channels for maximum customer accessibility at minimum cost. The SC network structure is comprised of constituent companies and their links between these

companies. From gathering and acquiring raw materials to the point of consumption at the customer site, the critical dimension of the length of the supply chain is paramount. The length of the supply chain is determined by what exactly is being processed from the upstream to the downstream processes that the focal company interacts directly or indirectly with through its suppliers or customers.

As acknowledged by Simon Croom, Romano, and Giannakis (2000) a typical supply chain network upstream will consist of the following elements: Supply network sourcing, transportation routes, rationalisation, supply network structure, partnership sourcing, lean supply, network sourcing, supply base integration and interplant planning and logistical integration.

Furthermore, Simon Croom et al. (2000) also found that the supply chain network downstream will typically consist of the following elements: transportation routes rationalisation, distribution channel redesign and Facilities location (warehouses, etc.)

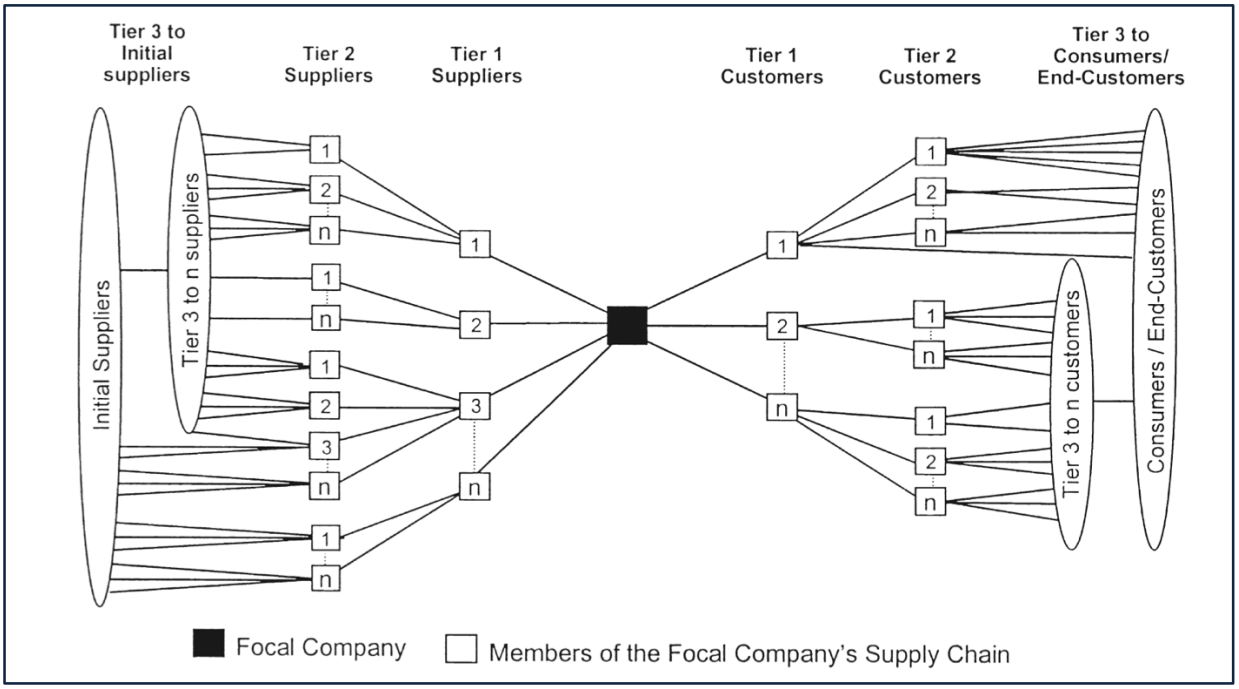


Fig 10: Image extracted from (Lambert & Cooper, 2000): Supply Chain Network Structure

The supply chain network structure should cater for the accurate and timely flow of information, through the growth of e-commerce business platforms in South Africa, most companies have opportunities to enable them to obtain and build integrated databases

and synergistic data sharing. Efficient information flow will guarantee better visibility of fluctuating customer demand, supplier performance metrics and quick response to make sure the whole value chain remains customer-centric.

Lambert and Cooper (2000) illustrated that:

> Three structural dimensions of the network are essential when describing, analysing, and managing the supply chain. These dimensions are the horizontal structure, the vertical structure, and the horizontal position of the focal company within the end points of the supply chain.

Horizontal Structure	Number of tiers across the supply chain.
Vertical Structure	Number of suppliers or customers represented within each tier.
Horizontal Position	A company can be positioned at or near the initial source of supply, be at or near to the ultimate customer, or somewhere between these end points of the supply chain.

Table 2: Table extracted from (Lambert & Cooper, 2000): Supply Chain Network Structure

These dimensions are significant in determining the best strategies to employ in regards to decision making and maintaining a competitive advantage through a capable supply chain structure. Typical decision making and strategy execution may warrant an increase or decrease in the length or width of the supply chain structure or affect the relative horizontal position of the **focal company**. Of course, interrelated roles and perspectives of each member firm will be scrutinized to ensure maximum benefit.

Hallikas, Karvonen, Pulkkinen, Virolainen, and Tuominen (2004) concluded that in network collaboration, companies deepen their relationship with partners and thus become more dependent on each other. The key success factors in networking, and the motives for entering a partnership or alliance form the basis for the development of network arrangements. They also maintained that opportunities like reduced transactions costs, ability to concentrate on core skills, access to key technologies, and risk sharing among partners give direction for the development process.

2.2.7 SCM BUSINESS PROCESSES:

Depending on the company or industry in South Africa, the key supply chain processes can include:

Table 3: Table extracted from (Lambert & Cooper, 2000): Supply Chain Risk Management

Customer relationship management	Identifying key customers which the focal company targets as critical to its operations and how to guarantee maximum customer satisfaction. (Manuj & Mentzer, 2008)
Customer service management	Key point of contact for administering the product/service agreement. Customer service provides the customer with real-time information on promised shipping dates and product availability through interfaces with the organizations' production and distribution operations. (Lambert & Cooper, 2000)
Demand management	Managing inventory variability together with real-time customer demand. Customer irregular order patterns must be dealt with through the company's capabilities to supply (Peck, 2006)
Manufacturing flow management	A customer pull process instead of making to stock is ideal to avoid excess inventory costs. A rapid and flexible manufacturing process able to meet customer demand will reduce cycle times and perform rapid changeover to accommodate mass customization and improved responsiveness to customers.(Sheffi & Rice Jr, 2005)
Order Fulfilment	On time delivery of orders from customers through seamlessly streamlining all internal processes. Performing the order fulfilment

	process effectively requires integration of the firm's manufacturing, distribution, and transportation plans. (Lambert & Cooper, 2000) Objective is to also reduce the total delivered cost to the customer.
Procurement	Strategic plans are developed with suppliers to support the manufacturing flow management process and development of new products.(Lambert & Cooper, 2000) Effective communication guarantees coordination between various stakeholders. Buyers should focus their efforts on managing suppliers as opposed to placing orders and expediting.
Product development and commercialization	If new products are the lifeblood of a corporation, customers and suppliers must be integrated into the product development process to reduce time to market. As product life cycles shorten, the right products must be developed and successfully launched in ever shorter timeframes to remain competitive. (Lambert & Cooper, 2000)
Returns.	Effective process management of returns enables identification of productivity improvement opportunities and breakthrough projects. (Lambert & Cooper, 2000)

2.3 FIRST SUB-PROBLEM DISCUSSION

The first sub problem is:

Supply chain practitioners need to be competent in identifying significant supply chain risks in the Gauteng automotive sector regardless of the inherent complexity to ensure businesses perform well.

2.3.1 RISKS IN SUPPLY CHAIN MANAGEMENT

Globalization, e-trade, advanced technologies and emerging production techniques have increased supply chains' efficiency and added value. However, despite numerous advantages, these factors make supply chains more fragile and vulnerable to risks. (Kırılmaz & Erol, 2016, p. 12). The global landscape is changing at an alarming rate and is posing multiple challenges to those who are attempting to optimize their supply chain in South Africa. In the past, when firms manufactured in-house, sourced locally and sold direct to the customer, risk was less diffused and easier to manage as depicted by Harland, Brenchley, and Walker (2003).

As new competitors enter the automotive market in Gauteng such as IVECO, product lifecycles are diminishing and customers become more demanding in their requirements as their expectations are not just based on cost and performance of product or service but are evolving into ethical, environmental, and sustainability concerns. Such a dynamic and complex environment adds a challenging new dimension as companies seek ways not just to manage the change, but also to use their supply chains as a source of competitive advantage as they focus beyond their organizational boundaries. The pursuit of collaboration beyond an organization's borders, is increasingly recognised as an effective strategy to deal with some of the contemporary challenges facing global supply chains.

"The previously, relatively simple business-to-business or business-to-customer relationships involving product/service and payment exchanges conducted at arm's length are now embedded in complex inter-organisation network flows of intangible and tangible features" as recognized by Harland et al. (2003, p. 53). The intangible features

in networks are difficult to examine as they are 'tangled up' with many other features and their accrual is highly context specific, Araujo and Easton (1999) also recognised a similar observation.

Risk is defined as an incident or situation that promotes or catalyses a threat, danger or disruption to (In the context of this research) normal business operation.

Zsidisin (2003) later defined supply risk:

> As the probability of an incident associated with inbound supply from an individual supplier failure or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or causes threats to customer life and safety". (p. 217)

In addition, Peck (2006) defined it as "anything that disrupts or impedes the information, material or product flows from original suppliers to the delivery of the final product to the ultimate end user".

Chopra and Sodhi (2004) suggested that typical supply chain risks involve disruptions and delays caused by supply risks such supply capacity constraints, quality issues, supplier liquidity problems, supplier dependency, product design changes, delivery delays. Procurement related risks referred to by Hallikas, Virolainen, and Tuominen (2002) include exchange rates, inventories and stock-outs. Followed by the logistics and transportation risks which were suggested by T. Wu and Blackhurst (2009). Furthermore, there are demand risks which were mentioned by Zsidisin, Ellram, Carter, and Cavinato (2004) such as demand volatility and inaccurate forecasts, information distortion and stock accumulation due to the bullwhip effect. Therefore, with such a wide gamut of risks that are potent to the supply chain, Faisal (2009, p. 42) suggested a representative classification of supply chain risks separates them into two major categories:

> Endogenous risks that are caused by companies' activities along their supply chains and exogenous risks that are brought about to companies by their interaction with external environment that they operate.

The observations of the above-mentioned risks have led to the necessity of developing procedures and techniques for identifying, assessing and mitigating supply chain risk. Xie, Anumba, Lee, Tummala, and Schoenherr (2011) apply the risk management

process (in general terms: Identify and assess risks and identify and prioritise mitigation measures) to the supply chain context. This approach allows managers to face risks in a more systematic way, enabling prioritising measures on the basis of available resources and desired performance.

The literature analysis suggests that inter- and intra-organisational factors play an important role of a firm's pro-activeness in managing supply risks. As this is also in line with contingency theory, which suggests that an optimal course of action is dependent on the internal and external situation of a firm. Grötsch et al. (2013). One can say that risk varies depending on the quality of SCM, therefore, everything that influences SCM indirectly influences supply chain risk Lavastre et al. (2014). Trkman and McCormack (2009) explain that SCRM is mainly influenced by supplier's attributes, which are defined by the market, technology and the environmental turbulence experienced by each supplier and sub supplier.

Supply chain integration is also considered to be an effective strategy in mitigating the risk of supply chain interruption, and has a direct positive influence on the formation of warning and recovery capability of firms as researched by Shao (2013, p. 287). Companies also must accept some degree of risk and apply risk mitigation strategies to gain a competitive advantage and make profit. For example, to reduce raw material and production costs companies may decide to outsource certain items, materials or sub-assemblies to other countries in the Far East thus increasing globalization and e-trade. However, long supply chains (SC) and intercontinental transportation are subject to numerous risks arising from communication, geopolitical, cultural, transportation or legal complexities. If one or more of these risks emerge, firms are likely to encounter much higher costs rather than the financial advantage of supplying from intercontinental instead of local suppliers.

2.3.2 OUTSOURCING AS A RISK IN SCM

According to Walker, Knight, and Harland (2001)brings competence and technology to the whole supply chain by using other players and experts who can add value to the focal company. Outsourcing not only impacts on the organisation and its immediate

relationships, but also changes supply network structure and processes. Thus networks have become more globalized. However, by globalizing and outsourcing, the focal company is also sacrificing a debatable degree of control and influence regarding its production process and this can be a risk especially if outsourcing is conducted with institutions that prove to be unreliable in future.

Fombrun and Wally (1992) formulated that the transnational mobility of capital, information, people, products and services is increasing, leading to “global entanglements”. These global entanglements represent the inter-networking and inter-relatedness amongst organizations for services, products and resources. This vast and complex network and information sharing does bring about its disputes, challenges, benefits and opportunities.

Harland (1997, p. 73) noted that:

> Strategic intent, global brands, economies of scale and scope, management of the value chain, comparative advantage, market access, the growth of free trade and facilitating information technologies, most recently e-business, have all been cited by various authors as contributory reasons for globalization.

Furthermore, the advent of technology and e-commerce has enabled firms to respond quickly to the rapidly changing market demands and surged the capability to acquire new markets and suppliers. Outsourcing is a recent trend, usually adopted to gain lower production costs, but also can be used to reduce core organizational risk. In a global market, supply management offshore-sourcing strategies can include manufacturers at low cost locations such as China, India, or Vietnam, assemblers at high-tech operations in Taiwan and Korea, and distributors where customers reside all over the globe (Dexiang Wu, Wu, Zhang, & Olson, 2013, p. 247)

2.3.3 TYPES OF RISK IN SUPPLY CHAIN MANAGEMENT:

Situations can give rise to different types of loss (Harland et al., 2003, p. 58). Brand Reputation is always at risk if a company is constantly in the blind spot of its vulnerable activities. Today, supply chains across industries are being stretched the way it was never done before. The most trusted brands and suppliers do only the sub-assembling and approved redesign of components which are outsourced for manufacturing (Venkatesh, Rathi, & Patwa, 2015, p. 162).

Table 4: Types of risk in Supply Chain Risk Management

Type of Risk	Source	Description
Strategic risk	Simons (1999)	Affects business strategy implementation
Operations risk	(Meulbrook, 2000) (Simons, 1999)	Affects a firm's internal ability to produce and supply goods/services ''…..results from the consequences of a breakdown in a core operating, manufacturing or processing capability''
Customer risk	(Simons, 1999) (Smallman, 1996)	Affects likelihood of customers placing orders; grouped with factors such as product obsolescence in 'product/market risk'
Supply Risk	Meulbrook, 2000)	Adversely affects inward flow of any type of resource to enable operations to take place; also termed 'input risk' Categorized by Smallman with human technological and organisational risks as 'direct risks'
Asset impairment risk	(Simons, 1999)	Reduces utilisation of an asset and can arise when the ability of the asset to generate income is reduced.
Competitive risk	(Simons, 1999)	Affects a firm's ability to differentiate its products/services from its competitors.
Reputation risk	(Schwartz & Gibb, 1999)	Erodes value of whole business due to loss of confidence. Examples are Nestlé's baby milk issue and Shell's Brent Spar oil platform disposal issue.
Financial risk	Meulbrook (2000)	Exposes a firm to potential loss through changes in financial markets; can also occur when specific debtors default.
Fiscal risk	Meulbrook (2000)	Arises through changes in taxation.
Regulatory risk	Meulbrook 2000) (Cousins, Lamming, & Bowen, 2004) (Smallman, 1996)	Exposes the firm with changes in regulations affecting the firm's business, such as environmental regulation. Categorized by Smallman as 'indirect risks'
Legal risk	Meulbrook (2000)	Exposes the firm to litigation with action arising from customers, suppliers, shareholders or employees.

Many disruptions and risk factors have threatened manufacturing, production service and retail distribution systems. Current business best practice and incorporates risk and risk taking at various organizational levels, balancing risk and reward subsequently with the intent to realize a benefit instead of a loss from the venture. Business entities are always exposed to potential risks as they are interconnected in a supply chain. The performance of a business entity would be disturbed by the realization of risks, and substantial effort would be required to bring its performance back to the previous level (Lee, Zhou, de Souza, & Park, 2016, p. 153).

As further reiterated by Lee et al. (2016) it is important for a firm to understand its risk exposure level within the supply chain, especially the risk caused by its suppliers. This is crucial in helping to maintain the supply chain network risk exposure level. The selection of suppliers in a global market is often considered as a problem involving complex systems. This has been severe under the supply chain management framework, because the factors such as default risk from other SC members and the effects to SC partners need to be considered (Dexiang Wu et al., 2013, p. 250).

2.3.4 RESEARCH QUESTION 1

The critical question for this study is to seek **gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance?**

The research instrument will seek to identify the supply chain risk factors that are prevalent in the current automotive sector in Gauteng. These factors should be the ones that cause the most disruption, and have a negative impact on the supply chain. The aim of is to also uncover the apparent supply chain visibility and disruption warning capabilities of participating firms.

2.4 SECOND SUB-PROBLEM DISCUSSION

The second sub problem is: **Once the comprehensive risk drivers and sources are identified in the Gauteng Automotive manufacturing sector, how do supply chain professionals select which effective strategic risk management methods**

and systems, have the best intended positive impact on their business objectives and targets.

2.4.1 TYPICAL RISK MANAGEMENT PROCESS IN SCM

According to Hallikas et al. (2004) typical risk management process enterprise consists of the following steps:

1. Risk identification.
2. Risk assessment.
3. Decision and implementation of risk management actions.
4. Risk monitoring.

The method in which supply chain risk management is currently being conducted details the characterization, classification of SC risks and the foundation of their sources. As the interconnections of the enterprises in the network make them dependent on each other, it can be useful to share partially the risk management process and to develop collaborative means to manage the risks (Hallikas et al., 2004).

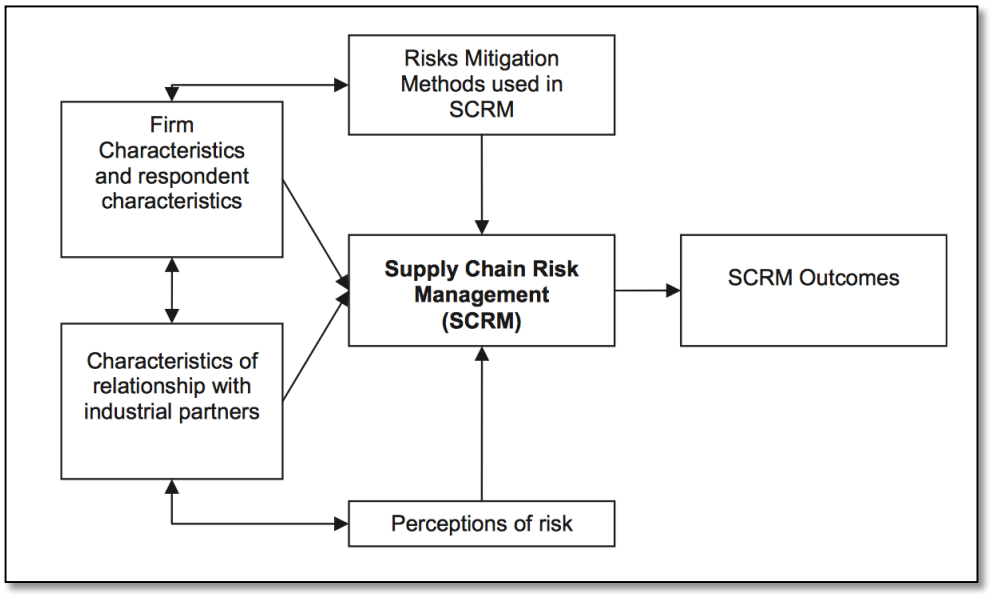


Fig 11: Image extracted from (Lambert & Cooper, 2000): Supply Chain Network Structure

2.4.2 RISK IDENTIFICATION:

This is the first step in the risk management process and Hallikas et al. (2004) discussed through identifying the risks, the supply chain specialists gain

consciousness on actions or phenomena which lead to uncertainty. The main focus of risk identification is to recognize future uncertainties to be able to manage these scenarios proactively. Walker et al. (2001) also denote that the likelihood of an event occurring depends partly on the extent of the exposure to risk and partly on the likelihood of a trigger that will realise the risk.

It is crucial for South African companies to understand that each firm is responsible for managing and acting on its identified risks. Since risk identification is not an easy task, each firm should consult the rest of its network and use information sharing or bid data analytics to efficiently identify the risks inherent in the focal company's network with tier1 and tier 2 suppliers. Analysis of other competing networks should also be done to assess the potential impact and also to benchmark.

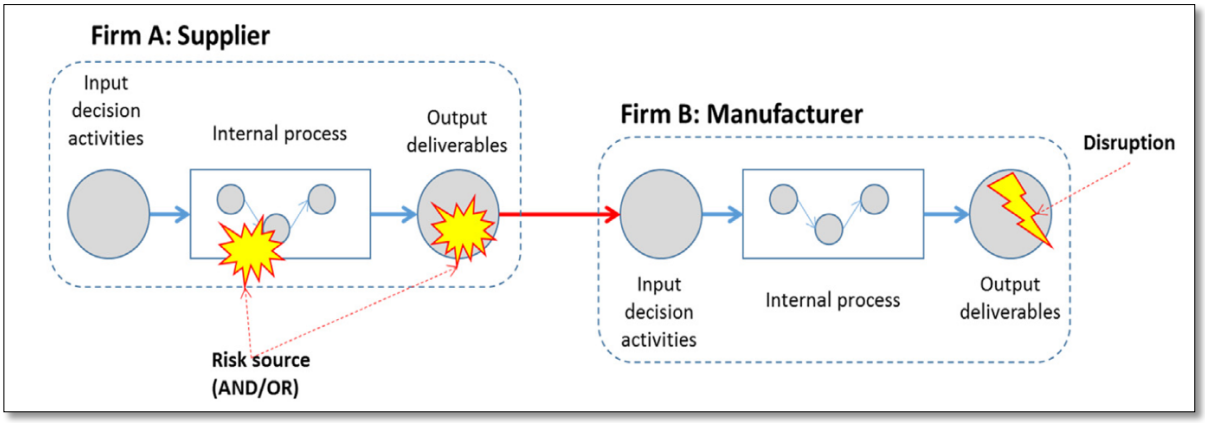


Fig 12: Image extracted from (Lee et al., 2016): Risk analysis view: deliverables of a supplier would lead to the performance disruption of a manufacturer.

Thun and Hoenig (2011) noted that the impact of an incident on a supply chain depends on the particularity of the incident on the one hand and on the design of the supply chain on the other hand. The latter refers to the aspect of vulnerability of a supply chain.

Christopher and Peck (2004) define vulnerability as:

> An exposure to serious disturbance, arising from risks within the supply chain as well as risks external to the supply chain. The mitigation and control of vulnerability is the aim of supply chain risk management

which is defined as the identification and management of risks for the supply chain, through a co-ordinated approach amongst supply chain members, to reduce total supply chain vulnerability.

2.4.3 RISK ASSESSMENT:

Critical risk assessment and prioritization is important to determine the next steps to effect the right in accordance with what has occurred as agreed by Hallikas et al. (2004). Calculations and estimates regarding the probability of a risk consequent should take into account the inherent company's risk propensity and know-how. Furthermore, the network acquaintance must also be considered together with any imposed impacts. There can be a recurring and repetitive effect on other entities of the supply chain network contained.

Impact assessment scale

Rank	Subjective estimate	Description
1	No impact	Insignificant in terms of the whole company
2	Minor impact	Single small losses
3	Medium impact	Causes short-term difficulties
4	Serious impact	Causes long-term difficulties
5	Catastrophic impact	Discontinue business

Probability assessment scale

Rank	Subjective estimate	Description
1	Very unlikely	Very rare event
2	Improbable	There is indirect evidence of event
3	Moderate	There is direct evidence of event
4	Probable	There is strong direct evidence of event
5	Very probable	Event recurs frequently

Fig 12: Image extracted from (Hallikas et al., 2004) the assessment scales for the consequence and probability of risk events.

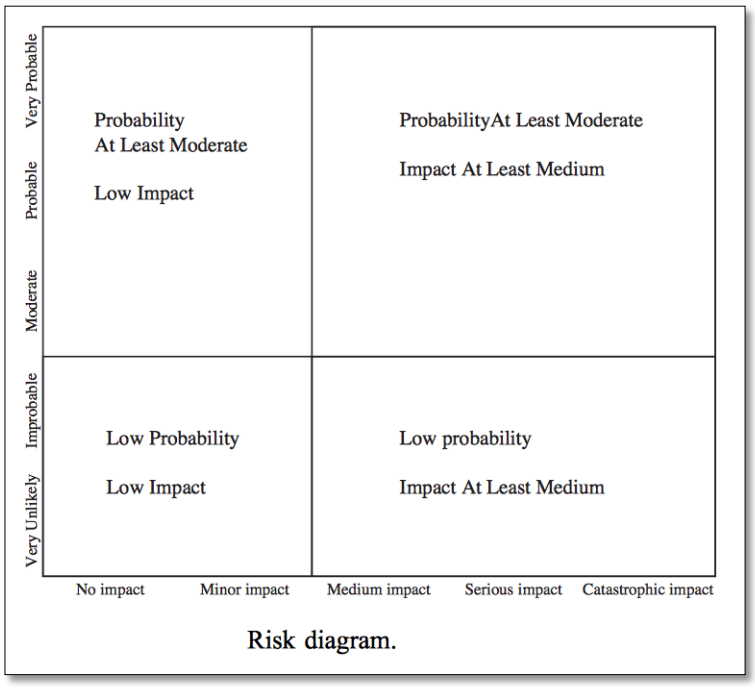


Fig 12 &13: Image extracted from (Hallikas et al., 2004) the assessment scales for the consequence and probability of risk events.

When all the risks have been identified, and ranked it is useful to represent them in the form a vulnerability framework map shown above. Vulnerability is highest when both the likelihood and the impact of disruption are high. Rare, low-consequence events represent the lowest levels of vulnerability and require little planning or action.

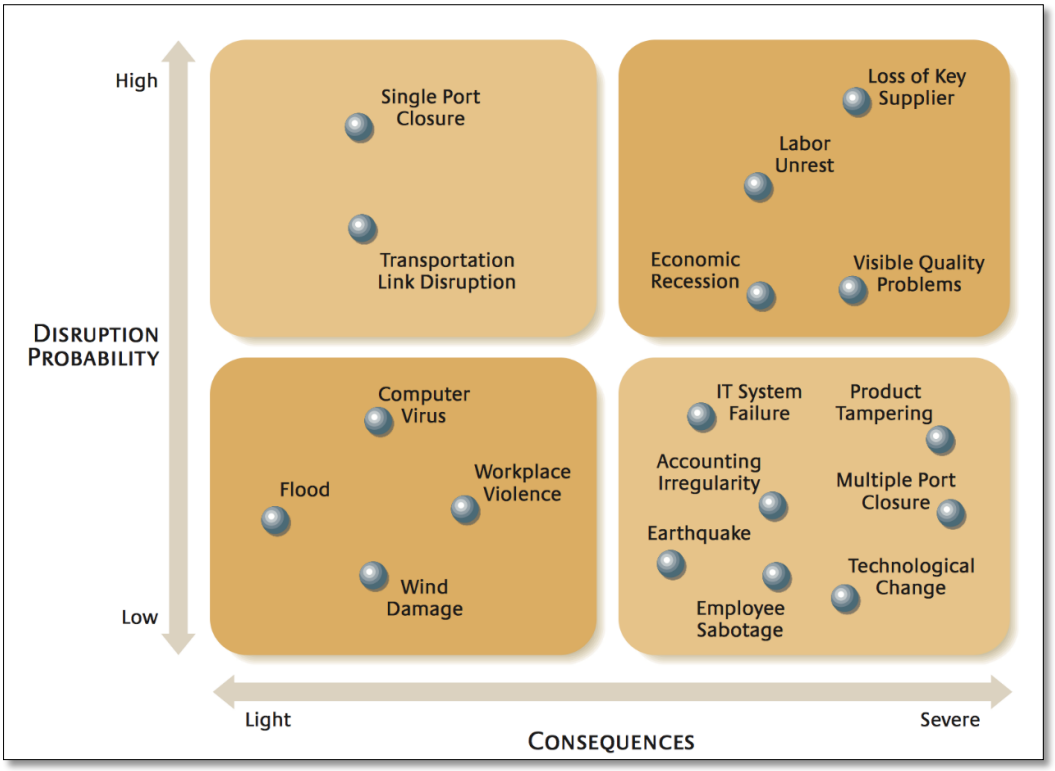


Fig 14: Image extracted from (Sheffi & Rice Jr, 2005) A sample enterprise vulnerability map.

Sheffi and Rice Jr (2005) explain and depict that an enterprise vulnerability map categorizes the relative likelihood of potential threats to an organization and the company's relative resilience to such disruptions. Such maps can then direct management attention and prioritize the planning. The risk assessment is designed to ensure that the required knowledge and attention is given to correctly to each specific risk.

2.4.4 RISK MANAGEMENT ACTIONS:

Ingrained culture and organizational risk propensity have an impact on how the risk is addressed in a company, bias and ingrained philosophies of past experiences should always be avoided as a potential pitfall. Generally, risk taking propensity refers to a company's willingness to commit their resources to risk management. Sitkin and Pablo (1992) defined risk taking propensity as a general tendency for an organization to either take or avoid risks. Weber, Blais, and Betz (2002) further explained that risk taking propensity ranges from risk-aversion tendencies to actively avoiding risk to risk-seeking tendencies to actively exploit uncertainty.

Also, Gilley, Walters, and Olson (2002) and Das and Joshi (2007) observed that a company with may actually realize massive benefits by taking and engaging risk head on. However, this is not always the case because in a typical business scenario characterized by high uncertainty and complexity not every risk will yield a positive result, some negative risks if not most, might end up in supply chain disruptions with serious implications to the business viability model.

According to Hallikas et al. (2004), The generally used strategies for risk management include:

- Risk transfer
- Risk taking
- Risk elimination
- Risk reduction and further analysis of individual risks.

Through analysing contract details and implementing the best plan of required tasks a common structural strategy can be effected. Some of the risks can be reduced by

collaborative development in the network, others must be managed by each company themselves. The network relationships often include transferring risks from one company to another. This may reduce the total risk if the company taking the risk can cope with it better than the company transferring it as recommended by Hallikas et al. (2004).

2.4.5 RISK MONITORING:

The company and its environment are not static, and thus also the risk status changes. Hallikas et al. (2002) recognized that risk factors can be monitored to identify the potential increasing trends in their probability or consequences. In addition, new significant risk factors may appear. To identify these, it is necessary to monitor the changes in the network, customer needs, technology, partner strategies and competitors and to update the risk assessment correspondingly.

Bode, Wagner, Petersen, and Ellram (2011) proposed a cause-oriented focus and an effect-oriented focus when monitoring supply chain risk. A cause-oriented approach means in order to deal with each risk effectively thereby reducing the frequency of it occurring as well as negating its impact on the network, there needs to be emphasis on its root cause and proving effectiveness. There are different strategies of adequately dealing with each risk and because each risk is unique, there should be careful and deliberate thought in finding the right strategy.

2.4.6 STRATEGIC RISK MANAGEMENT:

The strategies take into context the nature, character, sources and drivers of the drivers of each identified risk. This entails recognizing the factors motivating the choice of a particular strategy for a given situation (Manuj & Mentzer, 2008). A short-term focus leads to adoption of strategies that provide immediate results and involve lower investments, and vice versa. Risk management is a continual process that involves long-term dedication of supply chain members (Giunipero & Aly Eltantawy, 2004).

Manuj and Mentzer (2008) also illustrated that their findings suggest that a short-term focus does not necessarily suggest an absence of risk management, but a

significantly lower importance to managing risks. Firms that achieve higher levels of flexibility significantly outperform their less flexible counterparts (Fawcett, Calantone, & Smith, 1996). However there is a caveat that was recognized by Manuj and Mentzer (2008) that flexibility comes at a cost, is not necessarily useful in all cases, and thus, should be determined by the level of risks faced by the supply chain.

At this point it is also critical to note that strategy should align with the supply chain environment in which it is applied. Manuj and Mentzer (2008) also agree that the environment facing the supply chain emerged as most important, primarily because supply and demand risks are outside the scope of the firm and require supply-chain wide attention. In their research Manuj and Mentzer (2008) also stress that:

> Several outcomes are of interest in global supply chain risk management. Foremost, risk management should lead to closely matching the desired cost savings and profitability targets. Therefore, total supply chain cost and profit that account for both benefits and costs of risk management strategies are important outcomes that need to be measured to ascertain the effectiveness of a risk management strategy. However, other measures of supply chain performance that are most likely to be impacted by global supply and demand uncertainties should also be included to evaluate a risk management strategy holistically.

Manuj and Mentzer (2008) also found out from their study that there are 6 risk management methods that are employed in supply chain which are:

Table 5: Risk Management methods

Risk Management Strategy	Brief Explanation	Sources
Postponement	Postponement entails delaying the actual commitment of resources to maintain flexibility and delay incurring costs.	(Bucklin, 1965; Chiou et al., 2002; Zinn and Bowersox, 1988)
Speculation	Speculation (also called selective risk taking, decisions are made on anticipated customer demand. This is possible under	(Bucklin, 1965)

	low demand uncertainty.	
Hedging	Globally dispersed portfolio of suppliers and facilities such that a single event will not affect production.	
Control/share/transfer	Control, share, or transfer of risks take the form of vertical integration, contracts, and agreements.	(Achrol et al., 1983; Agrawal and Seshadri, 2000; Cachon, 2004)
Security	Encompasses information systems security, freight breaches, terrorism, vandalism, crime, and sabotage.	(Downey, 2004)
Avoidance	Takes the form of exiting through divestment of specialized assets, delay of entry into a market or market segment, or participating only in low uncertainty markets.	(Miller, 1992).

Further influence on SCMs in automobile manufacturing is attributed to the fact that, vehicle manufacturing firms focus on maintaining lean production systems with minimum inventories held within the whole supply chain, thereby allowing for increases in the flexibility (Nishiguchi, 1994) and productivity (Lieberman & Demeester, 1999) of production. Since the mid-1980s these changes have been a direct response to the principles of Just-In-Time (JIT) manufacturing and Total Quality Management (TQM) developed by Japanese automobile producers (Schonberger, 2007), which were demonstrated to provide for radically higher levels of final output product quality than existing Western mass-production techniques had previously allowed for.

2.3.4 RESEARCH QUESTION 2

The aim of the research instrument and methodology will be **to understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**

Supply chain agility has a positive impact on a firm's disruption recovery capability and various other Supply chain integration strategies as well. It is critical to uncover these strategies that offer the mitigation capabilities in terms of supply chain disruption and inefficiencies.

2.4 THIRD SUB-PROBLEM DISCUSSION

The third sub problem is: **Due to the uncertainty and complexity surrounding the automotive environment in Gauteng, have supply chain professionals gained insight on why the selected strategic risk management practices are effective, is it possible that these strategies have evolved over time?**

Supply chains operate in an unpredictable environment and several factors and trends contribute to the exposure to uncertainty. When a supply chain disruption occurs, how a firm can effectively recover from a disruption depends on its recovery capability. Disruption recovery management involves developing methods to quickly recover from the disruption and prevent it from impacting the operations as indicated by Shao (2013). To successfully recover (i.e. reduce or eliminate the negative impact) from a supply chain disruption, the firm must have in place an effective means of discovering supply chain disruptions.

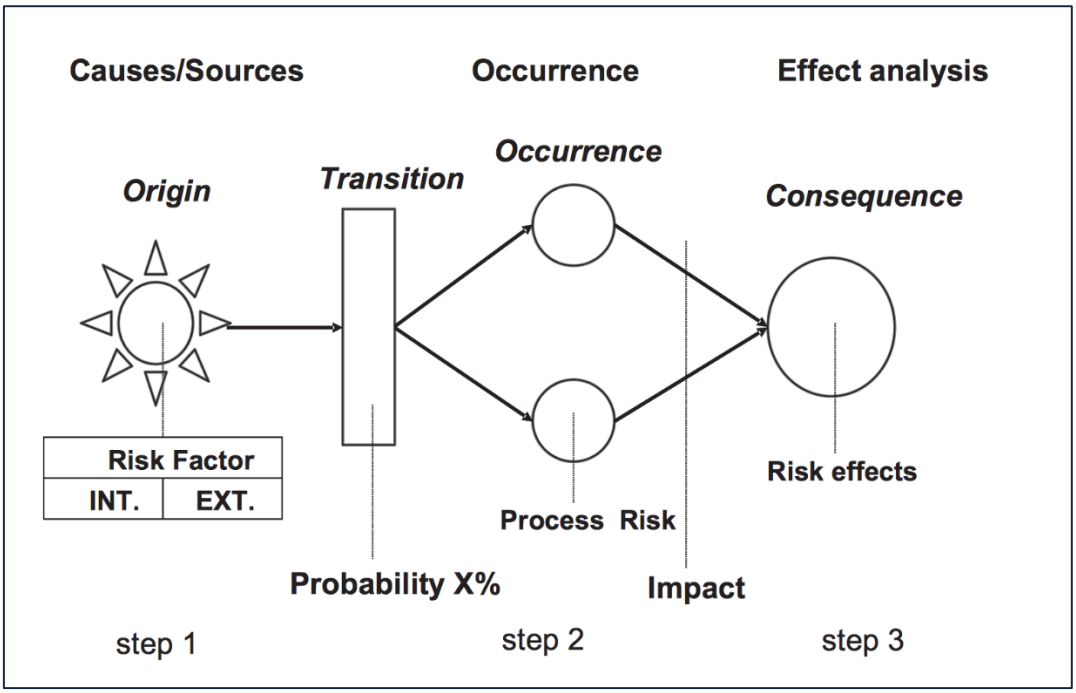


Fig 15: Image extracted from (Sheffi & Rice Jr, 2005) A sample enterprise vulnerability map.

As shown in the above diagram, any risky event is triggered by an internal or external source (step 1) and evolves through an occurrence affecting an activity (step 2). A probability and an impact may be associated to such occurrence, which in turn brings consequences (step 3) usually in terms of time, cost and quality variance against expected performance as illustrated by Hillson (2003). The aim of any supply chain risk management strategy or system is intended to deal with the entire risk escalation process and mitigate any effects of the whole chain.

Locke and Latham (1990) suggested that:

> Prior research has shown that goals can motivate the discovery and use of analytic strategies, increase the use of "trained strategies" (those learned through training), enhance planning quality, interact with strategies to influence performance, and have a mediated effect on performance through strategies.

Therefore, supply chain goals and targets assist in selecting the right strategies for mitigating risk and ensuring a highly performing supply chain. To manage supply chain risk, organizations must expand their focus beyond traditional concepts of risk to include economic and political factors along with risks related to reputation, ethics, and data integrity. Strategic risk management involves anticipating and managing business risks before problems occur rather than responding and reacting to threats after the fact, when the damage has already been done. In response to this expanding emphasis on pre-emptive strategic risk management, understanding why these strategies work to managing potential events that could affect the entity's ability to manage business risks such that they remain within its risk appetite.

2.4.2 RESEARCH QUESTION 3

The aim of the research instrument and methodology will be **to understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector?**

The research instrument will attempt to get a basic high-level understanding of why the respondents think that the discussed strategies foster the supply chain to be

efficient and meet its required objectives and influence business process performance. Various techniques are utilised by the automotive manufacturers and by gaining insight on the perceived mechanisms of functionality, this qualitative research can prove to be beneficial to other managers and practitioners

2.5 CONCLUSION OF LITERATURE REVIEW

The literature review reveals that business organizations across a variety of industries have begun to explore and apply supply chain risk management as a paradigm for reducing risk consequences and effects whilst at the same time improving supply chain capabilities and sustaining competitive advantage.

2.5.1 RESEARCH QUESTION 1:

Identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance?

2.5.2 RESEARCH QUESTION 2:

Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?

2.5.3 RESEARCH QUESTION 3:

Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector?

CHAPTER 3 RESEARCH METHODOLOGY

3.1 INTRODUCTION

The research incorporated qualitative research in order to establish understanding of the concept as well as to test current practices and trends.

The research aimed to understand: Risk factors that influence strategic supply chain management in the Gauteng automotive sector. Therefore, the current section describes the methodology that was followed to address the research questions that were put forward as possible solutions to the sub-problems in the Literature Review section.

3.2 RESEARCH METHODOLOGY OR PARADIGM

Miles and Huberman (1984) acknowledged that qualitative research is well suited for understanding phenomena within their context, uncovering links among concepts and behaviours, and generating and refining theory. The focus of this research was to investigate on strategies for analysis of the generated data that is applicable in the generation of taxonomy, themes, and theory regarding the automotive supply chain risk factors in Gauteng to increase clarity in defining methods which are common in defining the risk factors and consequences.

A qualitative research method was selected to conduct this research as it provided insight into complex and intricate factors influencing the automotive suppliers in Gauteng. Additionally, it allowed this exploration to develop theories and generate themes, and finally moved toward insightful explanations of findings.

In conducting the quality research strategy for this topic, the researcher aimed to generate themes that are recurrent unifying concepts or statements about the strategic risk management in supply chain. In this case, the subject of enquiry was the planning, scheduling and other activities that are done in automotive supply chains to ensure efficiency and less disruptions. It was critical to uncover the underlying strategic underpinnings of supply chain risk management and their implications in practice.

By acquiring more insight into the theory behind some of the strategic supply chain decisions that are taken by automotive organizations in Gauteng, the objective of the qualitative research was to gather a set of general, modifiable propositions that helped explain, predict, and interpret events or phenomena of interest as recognized by M. Q. Patton (1999).

3.2 RESEARCH DESIGN

This study has hypothesised that setting up an efficient supply chain system in South Africa is challenging due to certain significant risk factors inherent in the complex manufacturing sector. In order to study the strategic risk factors that are practiced in industry, the consideration of risks that are significant in the current landscape are key to business success must be morphed into an effective research instrument. The research problem identified concerns understanding which risk factors had the greatest impact on business continuity and profitability. Three sub problems were identified in the last chapter, and drew on extant qualitative methodological literature to deduce practical approaches to qualitative data research and collection on the topic.

The choice of the research paradigm is further based on Parkhe (1993) where the first sub-problem relates to a deductive approach as it led to the testing of the study propositions of existing strategic frameworks. The second sub-problem led to an inductive approach as findings on a particular case or interview led to generalisation of the results to that company through a framework applicable to strategic risk management for their supply chain. The mix of the deductive and inductive approaches is recommended by Parkhe (1993).

The qualitative methodology approach selected to formulate a strategy of enquiry that guides a set of procedures in conducting the research is based on the qualitative research method known as:

1. Phenomenology

3.2.1 PHENOMENOLOGY APPROACH:

This may also be referred to as Interpretative Phenomenological Analysis according to Hancock (2006). It is phenomenological, attempting to understand how participants make sense of their experiences (it does not assume that participants' accounts refer to some verifiable reality) but it recognises that this involves a process of interpretation by the researcher as described by Petty, Thomson, and Stew (2012). From this descriptive data, further interpretation and analysis enabled the researcher to uncover a description of the 'essence' of the phenomenon of strategic risk management in supply chains.

Phenomenology was crucial in this research in order to ascertain the exploration or identification of concepts or views in terms of the risk propensity of the interviewed person or risk propensity culture of the organization, even the behaviour regarding strategic decision making when confronted with different challenges or consequences arising from risk. Petty et al. (2012) articulate that to derive the essence, the researcher puts to one side their own views of the phenomenon, referred to as bracketing, in order to deepen their understanding.

3.3 POPULATION AND SAMPLE

3.3.1 POPULATION

The target population for this qualitative research study was the Automotive Original equipment manufacturers (OEMs) located in the Gauteng province together with their respective sub-component suppliers. Gauteng offers an excellent manufacturing base with access to various logistics corridors linking it to various distribution networks. The main manufacturing plants are located in the Gauteng geographical area. The Tier 1 sub-supplier component manufacturers are only those who specialise in equipment that is utilised for locally produced vehicle variants even though these variants will be later exported. OEM companies manufacturing commercial vehicles, trucks and buses for public transport are also included in the population including those manufacturing facilities with semi-knock down assemblies and production lines. Tier 2 suppliers to the OEMs were excluded from this research.

3.3.2 SAMPLE AND SAMPLING METHOD

It was paramount for this research study to embody a fundamentally rigorous approach in its selection criteria and sampling technique to ensure that the sample is a true representation of the collective population under study. The sampling technique best suited for this research is **Purposive non-random sampling**.

With the selected purposive non-random sampling the respondents to be interviewed were selected carefully to represent the subject specialists and best in business people, who are making the strategic decisions in efficiently optimizing their supply chains. The job characteristics, experience, influence and rank in the supply chain departments of individuals were used as the basis of selection, ultimately chosen to reflect the diversity and breadth of the sample population. Examples included, Procurement managers and engineers, Supply chain Managers, logistics managers and engineers and any senior consultants or advisers to institutions who render assistance and consultancy services to the OEMs in Gauteng. These were all crucial supply chain stakeholders in the automotive sector in Gauteng for example AIDC and NAAMSA.

Additionally, the best suited approach of Purposive non-random sampling which was diligently applied by the researcher was “theoretical sampling”.
Theoretical sampling ensures that an initial sample is drawn in this research will include sufficient factors that might affect variability supply chain strategies by Automotive companies in Gauteng, and then this is extended, as required, in the light of early findings and emergent themes. The full sample, therefore, attempts to include the full range of settings relevant to the exploration of the subject (Mays & Pope, 2000).

This approach gave the researcher the opportunity to analyse the operational survey questions in the research instrument, and the data collected as the sampling progresses therefore, the researcher could add to or change the emphasis of the sample design, and in doing so ensured robustness of the theories generated.

The respondent recruitment process was done through LinkedIn and sending invitation and participation emails to potential respondents. Furthermore, the researcher maximized the social capital that he has already invested in the Gauteng automotive sector to ensure that the panel of respondents is best representing the population. Each sample participant was invited to participate in the research through a formal letter sent via email or LinkedIn or Research gate platform followed up with a personal phone call to set up an interview session. The letter provided a summary of the intent of the research, data regarding methodology, confidentiality and sharing of research findings. There was also a topic indication and the opportunity for questions. The expected duration for each interview was 60 to 90 minutes.

The table below shows the details on the respondents interviewed by only one person who was the researcher to ensure there is first-hand experience in data uniformity and objectivity in the in-depth semi-structured interviews. There was goal to have interviewees from the full population of OEMs in Gauteng.

Table 6: Participants that were interviewed.

Description of Respondent	Company	Number that were Interviewed
Procurement or Purchasing Managers or Engineers	OEMS: (Nissan, BMW, Ford, Iveco, UD Trucks)	5 (One from Each OEM)
Supply chain Managers or Logistics Managers or Engineers	OEMS: (Nissan, BMW, Ford, Iveco, UD Trucks)	3 (One from Each OEM)
Logistics Managers or Engineers	Sub-Suppliers in Gauteng	5 (One from each Tier 1 Sub-component supplier)
Senior Supply chain consultants	(AIDC) Automotive Industry Development Centre	1
Senior Supply chain consultants	NAAMSA (National Association of Automobile Manufacturers of South Africa)	1

3.4 THE RESEARCH INSTRUMENT:

To ensure that rich and detailed data is collected on the research topic, semi-structured interviews were conducted with participants who were experienced and well-versed in supply chain management. As Robson (2011) pointed out, the conduct of semi-structured interviews involves a few pre-determined areas of interest with possible prompts to help guide the conversation. The in-depth semi-structured interview is a technique designed to elicit a vivid picture of the participant's perspective on supply chain risk. The strength of this research instrument is designed to elicit a vivid picture of the participant's perspective on the research topic as reinforced by Mack, Woodsong, MacQueen, Guest, and Namey (2005). Interviews were best suited because they focus on reports of experience or on data which cannot be adequately expressed numerically.

In-depth interviews were useful for learning about the perspectives of individual respondents on their supply chain strategies. The goal of any qualitative research interview is therefore to see the factors affecting strategic risk management from the perspective of the interviewee, and to understand how and why they come to have this particular perspective or strategy. As reinforced by Kvale (2006) to meet this goal, qualitative research interviews will generally have the following characteristics: a low degree of structure imposed by the interviewer; a preponderance of open questions; and a focus on 'specific situations and action sequences in the world of the interviewee rather than abstractions and general opinions.

According to Robert K Yin (2015) the qualitative interview follows a conversational mode, and the interview itself will lead to a social relationship of sorts, with the quality of the relationship individualized to every participant. This conversational mode, compared to structured interviews, presents the opportunity for two-way interactions, in which a participant even may query the researcher.

3.4.1 STRENGTHS AND SHORT COMINGS OF QUALITATIVE INTERVIEWING:

Table 7: Strengths and shortcomings of qualitative interviewing

Strengths	Shortcomings
Elicits in-depth responses, with nuances and contradictions. (Mack et al., 2005)	Interviews may supply indirect information which has been filtered through the perceptions and views of the participants. (Creswell, Plano Clark, Gutmann, & Hanson, 2003)
Researcher gets an interpretive perspective, i.e., the connections and relationships a person sees between particular events, phenomena, and beliefs. (Mack et al., 2005)	The presence of the researcher in the interview may introduce bias and presuppositions into the responses of the participant through leading questions. (Creswell et al., 2003)
Interviews can provide historical information that would not be observed by the researcher in a survey research or other similar methods. (Creswell et al., 2003)	Positioning on realism or relativism, subjectivity or objectivity, will strongly influence one's approach to research and to interview data. (Kvale, 2006)
Qualitative research interviews can be used to examine much broader issues, in areas such as gender or organizational culture etc.	Respondents may not be equally articulate and perceptive during interviews thus there will be lack of rich and details information useful for the research.(Creswell et al., 2003) Uncommunicative Interviewee (Cassell & Symon, 2004) or the **The Over-Communicative Interviewee** **I**nterviewee who repeatedly indulges in long-winded digressions from the interview topic.
The relationship between the researcher and the participant is not strictly scripted. Flexibility in demeanour and behaviour is key to extract more information from respondents instead of where they are just filling in a questionnaire on a computer screen. (Robert K. Yin, 2011)	Reflexivity refers to the recognition that the involvement of the researcher as an active participant in the research process shapes the nature of the process and the knowledge produced through it.(Cassell & Symon, 2004)

3.5 PROCEDURE FOR DATA COLLECTION

Through engaging with participants by posing questions in a neutral manner, listening attentively to participants' responses, and asking follow-up questions and probes based on those responses. The table below shows the structure of how the semi-structured interview questionnaire and data collection were laid out.

Table 8: Semi-structured interview questionnaire and data collection layout

Category	Examples	Sources	Research Instrument
Risk Drivers	Globalisation, Product variants, Outsourcing, Centralized distribution or production.	(Thun & Hoenig, 2011), (Lavastre, Gunasekaran, & Spalanzani, 2012)	Interviewing Respondents
Risk Sources	Operating uncertainties: labour uncertainty (labour unrest, strikes), IT system uncertainties and production uncertainty, financial credit uncertainty, demand risk, politics, government policies, environmental sustainability,	(Miller, 1992), (Jüttner, Peck, & Christopher, 2003), (Blos, Quaddus, Wee, & Watanabe, 2009),	Interviewing Respondents
Risk Consequences	Sales losses, cost increases, product quality reduction, Threats to customer life and safety, Negative reputation.	(Jüttner et al., 2003), (Blos et al., 2009)	Interviewing Respondents
Risk Mitigation Strategies	Avoidance, Control, Transfer, Share, Flexibility, imitation, cooperation.	(Miller, 1992), (Lavastre et al., 2012)	Interviewing Respondents

A sample of the proposed sample questionnaire for the semi structured interview is shown in Appendix A, it was designed to ensure all participants are asked typically in the same question structure without any interference from researcher error or interviewer effects. Furthermore, this was also used to minimize bias. The interpretation of the conducted interviews was shared with the respective respondents to maximize the potential to check and clarify "true meanings" with the respondent. The questions in the research instrument were used more as a

predetermined and sequenced guide to allow the research to generate and gather all required and relevant data to analyse.

3.6 DATA ANALYSIS AND INTERPRETATION

To do a complete analysis of a conversational interaction, the researcher went beyond analysing the spoken words and examined the nonverbal portions of the conversation between two (or more) people, including people's tone of voice, pauses, interruptions of each other, and other mannerisms as described by Robert K Yin (2015). The analysis of qualitative data usually moves through five phases described below:

1. Compiling Data - compiling data into a formal database, calls for the careful and methodical organizing of the original data in this research. Robert K Yin (2015).

2. Disassembling Data - disassembling the data in the database, will involve a formal coding procedure in this research. Robert K Yin (2015).

3. Reassembling (Arraying) Data - is less mechanical and benefits from a researcher's insightfulness in seeing emerging patterns that have recursive and iterative relationships in this research. Robert K Yin (2015).

4. Interpreting - involves using the reassembled material to create a new narratives, theories and themes with accompanying tables and graphics where relevant, that will become the key analytic portion in this research. Robert K Yin (2015).

5. Concluding - calls for drawing the conclusions from the entire supply chain risk study in this research. Robert K Yin (2015).

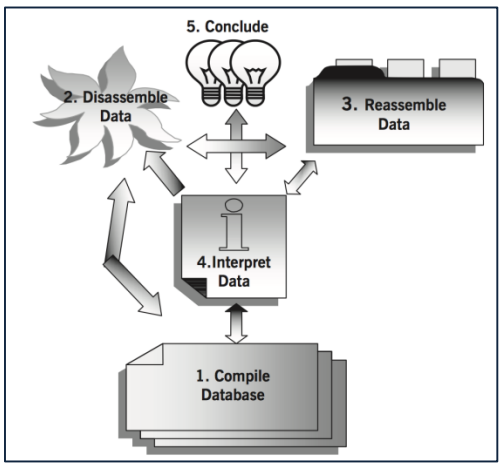


Fig 16: Image extracted from (Lambert & Cooper, 2000): Supply Chain Network Structure

Table 9: Table extracted from: (Bradley, Curry, & Devers, 2007) Selected Types of Results from Qualitative Data Analysis

Results	Definition	Application / Purpose
Taxonomy	Formal system for classifying multifaceted, complex phenomena according to a set of common conceptual domains and dimensions	Increase clarity in defining and comparing complex phenomena
Themes	Recurrent unifying concepts or statements about the subject of inquiry	Characterize experiences of individual participants by general insights from the whole of the data
Theory	A set of general propositions that help explain, predict, and interpret events or phenomena of interest	Identify possible levers for affecting specific outcomes; guide further examination of explicit hypotheses derived from theory

As data analysis continued, these codes were focused into broader more conceptual strategic management concepts and categories to capture the complexities of the risk factors inherent in supply chain processes Robert K Yin (2015). This process was facilitated by constantly comparing similarities and differences within and between the data sets collected through interviews by the constant comparative method of analysis. Data collection and data analysis occurred concurrently, taking an iterative process. Robert K Yin (2015).

3.7 LIMITATIONS OF THE STUDY

- This research study possessed partial external validity because the focus was on the automotive sector in Gauteng, therefore due to the geographical constraints it can only be partially applicable in other provinces of South Africa.
- The interpretation of the organizational risk behaviour was determined by the respondents on the data collection tool, although this might have been exposed to prejudice and bias.

3.8 VALIDITY AND RELIABILITY

Without accuracy and factualness, research is not worth any acknowledgement. This research sought to use strong designs to strengthen the validity of the strategic risk management in supply chain study and ensured that the data collected properly addressed the research topic being studied. As agreed with Maxwell (1992) this research relied implicitly or explicitly on a variety of understandings and corresponding types of validity in the process of describing, interpreting and explaining phenomena of interest.

Mays and Pope (2000) further provide an explanation that the researcher concurs with and from this position it is possible to assess the different perspectives gathered from the research instrument whilst ensuring applicability, consistency, trustworthiness and neutrality through utilizing tactics such as prolonged engagement and persistent querying on unclear facts.

Also important are characteristics of the investigator or researcher, who must be responsive and adaptable to changing circumstances, holistic, having professional immediacy, sensitivity, and ability for clarification and summarization.(Guba & Lincoln, 1981)

The verification strategies used to ensure both reliability and validity of data are realized include:

- Methodological coherence - to ensure congruence between the research question and the components of the method. Data may demand to be treated differently so that the question may have to be changed or methods modified (Morse, Barrett, Mayan, Olson, & Spiers, 2002).

- Sampling sufficiency - sample must be appropriate, consisting of participants who best represent or have knowledge of the research topic. This ensures efficient and effective saturation of categories, with optimal quality data and minimum dross (Morse et al., 2002).

- Forging synchronicity between the sample and supply chain the collected data and the examination that follows – themes of interactions between what is known in strategic handling of risk and what the researcher realized in his research This perceived synergy is the main strategy of attaining reliability and validity for uncovering the underlying factors critical to the research.

- Thinking theoretically or theory development - Thinking theoretically requires macro-micro perspectives, inching forward without making cognitive leaps, constantly checking and rechecking, and building a solid foundation (Morse et al., 2002). This was achieved by deliberating and deciphering of the supply chain interview data from a small scale and a larger theoretical or conceptual understanding. In this way, strategic management of supply chain risk theory was developed through the mechanisms discussed.

3.9 EXTERNAL VALIDITY

External validity refers to the degree to which findings can be generalized across social settings or phenomena. External validity criteria is problematic because in many studies the sample is small and studies are more or less case studies (Kaivo-oja, 2016). This data, while typically not aimed at establishing generalizability, lend themselves to generating new theoretical insights about certain phenomena in greater depth and detail than is possible through quantitative designs (M. Patton, 2002). Therefore, because this study focused on the strategic risk management factors affecting the automotive sector in Gauteng it may not be fully generalized to wider settings and populations, For example the automotive sectors in the Eastern

Cape or Kwazulu Natal. This was mainly due to the fact in Gauteng there is no port hence the logistic dynamics, objectives and targets might not be similar.

The nature of this qualitative research was concerned with the supply chain risks concepts and idiosyncratic characteristics of the automotive group in Gauteng; therefore, the findings or theory may only applicable to a similar group in the automotive sector only in South Africa, hence there is only partial external validity.

As discussed earlier, the sampling technique used for this research topic, together with theoretical sampling, targeted supply chain specialists and managing participants that provided sufficient expertise on supply chain risk so that an understanding of the phenomena and the exploration of theory directly related to the phenomena was achieved for applicability in the Gauteng automotive context.

3.10 INTERNAL VALIDITY

Internal validity refers to the match of observations and theoretical ideas of qualitative research projects (Kaivo-oja, 2016). The aim of this research was to perform a qualitative analysis uncovered a subjective viewpoint on supply chain risk management at the very heart of strategic management practice in Gauteng.

The research instrument being utilised in this study was structured to ensure that it will facilitate the strategies of enquiry that will ensure that the research will obtain, evidence, truth, objectivity, deduction, reason and truth regarding the way that companies formulate and implement the risk management strategies for their supply chains. The depth of the literature review for the research herein, set a solid base for the constructs or initial concepts, notions, questions which ultimately determine which data is to be gathered in the semi structured interviews with the relevant stakeholders that have been carefully sampled.

The researcher ensured that the investigation and interrogation of these stakeholders constantly merged theory construct and data collection to ensure that full and meaning and explanations were acquired to reflect the true essence of risk management paradigms. Additionally, the research performed more assessments quality checks and balances with all participants of the research. In order to improve

internal validity of this research study, the following action plans and activities were conducted during the research:

- **Implementing Triangulation** – The technique of data triangulation was employed between two or more data sources which are of different interest groups which are supply chain OEM specialists and the Sub-suppliers that they engage with in the value chain. Due to the interaction of these two groups in their operations, they had different interests that culminate to the same goals which are: on-time delivery, optimum performance and efficiency and quality requirements. Consequently, patterns, taxonomies and concepts began to develop and converge into more coherent, consistent and objective themes which could adjudicated thus depicting an accurate, credible and defensive finding for the research. This was done with a constructivism approach. The research safeguarded comprehensiveness and aimed for a more reflexive analysis of collected data. Quick observations and plant tours of some plants were allowed, were carried out as a form of research instrument, to ascertain the implementation the strategies which were mentioned in the interviews. (Method Triangulation)

- **Avoiding Reflexivity** – the researcher undoubtedly aimed to avoid shaping the outcomes of the research process including ensuring no influence of prior assumptions and experience or any personal or intellectual biases. This greatly improved the internal validity of the research report.

- **Respondent Validation** – This technique was employed carefully by the researcher through trying to establish a level of correspondence between the respondent account and some literature review comparison or giving participants the opportunity to comment on transcripts and emerging findings. The respondents' reactions and expressions as they respond to the semi structured interviews was incorporated into the study findings enabling the research to adjudicate the credibility and confidence of certain given accounts. The research aimed to ensure that the research design explicitly incorporates a wide range of different perspectives so that the viewpoint of one group is never presented as if it represents the sole truth about any situation as agreed by Mays and Pope (2000).

3.11 RELIABILITY

In order to improve the reliability of this report, the researcher made certain that the research findings give an accurate representation of the Gauteng automotive sector population and the factors affecting the strategic risk management factors in the inherent supply chain. The design mechanisms used in the research instrument guaranteed stability of the instrument meaning that, the results of the research can be reproduced with the same research methodology and research instrument. The aforesaid instrument was free of leading questions or any reflexivity.

Consistency, coherence and single sense of purpose to present a logical consistency between the theoretical references in the literature review, supply chain research questions, research instrument and data analysis of strategic management findings as agreed by Twining, Heller, Nussbaum, and Tsai (2016). Conventionally conceived and dependable results were key to ascertaining the reliability of the research report. The researcher aimed to ensure that through the validation action plans discussed above, there was basis of accordance with the authenticity, confirmability, neutrality and objectivity of the way the report was conducted from start to finish. Sensitizing the respondents to the subject matter guaranteed a high degree of authenticity and objectivity when the semi structured interviews were conducted as agreed by Golafshani (2003).

The researcher was transparent and explicit about the data analysis process because this was critical for establishing the credibility and trustworthiness of the research. The researcher's assumptions and decisions were made clear including how interpretations of data were checked and inferences drawn as confirmed by Avenier and Thomas (2015). The confirmation that the researcher could separate himself in this way, has echoes of objectivity within post-positivism.

3.12 RESEACH INSTRUMENT

Question guidelines of inquiry:

1. How has the Automotive supply chain evolved over the past 5 to 10 years
2. Do you have some sense of the different ways in which the automotive supply chain environment might evolve over the next five to ten years?
3. Do you know which factors, or drivers of change, are most likely to dominate how the industry will evolve? How do you integrate this with supply chain strategies?
4. Please identify key environmental externalities that could impact future strategies in the automotive supply chain?
5. How do the automotive supply chain capabilities assist players to be competitive? How do you identify these capabilities?
6. Could you indicate significant manifested risk factors involving the supply chain that impacted production in Gauteng?
7. How did you identify the main sources and drivers of the risks mentioned before?
8. Please describe the main consequences for the OEMs as a result of the occurrence of the risks.
9. How did the OEMs deal with these effects or consequences in your organization and also with your supply chain member firms?
10. What tools, techniques or methodologies make it easy (or difficult) for OEMs to deal with risk within the automotive supply chain perspective in Gauteng?
11. What helps you to deal and advise on supply chain risk? How do you employ strategies for risk management?
12. How do you conduct risk mitigation / contingency planning for the automotive supply chain?
13. Are there any trigger events or signals in the automotive supply chain that prompt you to respond?
14. What future surprises could really help / hurt the automotive supply chain?
15. Kindly describe the facilitators / impediments / constraints in your supply chain risk management process.
16. How do you conduct Future Strategy development process for the automotive supply chain?
17. Please explain how you conduct Strategic decision making under uncertainty for the automotive supply chain and logistics.
18. Are there any key pieces of infrastructure or system elements that seem to be missing in the automotive supply chain?
19. What core systems or strategies would you like to see driving change in the industry?

CHAPTER 4 PRESENTATION OF RESULTS

4.1 INTRODUCTION

This chapter presents the insights, opinions and experiences of the participants interviewed on the questions in the research instrument regarding the strategic risk management practices in the automotive industry in Gauteng.

The semi structured interviews took place during the period 20 May to the 15th of July 2017. Participants involved in the interviews were supply chain and logistics professionals and procurement managers. The research was conducted until a point that saturation of collected data as acknowledged by (Creswell & Poth, 2017). Saturation in terms of the underlying practical constructs and theoretical from experiences that were discussed with the participants.

4.2 PROFILE OF RESPONDENTS

Miles and Huberman (1984) acknowledged that qualitative research is well suited for understanding phenomena within their context, uncovering links among concepts and behaviours, and generating and refining themes. The data below focuses on the demographics of the individuals who participated in this research.

In depth, semi structured interviews were conducted with 15 participants from the Gauteng automotive industry. Race and gender were not part of the selection criteria however the research managed to achieve a decent mix of gender in the respondents with 14% Female and 86% Male.

Participant	Age	Number of years Expereince	Gender
1	52	12	M
2	56	36	M
3	40	9	M
4	40	6	M
5	31	11	M
6	65	43	M
7	48	13	M
8	45	20	M
9	52	29	F
10	33	6	M
11	34	6	M
12	38	5	M
13	32	7	M
14	32	6	M
15	56	20	F

Table 4.1: Table showing Age and sex demographics of participants

From the table showed on the previous page, the average age of the respondents was 44 Years and the average number of years of experience in the automotive industry was 15 years. The pie chart below shows the industry designation for the participants. By industry definition, the context is whether the participant is a subcomponent supplier, original equipment manufacturer or industry expert from NAAMSA and AIDC.

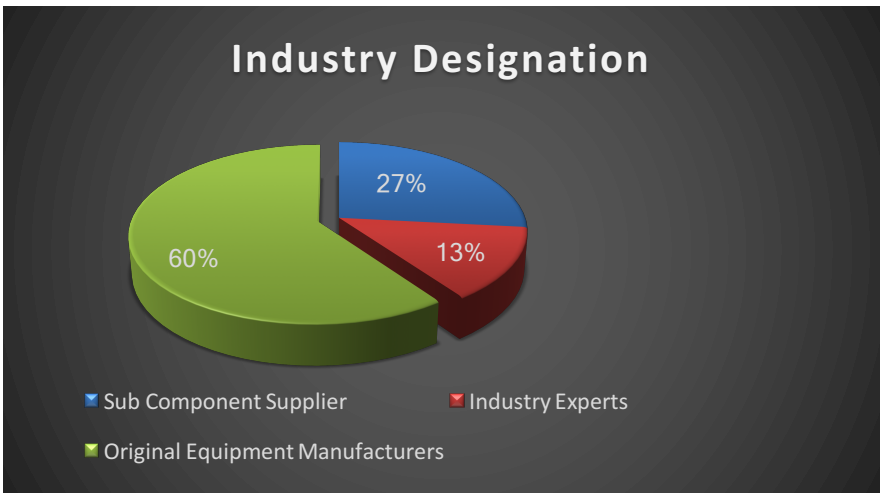
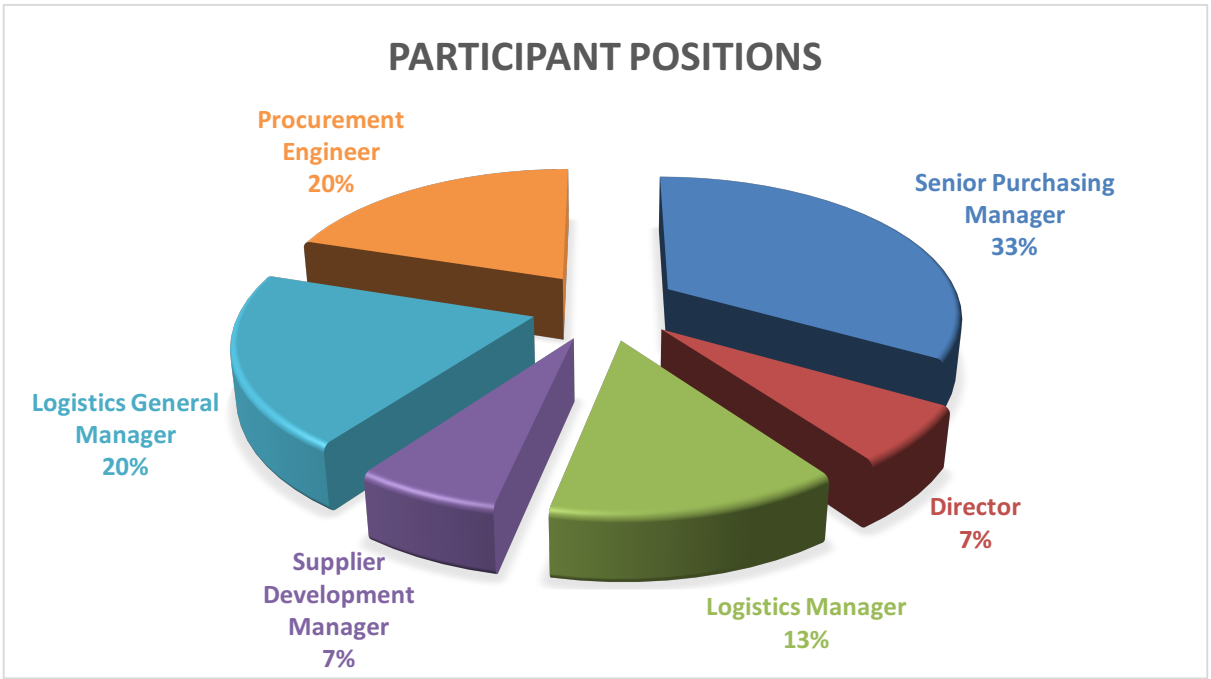


Fig 4.1.1 Distribution of Participant industry designation

The pie chart below shows the distribution based on participant positions in their respective companies.

Fig 4.1.2 Distribution of Participant positions



The pie chart below shows a representation of the general size of companies in which the respondents who were interviewed work. The numbers represent the number of direct employees at each organization over the past 5 years.

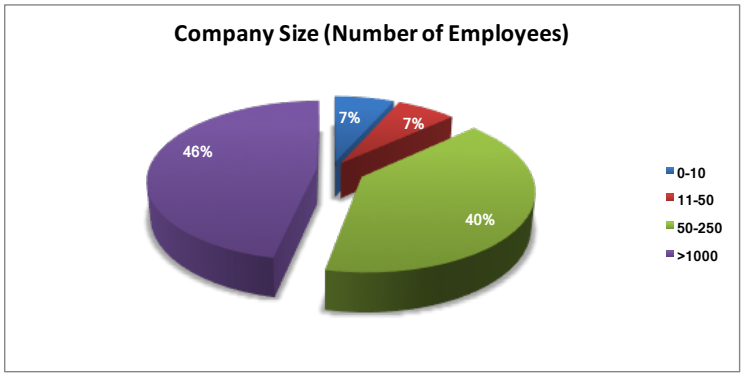


Fig 4.1.3 Distribution of company size

The last pie chart below shows a representation of the general revenue amounts (MZar - Millions of Rands) generated by the different organization that participants came from.

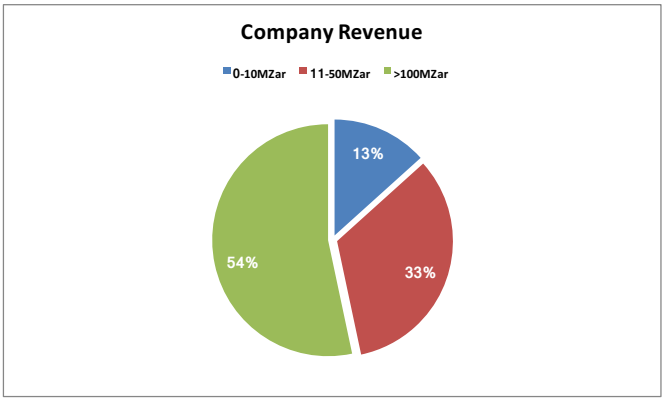


Fig 4.1.4 Distribution of company size

4.3 GRAPHICAL REPRESENTATION OF RESULTS

The results on the responses of the questions are to be displayed using radar charts. The radar charts are useful for showing commonality.

- The objective of the radar chart is to assess the symmetry or uniformity of the responses rather than to compare their magnitudes or relative importance.
- Due to the nature of this case study, the responses fit a circular display because the supply chain phenomena and experiences are intuitively circular in nature or by convention.

An example for question 12 on the research instrument, a table used to create the radar charts is shown below:

12. Risk mitigation / contingency planning for the automotive supply chain?															SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Process FMEA Analysis	1			1	1		1		1			1		1	1	8	53%
Root cause Investigations	1		1	1				1	1	1		1	1	1		9	60%
Scenario Development		1			1		1			1			1			5	33%
Cross Learning			1			1		1	1		1	1			1	7	47%
Desk based and Internet research	1	1			1		1				1		1	1	1	8	53%
Workshops, conferences and workgroups	1		1	1			1	1	1	1	1			1	1	10	67%
Big Data analytics	1	1			1			1						1		5	33%
Preventative and corrective action	1	1	1	1	1	1		1	1	1		1		1		11	73%
Recovery capability				1	1								1		1	4	27%
Equipment and maintenance planning	1			1	1		1			1	1	1	1		1	9	60%

Table 4.2: Table showing responses for Question 12

It is paramount at this point in time, to highlight that the on the left-hand column are the codified themes that came up as the participants were responding to the questions in the research instrument. The figure “1” in the columns indicates that the specific respondent mentioned or acknowledged that codified theme in answering the relevant question.

The sum on the far-right hand of the columns indicates the total number of respondents who acknowledged the respective theme on that row only. For example, 8 respondents acknowledged that Process FMEA Analysis is one of the risk mitigation tools that they use in their supply chain. Since 8 out of a total of 15 respondents recognized Process FMEA analysis, then the percentage of respondents who specifically acknowledged process FMEA analysis will be (8/15 = 53%). Please note that amongst the 53%, the participants went on to acknowledge other themes as well for the same question.

Hence the percentages help to express the magnitude of respondents who accepted or mentioned the specific theme as compared to the total number of respondents that the same question in the research instrument was asked to during the semi structures interviews for this research. These percentages are relatively applicable in comparing themes from the same question only in order to guarantee validity and maintain context for the same question as well.

4.3.1 INTERVIEW QUESTION 1: How has the automotive supply chain evolved over the past 5 to 10 years?

This question was designed and structured to ensure the 1st research problem which is to **gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.** Therefore, going back in time to identify the critical changes which have occurred was crucial to highlight possible evolvement over time in supply chain.

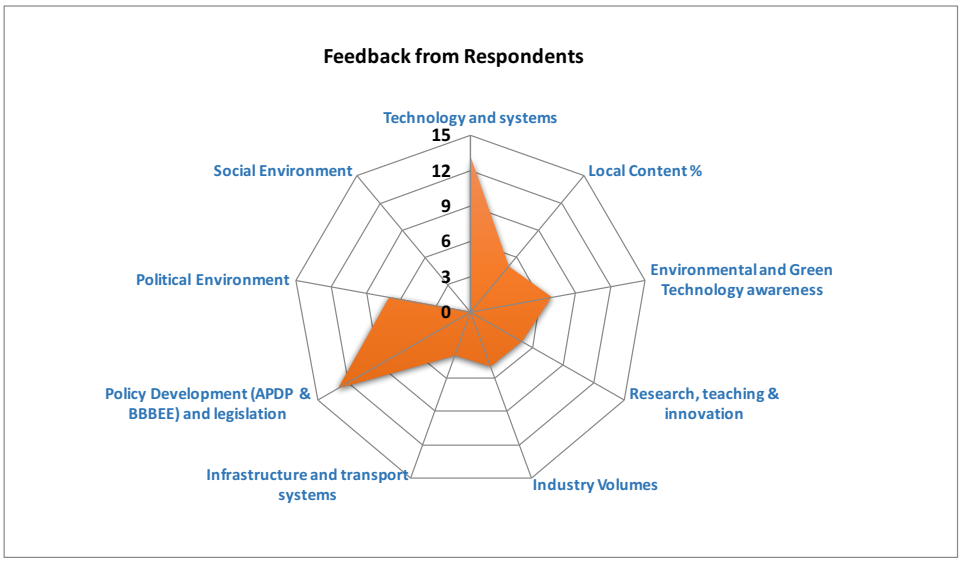


Fig 4.1: Image showing radial chart from Question 1 coding analysis of responses

According to the respondents interviewed, the common factors that seem to have evolved over the past 5 to 10 years are policy development in terms of APDP and BBBEE (13 participants acknowledged) followed by technology and systems on the constituent vehicles. Crucial to note is that 4 of the 15 participants stated observed changes in the infrastructure and transport systems, industry volumes and the social environment. Meaning that these factors have remained static over the past couple of years.

On the factors with high commonality, there was strong consensus and evidence that major changes have occurred. It is critical to point out that in the radar diagram above, the high degree of commonality does not reflect the degree of importance to any respondent or the group as a collective. There has been major evolvement in policy development technology and systems etc. whether these changes have been positive or negative will be discussed in chapter 5.

4.3.2 INTERVIEW QUESTION 2: Do you have some sense of the different ways in which the automotive supply chain environment might evolve over the next five to ten years?

This question was designed and structured to assess the strategic insight that is practices by the respondents. This foresight is critical to business success, high performance and sustainability of future operations.

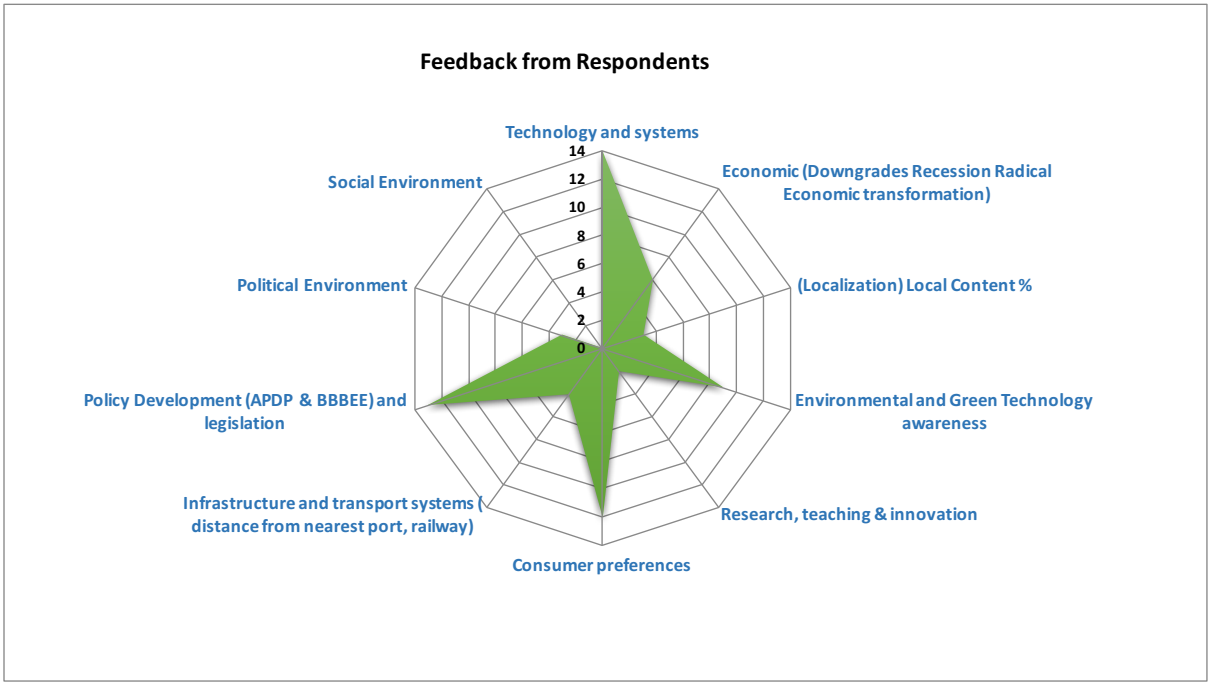


Fig 4.2: Image showing radial chart from Question 2 coding analysis of responses

Most of the participants answered this question after pausing to reflect on how, they perceived the future in the eyes of the industry and their companies. They showed minor hesitation as they tried to balance aspects of future uncertainty and answering the question objectively. The question required insights into how, their organizations predicted the future in their operational environment of Gauteng based on certain assumptions.

As can be observed form the radar chart above which shows high commonality towards the policy development and consumer preferences, technology and systems and policy development are featuring as common codes that where acknowledged by the interview participants. It is interesting to point out that the social environment and the political environment did not come as recurring codes during the discussions on this question. Some of the common codes highlight a common thread of uniformity meaning that in some aspects supply chains are evolving in a similar way.

4.3.3 INTERVIEW QUESTION 3: Do you know which factors, or drivers of change, are most likely to dominate how the industry will evolve? How do you integrate this with supply chain strategies?

This question was designed and structured to set the stage for 1st research problem which is to **gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.** Answers to the second follow up question will be discussed in the upcoming chapter when the results are discussed.

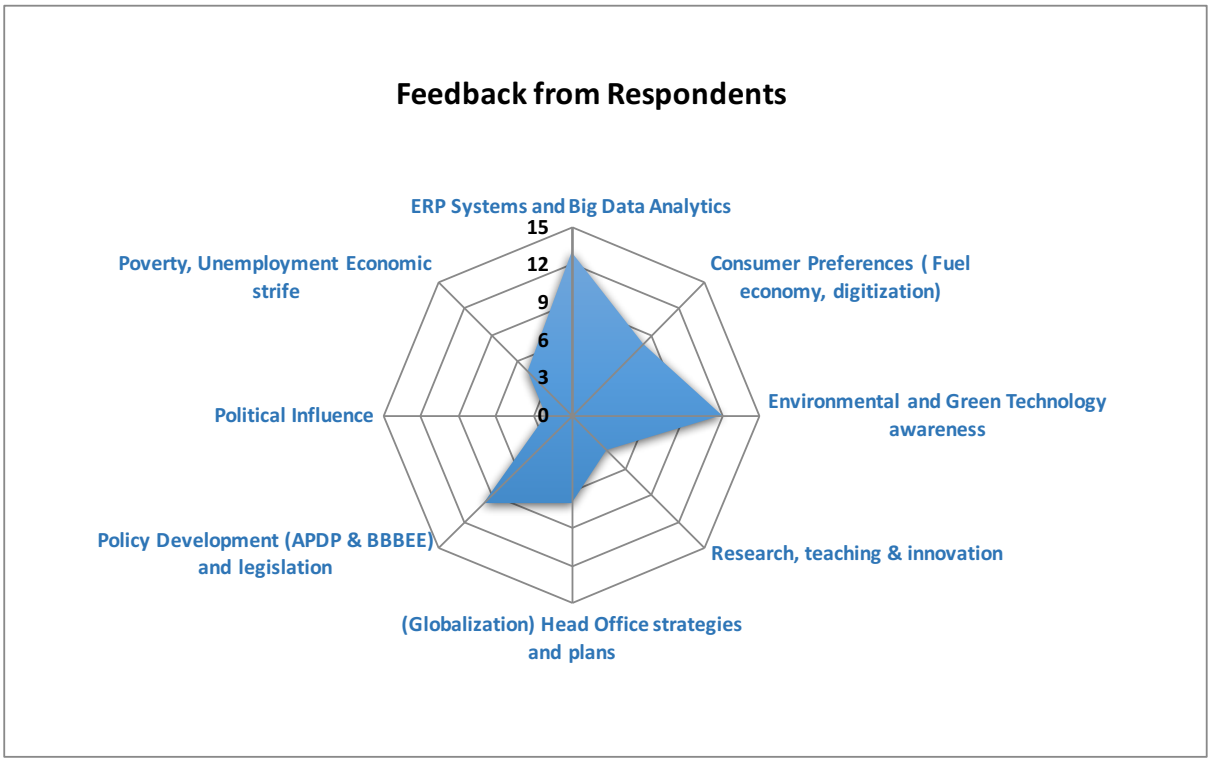


Fig 4.3: Image showing radial chart from Question 3 coding analysis of responses

This particular radar diagram displays the diversity on the codes based on replies from the interviewed individuals. Most drivers of change that were expressed by the responds include: environmental and green technology, ERP systems and big data and the reoccurring policy development. Potential patterns that could exist between these codes will be further analysed and discussed in chapter 5.

Consumer preferences is also mentioned as something that will dominate how the industry will evolve as an addition to how consumers are becoming more sensitive to climate change and green technologies. Most participants seem to be agreeing on the codes that were analysed for the question and the inter-relationships between the various codes will be analysed to identify meaningful connections in the data collected.

INTERVIEW QUESTION 4: Please identify key environmental externalities that could impact future strategies in the automotive supply chain?

This question was designed and structured to ensure the 1st research problem which is to **gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.** Therefore, understanding which environmental externalities in Gauteng have an impact was crucial to enquire on.

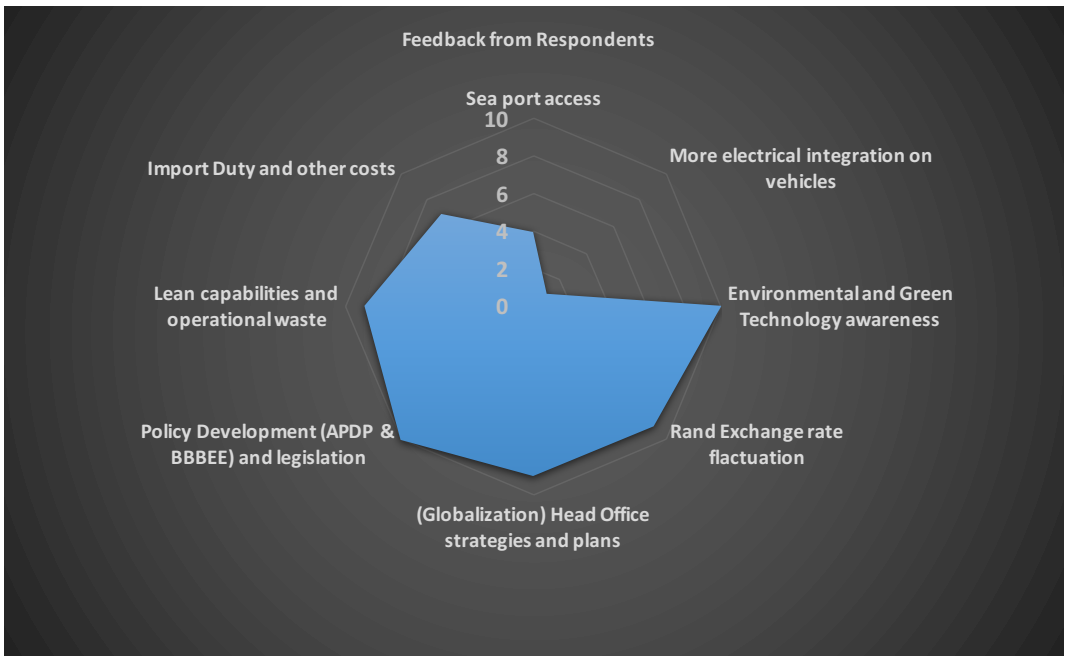


Fig 4.4: Image showing radial chart from Question 4 coding analysis of responses

Participant response with behaviour and gestures were a key strategy in coding the data for this question in order to determine which codes where clearly expressed in confidence and a full understanding of the phenomena and experiences that were shared by the participants in Gauteng. Technology and systems, policy development feature again as codes most mentioned in the interview setting, that have an impact on future strategy setting in the automotive supply chain.

In a challenging and competitive environment where OEMs are competing for market share and cost reductions, it is not a surprise that lean manufacturing capabilities and operational waste was mentioned. Looking at the results, an interesting observation shows there is commonality in the way the automotive players are being affected by key environmental externalities. Environmental in this question means (political, social, economic or geographical)

INTERVIEW QUESTION 5: How do the automotive supply chain capabilities assist players to be competitive? How do you identify these capabilities?

This question was designed and structured to ensure the 2nd research problem which is to **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?** Therefore, getting a sense of how the supply chain practitioners understand the capabilities of their operating environment needed to be investigated.

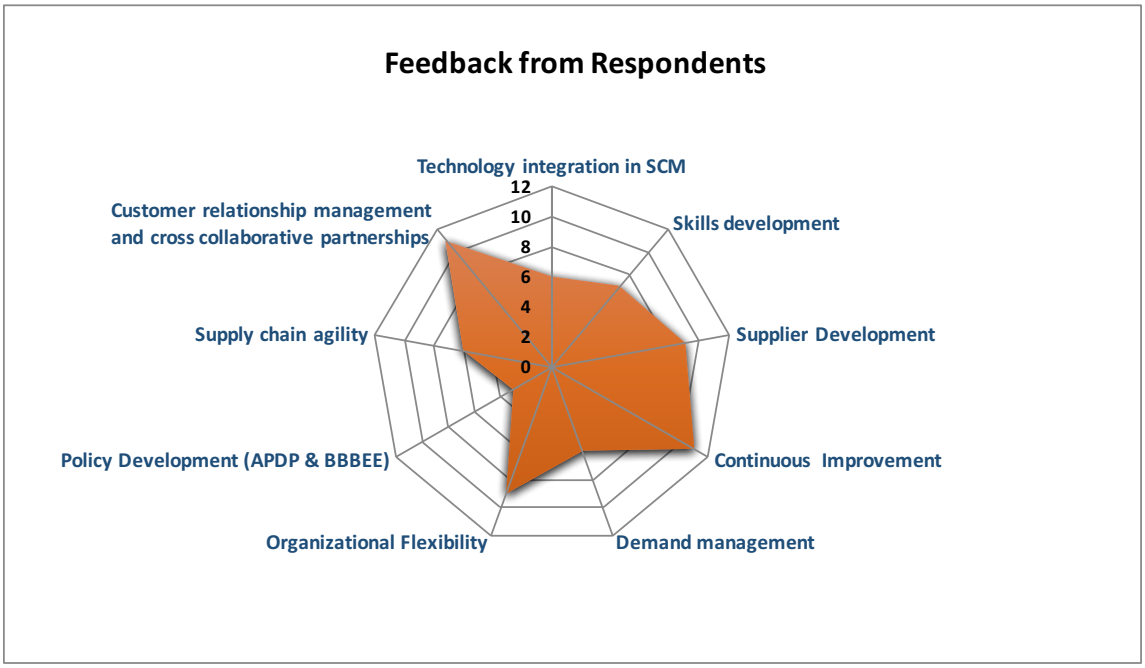


Fig 4.5: Image showing radial chart from Question 5 coding analysis of responses

Critical and fundamental codes that were mentioned are: continuous improvement, supplier development, technology, customer relationship management and supply chain agility as supply chain capabilities that assist the automotive sector to be competitive. It is observed that the different policies that are implemented by the government are not really considered powerful capabilities in making the industry players competitive when they export their vehicles. Several participants mentioned that South Africa's production costs are still quite high when benchmarked on the global market. How these capabilities were identified for each supply chain environment interviewed will be discussed in the following chapter. The codes mentioned above indicate and highlight the data

INTERVIEW QUESTION 6: Could you indicate significant manifested risk factors involving the supply chain that impacted production in Gauteng?

This question was designed and structured to ensure the 1st research problem which is to **gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.** Therefore, going back in time to identify the critical events that actually stopped production for the OEMs and sub suppliers was important.

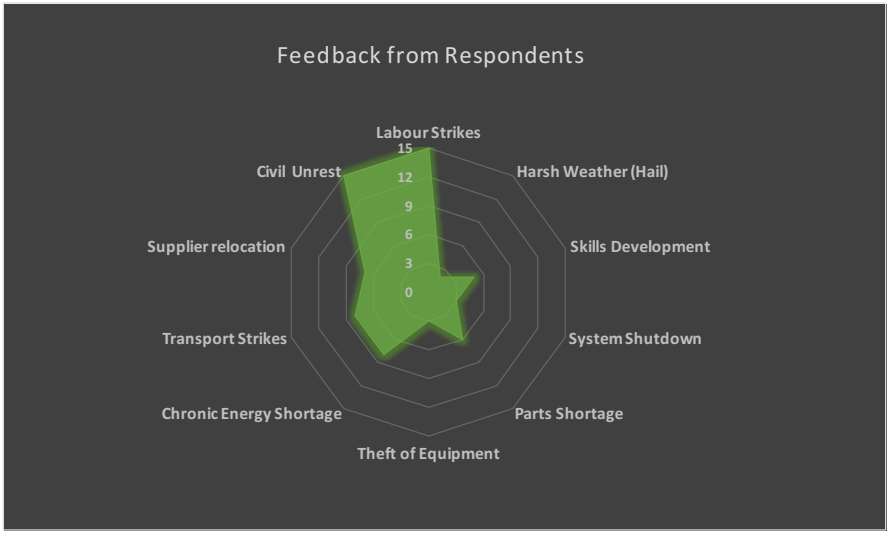


Fig 4.6: Image showing radial chart from Question 6 coding analysis of responses

Question 6 relied heavily on the recollection of accounts and experiences faced by the participants in their many years of dedicated experience, in the automotive industry. All the participants were quick to acknowledge that labour strikes coupled with civil unrest actually brought their plants and operations to a standstill. Despite the fact that the durations in which their plants were affected was different from plant to plane and between OEMs and sub-suppliers, there is intense commonality on how the industry is affected by the labour strikes and service delivery protests.

This intense commonality shows that the participants felt the effects of the strikes and civil unrest to a large extent that this was presumably felt industrywide by all players at different levels. This is a major concern to the stability and reputation of the whole automotive industry in Gauteng. As such some sub-supplies have either been forced to close down or forced to relocate to other counties with less unionized labour structures.

INTERVIEW QUESTION 7: The main sources and drivers of the risks mentioned before?

This question was designed and structured see how suppliers gather data and identify which significant supply chain risks in the Gauteng automotive sector. The main sources and drivers of risk need to be assessed to see how best to address them and minimize impact.

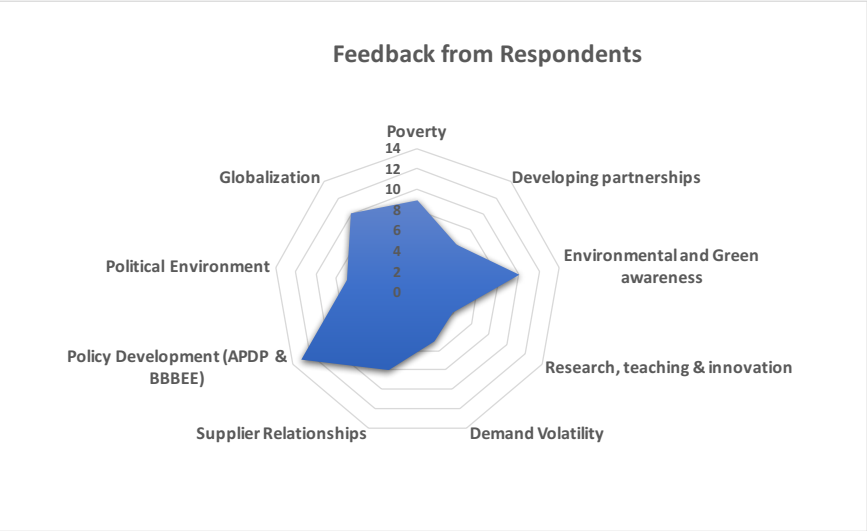


Fig 4.7: Image showing radial chart from Question 7 coding analysis of responses

Main sources of risk identified above include policy development and environmental and green technology awareness. Poverty in the communities where the labour forces come from and also the areas where the sub component suppliers and OEMs have set up operations was also mentioned. Globalization strategies by the mother companies that grant investment and licensing to the local subsidiaries have been highlighted by participants as bringing both positive and negative risks to their production.

Furthermore, policy development by the government and other supporting industry advisers and watchdogs also brings much uncertainties and potential for bringing innovation and re-strategizing to counter negative risk or take advantage of positive risk. Relationships between suppliers and OEMs also play a crucial role in managing, mitigating and eradicating risks in nay organization hence the respondents highlighted that the quality of relationships is decisive in how disruptions are avoided or overcome. Cross-collaborative relationships were mentioned as being the game changer in fostering competitiveness and successful risk management.

INTERVIEW QUESTION 8: Please describe the main consequences for the OEMs as a result of the occurrence of the risks.

Risk consequences for OEMS could mean either disaster if its negative risk or success if there is a chance of maximizing return on investment if its positive risk. In the results below it is noticed that all the participants actually gave phenomena based on negative risk only.

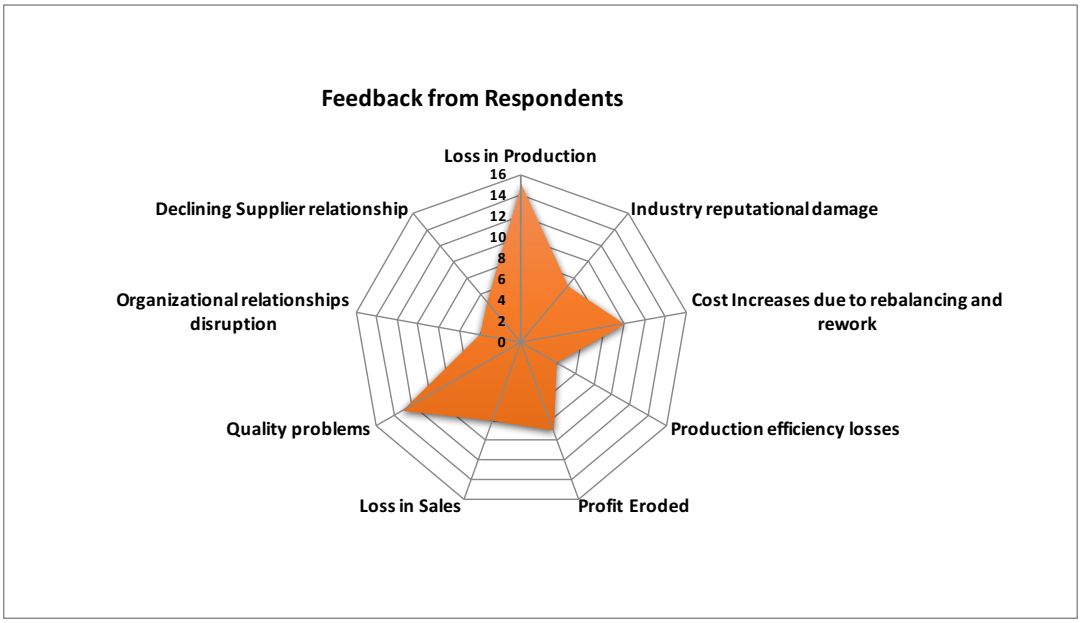


Fig 4.8: Image showing radial chart from Question 8 coding analysis of responses

Coding analysis of responses from OEM participants, sub component manufacturers and industry experts has revealed that the consequences that they suffered as a result of the occurrence of the negative risk factors include loss in production, incurrence of quality problems and concerns on the production lines as well as erosion of profits. These are all dismal consequences that put serious strain on business continuity.

The automotive industry thrives on Just in Time methodologies and efficient operations meaning they focus on maintaining lean production systems with minimum inventories held within the whole supply chain, thereby allowing for increases in the flexibility. Such consequential disruptions expose the limitations of such flexibility and test the relationships of upstream and downstream supply-chain incumbents on how they can still innovate to deliver and continue production under tough times.

INTERVIEW QUESTION 9: How did the OEMs deal with these effects or consequences in your organization and also with your supply chain member firms?

This question was designed and structured to ensure the 2nd research problem which is to: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?** Having discussed the consequences and different drivers of risk it was essential at this point to understand and delve into how the participants deal with the effects and whether or not it is done in a strategic way.

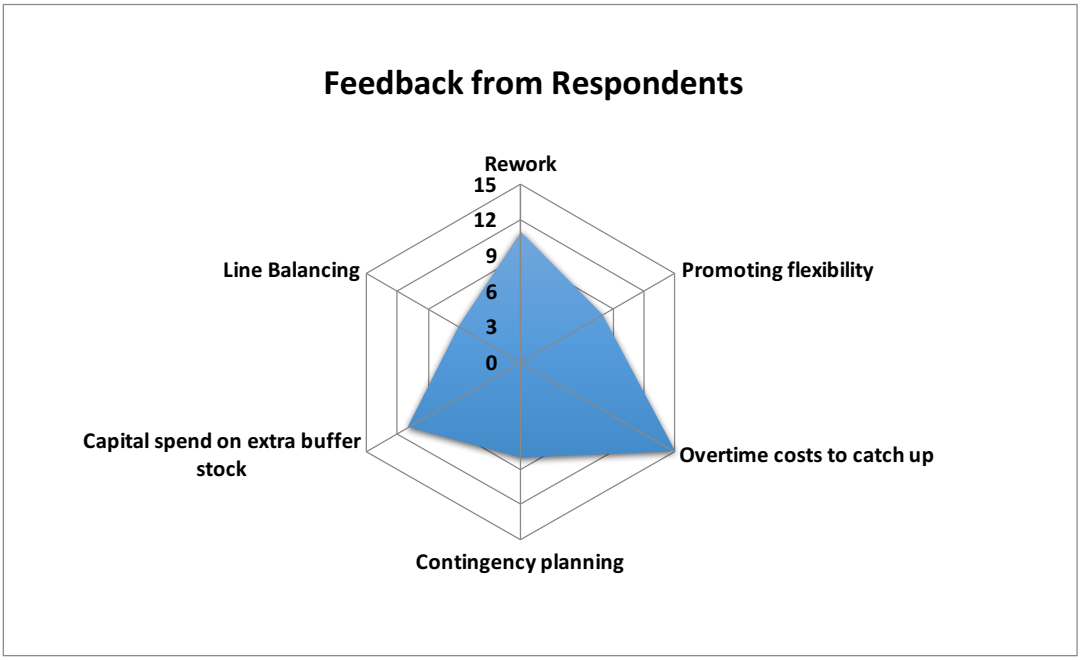


Fig 4.9: Image showing radial chart from Question 9 coding analysis of responses

Scrutiny of the codes raised during the interview, we find that in order to deal with the drastic disruptions OEMS and sub components suppliers had to spend money on overtime costs to catch up on production after the buffer stocks of parts and raw materials had been used up. The extent to which each participant was affected varied in terms of the number of days and amount spend on overtime. Rework on the quality concerns and problems is also another cost element that severely impacts organizations. The ways in which the OEMS dealt with the consequences of the risk events highlights more of a reactive approach which it to be further discussed in the following chapter.

Participants try their best to deal with such consequences pro-actively through contingency planning however if the strikes become protracted and take too long to resolve then inevitably organizations are forced to grind to a painful halt.

INTERVIEW QUESTION 10: What tools, techniques or methodologies make it easy (or difficult) for OEMs to deal with risk within the automotive supply chain perspective in Gauteng?

This question was also designed and structured to ensure the 2nd research problem which is to: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**

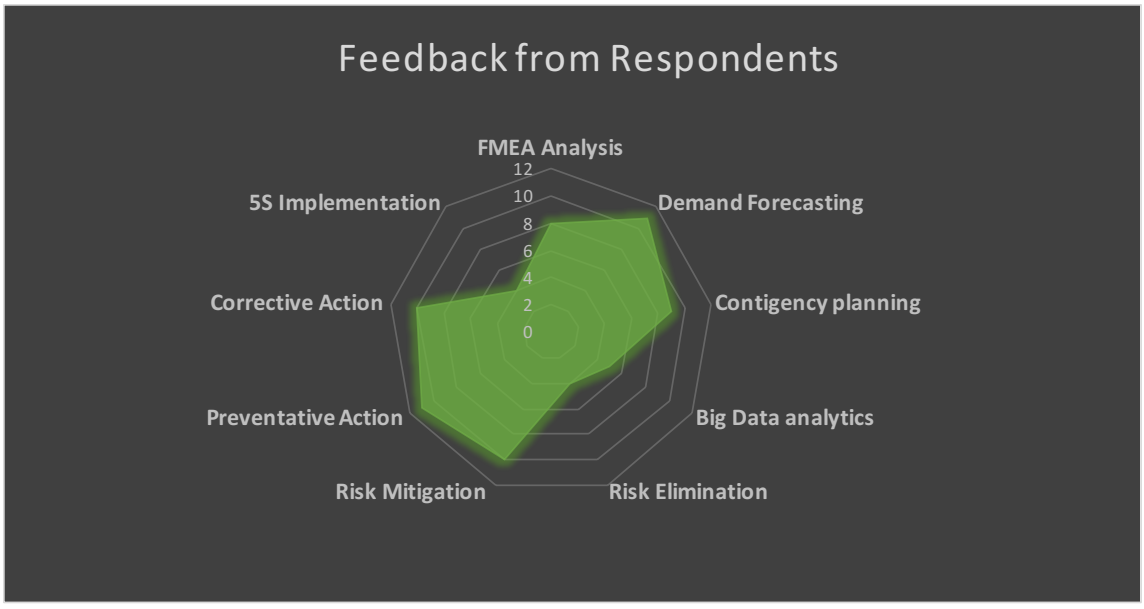


Fig 4.10: Image showing radial chart from Question 10 coding analysis of responses

Most participants highlighted that they employ risk mitigation methods and preventative action to deal with risk. Proactive management of risk mandates managers to investigate, identify and remedy the inherent risks which threaten the existence of their businesses to survive. Being best prepared to deal with risk before the risk event actually occurs will guarantee minimum impact than to be caught by surprise with unforeseen events.

Another practice or method which was mentioned and discussed during the interviews includes FMEA (Failure Mode Effect Analysis) which is a critical step by step analysis to assess and deduce all the ways in which a process or event can go

wrong. Demand forecasting and ensuring that the necessary resources have the ability to meet demand and counteract volatility is another method that is also employed by a fair number of participants.

INTERVIEW QUESTION 11: What helps you to deal and advise on supply chain risk? How do you employ strategies for risk management?

This question was designed and structured to ensure adequate information is provided for the 3rd research problem which is to: **Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector.**

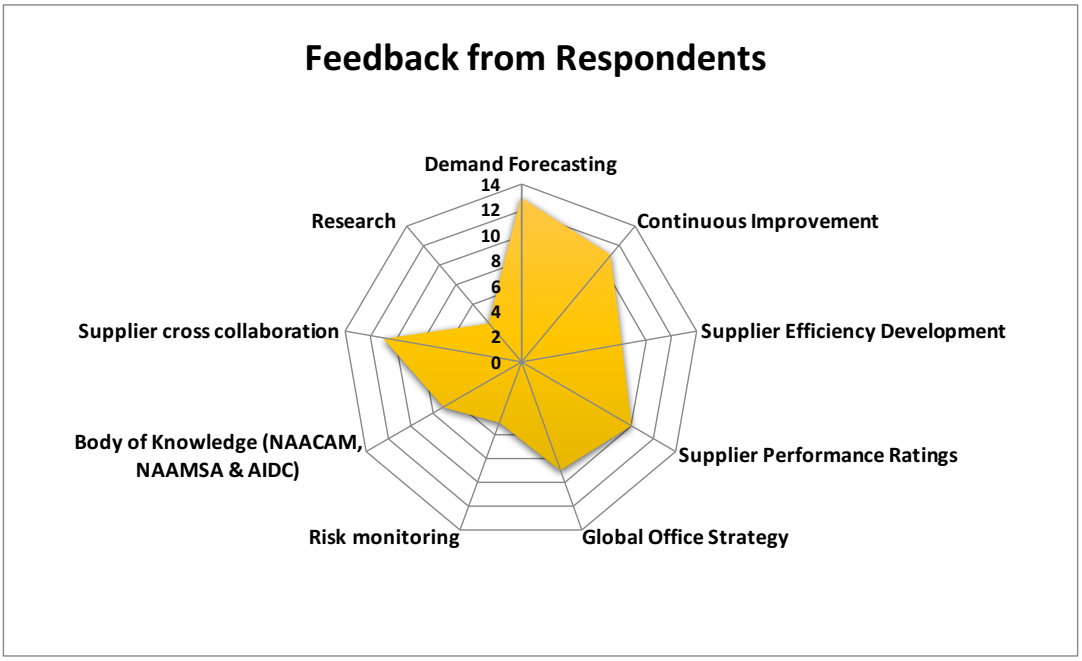


Fig 4.11: Image showing radial chart from Question 11 coding analysis of responses

Participants from various companies are using demand forecasting, suppler performance ratings, continuous improvement and supplier cross collaboration to deal with the numerous vulnerabilities in their supply chains. These countermeasures ensure that demand volatility and suppler reliability are boosted and lead-times are improved.

It is also important to note that participants conducting research on strategic risk management are quite low in numbers. Most participants highlighted that they use the data gathered by their systems or information provided by their global counterparts. They do not actively conduct academic research on strategic risk management.

INTERVIEW QUESTION 12: Risk mitigation / contingency planning for the automotive supply chain?

This question was designed and structured to ensure adequate information is provided for the 3rd research problem which is to: **Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector.**

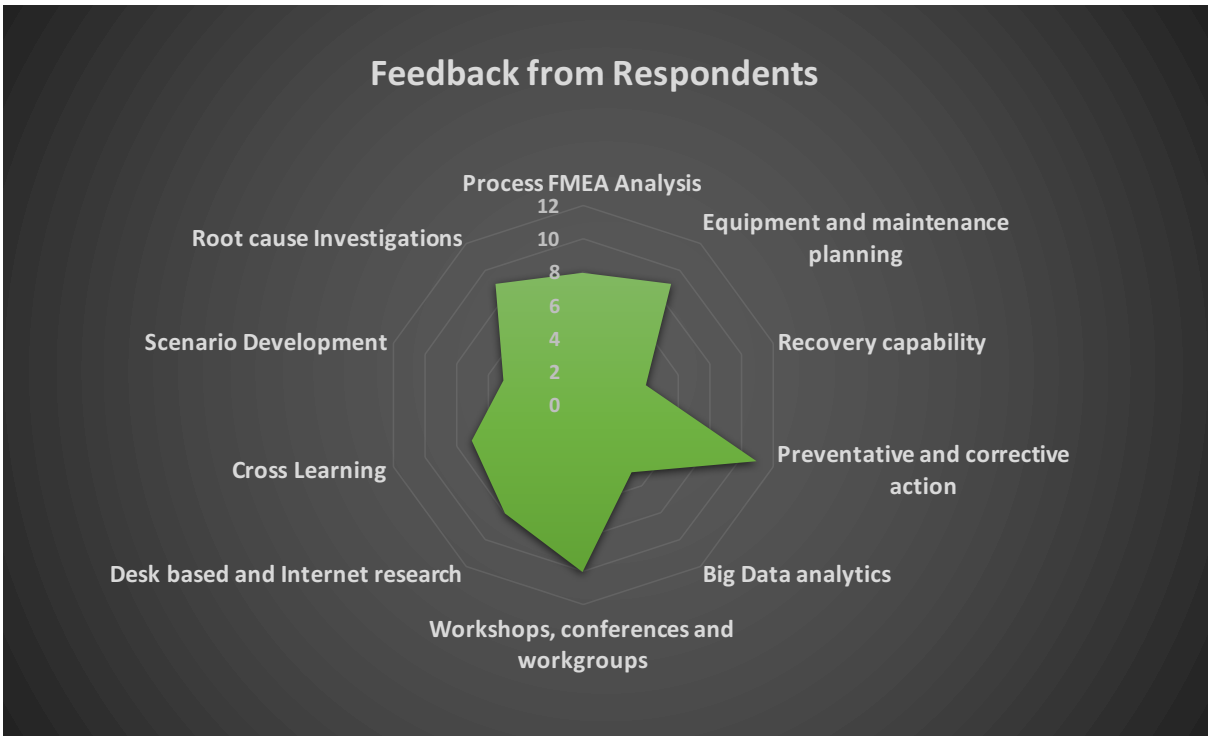


Fig 4.12: Image showing radial chart from Question 12 coding analysis of responses

In order to evaluate the best method of response, participants have to go through a risk evaluation process for comparing the results of risk analysis with risk criteria to determine whether the risk is acceptable or tolerable. Organizational objectives, laws, standards and risk propensity levels of organizations play an essential role in the options selected to handle the risk.

Looking at the above radar diagram, preventative and corrective action on processes, workshops and conferences on dealing with supply chains, equipment and maintenance planning are mentioned as the common of assessing how to conduct risk mitigation and contingency planning is executed. Root cause investigations on the supply chain is also a necessary consideration; the aim is to address risk with the correct countermeasures.

INTERVIEW QUESTION 13: Are there any trigger events or signals in the automotive supply chain that prompt you to respond?

This question was also designed and structured to ensure the 2nd research problem which is to: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**

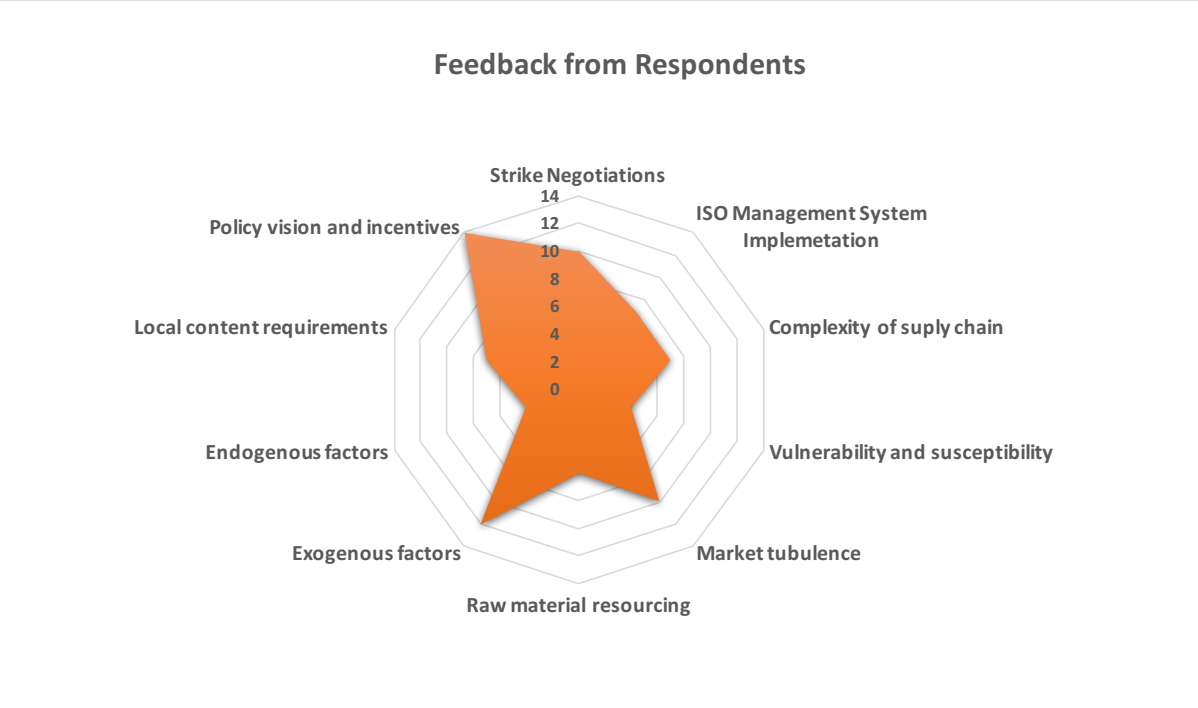


Fig 4.13: Image showing radial chart from Question 13 coding analysis of responses

Trigger events and weak signals in the operating environment help in the risk identification phase to ensure that there is proactive monitoring and scanning for any unforeseen and anticipated events that can cause production stoppages. A large portion of participants indicated that they pay particular attention to weak signals in the social environment, technology and systems and research teaching and innovation. Keeping a pulse on the weak signals also helps OEMs and sub-component suppliers to stay informed and alert on innovations and information that can potentially give them a competitive advantage on their operations and strategies and profit maximization. Action plans and preparations taken in advance provide an easier and quicker response to the crisis before it emerges. As organizations monitor these weak signals the optimal plan of action can be examined much earlier on.

INTERVIEW QUESTION 14: What future surprises could really help / hurt the automotive supply chain?

This question was designed and structured to ensure the 1st research problem which is to: **Gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.** Uncertainty, volatility and unforeseen circumstances are not always easy to identify and keep track of.

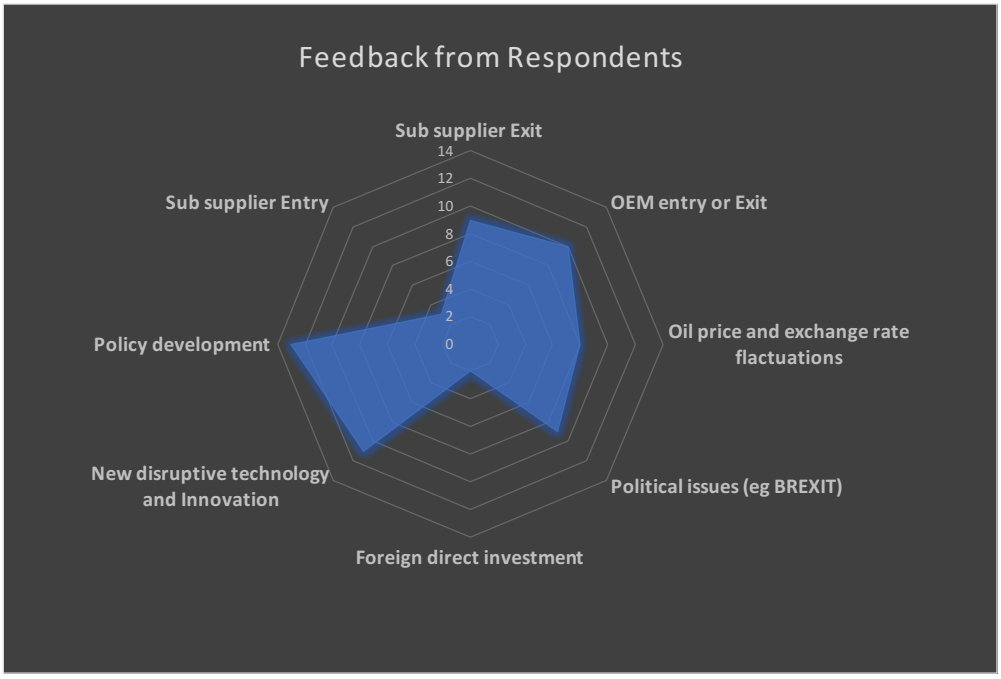


Fig 4.14: Image showing radial chart from Question 14 coding analysis of responses

Most participants were surprised by the questions and its context but it was meant to bring to their attention that even the least expected even can occur for example participant number 7 mentioned that they did not expect the hailstorms that hit Gauteng to cause such disruption to their outbound logistics and caused untold and unbudgeted expenses. Therefore, in order to improve risk detection systems most participants highlighted that surprises such as OEM entry or Exit (as was the case with general motors in June 2017) could bring about both positive and negative risks. Other codes that were highlighted include Policy development by the government of South Africa, new disruptive technology and innovation that is introduced to the automotive manufacturing sector and global political issues that have a far-reaching impact even on the Gauteng geographical location.

INTERVIEW QUESTION 15: Kindly describe the facilitators / impediments / constraints in your supply chain risk management process.

This question was designed and structured to ensure the 2nd research problem which is to: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**

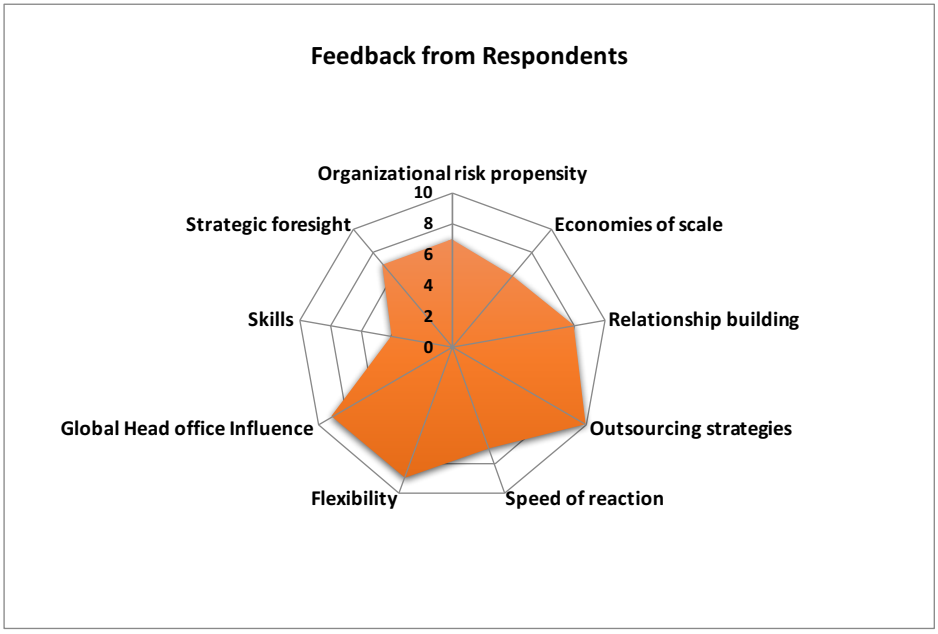


Fig 4.15: Image showing radial chart from Question 15 coding analysis of responses

When the particular objective is to build and maintain a resilient supply chain participants stressed that the facilitator and impediments that they pay particular attention to in Gauteng are: Global head office influence. In this code, there were different reactions and responses from participants because some wanted more influence and others specified that less influence is better for their local operations due to the decision making that is done on their behalf.

Speed of reaction focuses on effect-related issues, rather a more keyed up approach of pro-activeness, hence it can be a massive facilitator if the risk event does emerge and action is required to avoid losses, defects and preserve lead-times. Outsourcing strategies are also key to success and this can include decisions on what can be manufactured in-house and what is manufactured elsewhere on behalf of the original equipment manufacturer. This can also include decisions to have dual sourcing to promote flexibility of supply.

INTERVIEW QUESTION 16: How do you conduct Future Strategy development process for the automotive supply chain?

This question was designed and structured to provide an overall understanding of how automotive players in the industry in Gauteng are employing strategic development in their risk management processes despite the numerous challenges being faced economically, geographically and politically.

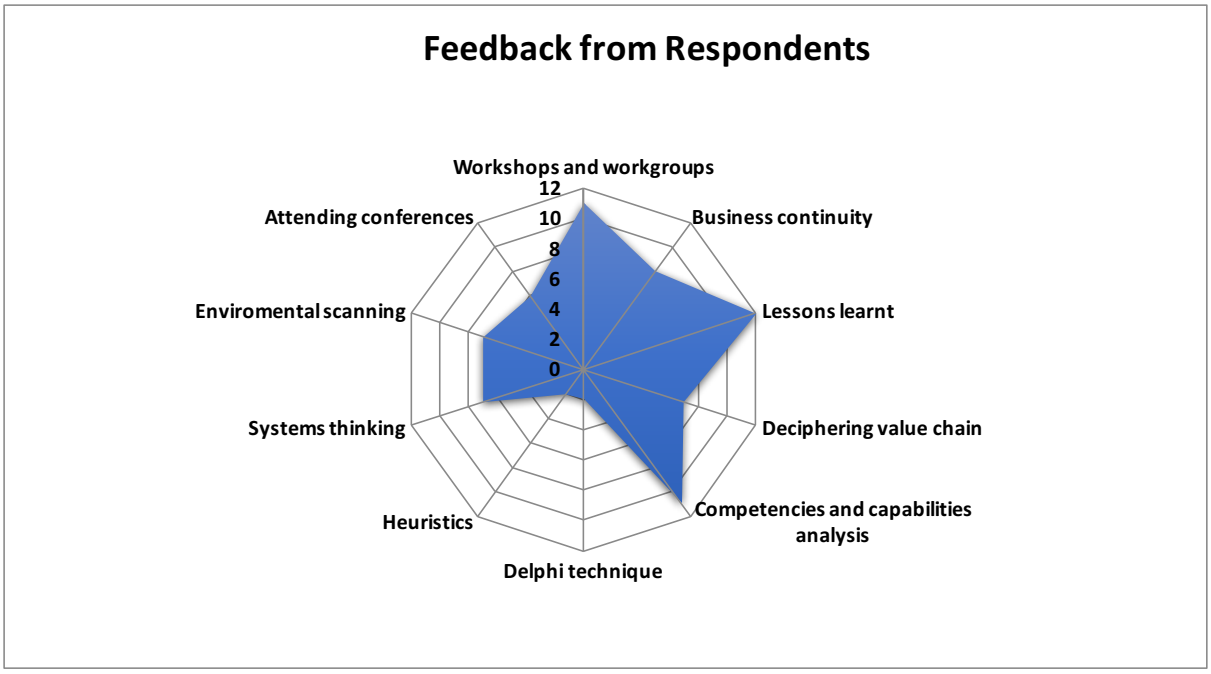


Fig 4.16: Image showing radial chart from Question 16 coding analysis of responses

In order to maximize the strategic development process, any industry player needs to focus on taking advantage of the competencies and capabilities therefore hence most participants resonated with the notion. Workshops and workgroups for idea sharing and investigating insights were cited by respondents. There is not a single best way to manage processes of organizing, decision-making and leadership for the development process since different environments provide different antecedents. However; business continuity is the main objective of the strategy development of the supply chain efficiency. Respondents also communicated that lessons learnt, competencies and capability analysis and deciphering the value chain to maximize the opportunities and minimize negative risks, enabling prioritizing measures on the basis of the existing resources and anticipated implementation.

INTERVIEW QUESTION 17: Please explain how you conduct Strategic decision making under uncertainty for the automotive supply chain and logistics.

This question was designed and structured to ensure adequate information is provided for the 3rd research problem which is to: **Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector.**

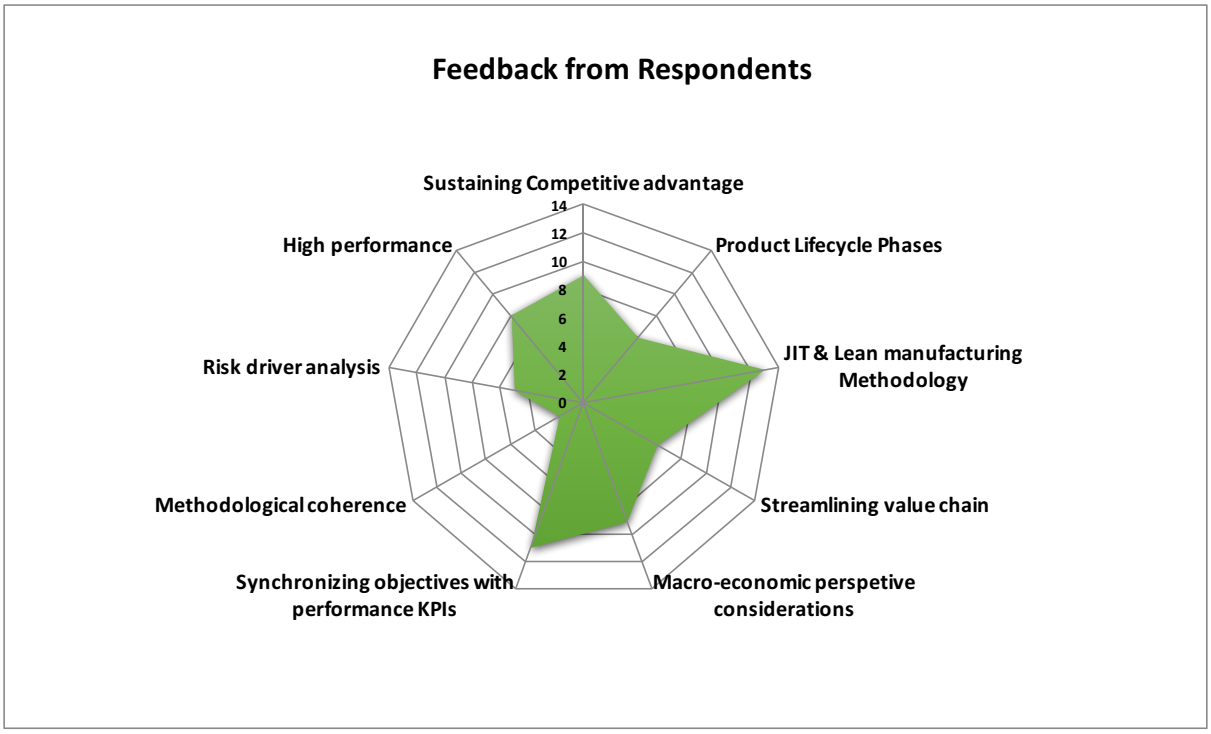


Fig 4.17: Image showing radial chart from Question 17 coding analysis of responses

The participant responses show that common practice in strategic decision making under uncertainty in the automotive supply chain is to synchronize objectives with performance KPIs and tackle perceived risks. JIT and Lean manufacturing methodology are also critical in the decision-making process, conversion of logistics management processes and co-ordination and collaboration with channel partners. Coding analysis has also revealed that macro-economic perspective considerations such as market turbulence, interest rates, price sensitivity, level of competition and demand swings are indirect influences on the decision-making process. Sustaining a competitive advantage and guaranteeing high performance of the supply value chain is paramount meaning efficient efficient flows of products information, services decisions, capital providing maximum value to the customer.

INTERVIEW QUESTION 18: Are there any key pieces of infrastructure or system elements that seem to be missing in the automotive supply chain?

This question was designed and structured to ensure the 1st research problem which is to: **Gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.** In this question, the research instrument was focusing on the missing links in the automotive industry in Gauteng.

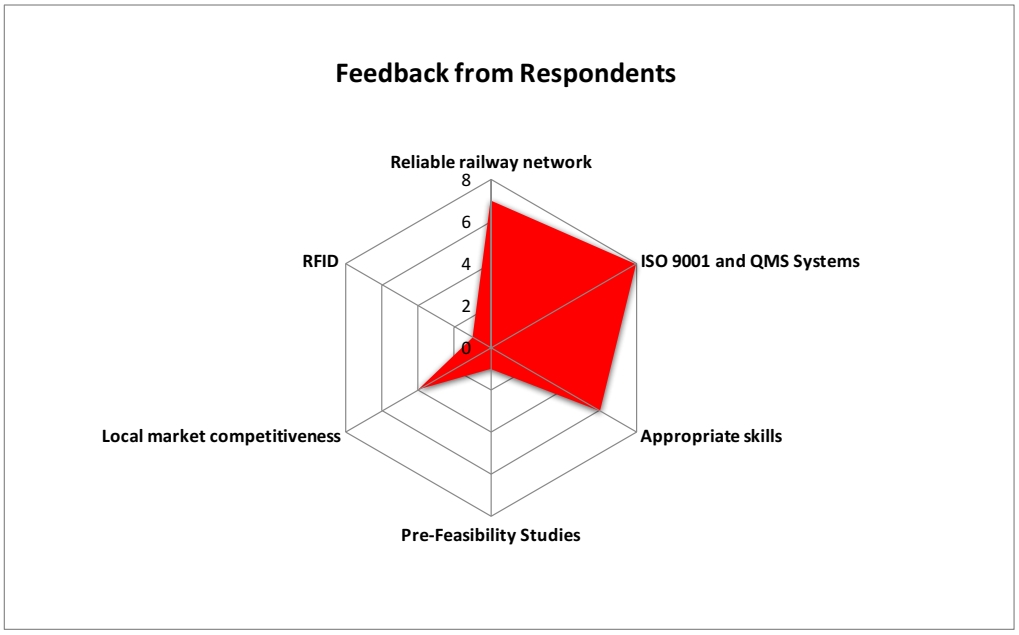


Fig 4.18: Image showing radial chart from Question 18 coding analysis of responses

As reflected on the findings from the research instrument above, it shows that most participants highlighted that a reliable rail network in Gauteng to the major ports emerged as an important factor that can assist industry players to be successful in this world of complex time-based competition. Such infrastructure could help reduce costs and efficient flow of finished products and components to major destinations in the country, this would greatly benefit both incoming and outgoing logistics.

Appropriate skills also emerged as an important factor that seems to be missing in the Gauteng automotive industry and this is evidenced by the incubation and skills development programs that have all been initiated by Nissan, BMW and Ford at their manufacturing plants. As participant 12 mentioned: “Ultimately, as young people get more engaged in these programs new innovations to support our local industry.” A lack of quality management systems like “ISO” on the sub component supplier side was also raised.

INTERVIEW QUESTION 19: What core systems or strategies would you like to see driving change in the industry?

This question was designed and structured to ensure the 2nd research problem which is to: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**



Fig 4.19: Image showing radial chart from Question 19 coding analysis of responses

As the interview was coming to an end this question was posed to make the participants sensitive to the fact that the management of risk that implies both strategic and operational horizons for long-term and short-term assessment. Hence the participants stressed that the core strategies and systems that would like to see driving change include digitization, innovation by all parties involved in the supply value chain. Skills development was also a major code that emanated from the interviews because it is an integral part of forming resilient systems with expertise, knowledge and experience overcome challenges. Industry 4.0 also came up as a strategy in making supply chains in Gauteng more competitive.

Other participants such as participant: 1,3,4,5,10, 12 and 15 highlighted that it would be good if they were given the space and allowed to have decentralized strategy formulations so that the strategies they employ will be relevant and significant to their local operational context.

4.4 TABULATION OF CODED RESULTS

The tabulated coded results based on the in depth semi-structured interviews that were used to understand phenomena within their context. These tables were used to generate the radar charts that were shown in section 4.3 above they will be shown in the Appendix B section of the research project.

4.5 SUMMARY OF PRESENTATON OF RESULTS

There was overwhelming consensus that estrangements and interruptions in supply chains do result in large financial losses and undermine the reputation of firms. Therefore, there is growing interest among supply chain practitioners in the Gauteng automotive industry to be more strategic in the way they manage risk. Many participants interviewed highlighted the challenges that they have faced in their operations due to the occurrence of the risk events and it is encouraging to note that they take ownership and aim to be more resilient and learn from past experiences to boost organizational performance.

In many experiences and phenomena shared by the respondents, there is commonality and uniformity in terms of the risks that have been experienced by industry players. From labour strikes, service delivery protests, system and equipment failure to hail storms, the car manufacturers in Gauteng are experiences similar issues which could be attributed to similar strategies of handling risks and similar ways of trying to mitigate the exposure.

With the aid of the thorough literature review that was done in the next chapter of this research, the coded results will be analysed and transformed into themes based on the research findings.

CHAPTER 5 DISCUSSION OF RESULTS

5.1 INTRODUCTION

This chapter discusses the findings of the study, which have been described in the previous chapter, and compares the findings to the research documented in the literature review. It also identifies similarities between the participants' perceptions, opinions and experiences and highlights any differences. The discussion will extend itself to identify any crucial findings found within and between the participants interviewed equally on the research instrument.

5.2 IDENTIFICATION OF RISK SOURCES AND DRIVERS

The Gauteng automotive industry need supply chains which are efficient and add value in order to deliver expected performance despite the uncertainty of the business climate and the complexity of inherent supply chains. The respondents who participated and engaged with the research instrument expressed keen interest and experience in the subject of strategic risk management.

The evolution of the Gauteng operating environment in terms of technology and policy development brings out the challenges to ensure a resilient supply chain. Participant 2 mentioned that: "*The APDP policy (Automotive Production and Development Programme) which replaced the Motor Industry Development Programme (MIDP) on January 1st, 2013."* The APDP consists of 4 pillars that drive the programme:

1. Import Duty
2. Vehicle Assembly Allowance (VAA)
3. Production Incentive (PI)
4. Automotive Investment Scheme (AIS)

Various benefits arise from these 4 pillars including Import duties on vehicles and components which have been frozen at 2012 levels (25% on light vehicles and 20% on components) through to 2020. The vehicle assembly allowance grants support in the form of duty-free import credits issued to vehicle assemblers based on 20% of

the ex-factory vehicle price. Hence, duty credits which are earned on export vehicles will be used to offset imported components for vehicles produced for the local market. The Production incentive is the manufacturer's selling price less the value of non-qualifying material and components. The incentive is calculated through the supply chain and is earned by the end producer, which is the vehicle assembler, or the component manufacturer; in the case of component exports and aftermarket sales. Participant 6 challenged that the policies that will be good for the automotive industry would be those that: *"Increase practical local content, focus on issues of inclusive economic transformation and incentives… those are the biggest factors that will drive change"*

Policy changes and updates bring quite significant uncertainty and change to the Gauteng automotive industry. This uncertainty poses operational and financial planning risks that have the potential to either boost profits or increase manufacturing costs as stipulated by most respondents on question 14 of the research instrument. In these tough economic times, the optimal reconfiguration policies are determined by taking into account the performance impact of the disruption and the recovery costs as stated by Tsao and Lu (2016). Policy changes also brings a new dimension to strategy making between fixed proportional (cost-pooling) and flexible (capacity-pooling) and dedicated production techniques as agreed by Behzadi, O'Sullivan, Olsen, Scrimgeour, and Zhang (2017, p. 29)

Subsequently it can be seen that there are both positive risks and negative risks associated with current and further policy development. Especially, since post-APDP support framework had been developed in order to provide a certain policy environment for automotive manufacturing in SA after 2020. The policy sets the context in which OEMs and sub-component suppliers operate and transfer synergies. As it currently stands, government remains committed to further development of the automotive industry in line with the National Industrial Policy Framework (NIPF) and the Industrial Policy Action Plan (IPAP). Long-term development of the sector will be achieved through high vehicle production volumes and associated local value addition.

Participants highlighted that they are doing everything in their power to take advantage of the tariff introductions for import vehicles, duty free imported components and production incentives; but they are also aware that tariffs are only a temporary measure that does not fully protect them from getting their market share devoured by imported vehicles. Therefore, as seen from Chapter 4, there is great consensus by the respondents that the main objective is for automotive partners in the Gauteng to be globally competitive so that more export volumes can be secured for the future.

Technology:

Industry 4.0, Digitization, Big data analytics and the integration of more efficient and faster ERP systems and data is forcing supply chain practitioners in Gauteng to rethink the way they structure and run their supply chains. The observations recognized in Gauteng from Chapter 4 actually mirror some of the global automotive technology evolution themes such as those listed above. Therefore, the contributors to this research are monitoring and trying to identify the respective risks that come about with such technology.

As participant 1 confidently expressed that: "*ERP systems are really the only thing that really changes, and these fundamental differences affect the way in which each company works*" The manufacture of automated driving, artificial intelligence in cars and electric powered vehicles is also gaining momentum in the technology adoption of future mobility strategies. Furthermore participant 12 highlighted that: "*The integration of our procurement strategies is what we need to look at because a lot of these things are now moving away from a mechanical sense more into an electrical sense."* This has been the trend for quite some time now but it is gaining more momentum. Gaining new technologies is undoubtedly a strategic way of remaining competitive but it has to be the right technologies that amplify the voice of the customer and also bolster the company's technical capabilities as reinforced by Hung and Tang (2008) and Das and Joshi (2007)

It is imperative to ensure that new technology and innovations supports the existing equipment and can complement the reconfiguration of the existing business models.

As stressed by Hung and Tang (2008) who said:

> As a component of its technology strategy, the firm should choose the appropriate mode for acquiring the needed technology; i.e., all available options to a firm should be carefully considered when deciding the mode of technology acquisition.

Hence in as much as technology is evolving, managers need to make sure that they select, acquire and invest the right technologies to encourage the success of their strategies and production plans in the future.

The extent to which effort is applied to the risk identification is applied in Gauteng is quite satisfactory as participants highlighted that they always attempt to identify downstream and upstream risks, in order to develop a common understanding of future uncertainties and appropriately deal with them. Such is the case that in the analysis of codes in Chapter 4, an important theme came out that customer preferences are constantly changing as people become more aware of green technology and environmentally aware as participant number 4 highlighted that cars powered by green fuels, autonomous driving are the main highlights of the future and Gauteng has capability to produce such cars.

Green supply chain is thought to be future direction of supply chain. Thus, establishing and implementing green supply chain has become a strategic task of every country industrial development. Liu (2017) agrees that for firms to be competitive amidst international green barriers, government regulations on environmental protection, they have to implement a long-term stance on social and environmental responsibility and to provide environment-friendly green products. This research's findings based on responses from question 2, 3 and 7 the respondents expressed a high degree of similarity in expressing that their organizations are becoming more aware to climate change and environmental sustainability in their products and processes. Furthermore, they are even recognizing green supply chains as a competitive advantage and means of product differentiation to appeal to all their stakeholders.

Visibility and information processing to gain insights has been stressed as the differentiating factor in identifying risk and different companies and industry players who contributed to the research show varying degrees of visibility in their supply chain activities. Consequently, this has a massive impact on products and automotive components with short life-cycles. More visibility helps to detect weak signals of unforeseen events with high disruptive effects thus organizations cannot be blind-sided by pending chaos as reported by Ali and Shukran (2016). Contributors to the research noted that when most of these risk events occur they not only affect one entity but have domino and multiple effects that can cause damage to the whole industry in Gauteng and even across South Africa. In their strategies, procurement specialists mentioned that they are trying to see how the supply chain in Gauteng can benefit from the increased connectivity of Internet of Things (IoT) and the various Cloud services and global data generation as this findings show in questions 2,3 18 and 19 in the research instrument.

Vulnerability and susceptibility of Gauteng automotive supply chains is also a critical element of success, as pointed out by Participant 13: "*I would say size, the advantage of being a small organization is that we have we have speed, we don't have massive pipelines and absolutely huge lead-times so it does give us the ability to change sources relatively quickly."* As agreed by 47% of the participants in answering question 9. Flexibility or agility of the organization came in with a 60% acknowledgement to foster a resilient supply chain.

All participants in this research highlighted that strikes and civil unrest in the South African automotive sector is one of the biggest risks they face as a key environmental externality. Labour strife is persistent in South African industry due to socio-economic context of high unemployment and strong union presence and activism that the automotive industry in Gauteng is not immune to. Labour unions, workers and firms all operate under the ecology of the country's institutions. As depicted by Participant 15: "*Strikes, we have supplier strikes, taxi strikes and what happened in Gauteng we had the big shift with the DA taking over Tshwane and of course some production disturbances."* Despite the high unemployment and mechanism for collective bargaining; strikes are a strong expression of demand for social justice in a context of inequality. The detrimental effects of such action is that

although warranted in certain views, it undoubtedly leads to loss in productivity and may lead to restructuring and job losses and deteriorating labour relations as agreed by (Harvey, 2016, p. 832)

Participant 3 also highlighted that: "*There was a big riot in Tshwane about the ANC mayor of Tshwane being selected without the vote of the public. The public was very upset, there lots of strikes, destruction of property, stoppage of traffic, a lot of our trucks couldn't get through on time and we had to find alternative routes and this specifically hurt our sequence suppliers where they need to deliver on-time, in sequence to the production line."* Undeniably, each participant has felt the dreaded effects of strike action in their organizations and as supply chain practitioners in their respective firms, recommendations will be given in the next chapter on they can best prepare for and improve labour relations in order to less vulnerable and susceptible to the labour force instability and public or civil unrest and service delivery protests. Something which can be adapted from the mining industry studies but totally relates to the automotive industry was challenged by (Harvey, 2016) concluding that Moreover, none of the above argumentation suggests that strike action is always irrational, but that there are strategies available that could prevent its frequency, and incentivise labour- beneficial growth.

5.3 STRATEGIC RISK ASSESSMENT AND ANALYSIS

Over the past few years, as discovered from the research, companies have shown growing concerns in relation to the possible risk environment and its impact on their production activities. Once these risks have been identified it is critical to assess and analyse them in order to decide on the best strategic, feasible methods of tackling them as concurred by (Bowersox, 1997) and (Prajogo, 2016). As mentioned by Participant 2 who stated that in forms of ways in which his organization identifies sources and drivers of risk: *"I can't say there is a formal way we do it, this basically comes or is raised in the management meetings and discussions that we do."*

The research suggests that to respond to this challenge, organizations have been trying to incorporate risk assessment and analysis practices into their strategic planning and management. Some of the practices mentioned include: Workshops

and workgroups, environmental scanning, systems thinking, heuristics, Delphi technique, competencies and capabilities analysis, Deciphering value chain, Lessons learnt and business continuity. In the automotive industry, protecting the assembly line from delays due to missing or non-conforming parts is a paramount concern because automotive supply chains are set to the pace of assembly lines (Kırılmaz & Erol, 2016).

As shown from the research instrument analysed results, competences and capabilities analysis emerged as a key theme used in analysing and assessing risk as mentioned by 73% of the participants. Increasing the information processing capability through investing in information sharing helps to develop risk-buffering strategies and cushions the pending impact as acknowledged by (Saban, Mawhinney, & Drake, 2017, p. 2). This information processing and exchange requires integration and coordination of all supply chain members in a complementary way such that another 73% of the participants mentioned the same sentiment in question 11.

The findings from the participants indicate that firms in Gauteng are actively involving their Tier 1 and tier 2 suppliers in collecting information about the external environment, thus enhancing their risk detection efforts in the process. As testified by one of the participants who stated that: *"With our suppliers we talk about everything that can affect our customer and we strive to put the proper safety controls in place, this is way before right in the early stages… before we even build a single car"*

5.3 DISCUSSION OF 1ST RESEARCH SUB PROBLEM

The 1st research problem attempted to: **Gather data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance.**

The major risks that were identified by the participants during the semi structured interviews are the following:

- Labour Strikes
- Civil Unrest
- Theft of Equipment
- Parts Shortage

- Supplier relocation
- Transport Strikes
- Chronic Energy Shortage
- Harsh Weather (Hail)
- Skills Development
- System Shutdown

As discovered from the results the logistics and supply chain managers in the automotive supply chain in Gauteng are trying to identify risk but there is vast room for improvement. The risk strategy that seems to be most prevalent is reactive rather than pro-active both from the OEM to the Sub-supplier perspective and experiences from the research instrument. From Question 2, 80% of the Participants generally agreed that the industry is evolving due to consumer preferences and the adoption of technology in manufacturing sites. Therefore, decision making at a strategic level should be done after considering the impact and risk brought about by such change as denoted by Micheli, Mogre, and Perego (2014).

Supply chain practitioners specified that they use tools such as workshops, root cause analysis, FMEA and continuous improvement initiatives to try and identify risks. Participant 7 highlighted that: *"This is the standard in the automotive industry, you will have a review of that FMEA, not only by the ISO auditors but by your customer as well, it is part of your documentation when you submit samples, you have done your run out rates inside your factory and proven capability to manufacture good for your customer"* Other participants also highlighted that rely on tools and methodologies from their global counterparts to identify risk here in Gauteng. The applicability and relevance of those tools is always in question on whether they are truly effective when used in the local context. Participant 9 added that *"Weekly planning and production capacity planning and daily planning of components and daily KPIs are ways we try to pick up trigger events and week signals"*

Logistics engineers and planners conduct an assessment of potential complexity-related risks which exist in their environments by close engagement with their suppliers which is agreed in the literature review by (Chopra & Sodhi, 2004). According to the findings of the research instrument, most OEMS are actively engaged in supplier development programs to try and upskill their sub component suppliers, make them more aware and sensitise them to quality requirements and

also enhance the cross-collaborative relationships and stakeholder engagement that can breed innovation. This very commendable because knowledge is shared across the supply chain making it a truly integrated value adding chain. One of the industry experts interviewed affirmed that: *"We are policy implementers, so whatever that needs to be implemented from a policy point of view, in terms of supplier development, skills development, infrastructure plus transformation we focus on those issues to support the industry."*

Based on the data collected in the supplier rating activities, the managers and engineers also gather risk specific data and identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance. More data and assessment is critical to ascertain the true risk exposure of the risk inherent environment.

5.3 DISCUSSION OF 2ND RESEARCH SUB PROBLEM

The 2nd research problem attempted to: **Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?**

In answering the questions that investigated the tools, methodologies techniques that are currently used, the participants mentioned that:

- Risk Elimination
- Root Cause analysis
- Demand Forecasting
- Contingency planning
- Big Data analytics
- FMEA Analysis
- 5S Implementation
- Corrective Action
- Preventative Action
- Risk Mitigation

The research instrument also indicated that the most effective strategic risk management practices which have the greatest positive impact on automotive firm performance in Gauteng are the following:

5.3.1 Speculation (Risk Taking Strategy)

Some participants have highlighted that they have implemented demand management systems in their supply chains. This is a form of a risk-taking strategy called speculation because strategic demands are made based on anticipated customer demand. This strategic risk-taking method is utilized by a large number of tier 1 and tier 2 suppliers in Gauteng. By observing trends and patterns by OEMs the sub suppliers can make relatively safe predictions on what is on the production line and how to effectively supply. Participant 10 mentioned that: *"If we know there is going to be a strike in July for example, we look to say okay, we start producing those parts beforehand and make an investment into stockpiles of raw materials and finished goods"* which concurs with what other participants mentioned especially participant 4 who also reiterated that: "*On another note we have what we call a business continuity plan in the organization which is reviewed discussed on what can go wrong and what can be done to meet future demand."*

5.3.2 Hedging (Risk Taking Strategy)

In order to neutralize the effects of the identified risks, a few number of participants approximately 33%, in response to question 17, mentioned that they have dual sourcing strategies or have a portfolio of suppliers on standby and ready to supply in case the main supplier cannot deliver, this makes sure that production is not affected. However, it is rather a costly option because each supplier has to have buffer stock on stand by and the process has to be managed carefully otherwise costs can escalate.

5.3.1 Risk Share or transfer Strategy

As participant 11 mentioned: *"It clear in an OEM-supplier relationship, one cannot go at it alone we have to work collectively to meet the result and reduce risk."*

As indicated by the participant above suppliers and OEMs need to synchronize their activities and business processes in order to achieve greater efficiencies of production. Hence by sharing or transferring risk due to the

inherent unpredictability of supply chains, both parties share the risk to protect against unforeseen risks. Significant efforts are made to see who can better handle a situation whilst it still lies in their realm to control or mitigate, no problems should be allowed to be hidden and fester into serious consequences, transparency is a crucial element of risk sharing.

5.3.1 Risk Avoidance

One participant mentioned that: *"So you find that at times we take these risks lightly until we get hit for example I mentioned the lack of multi-sourcing. For example, going back to the mirrors I mentioned earlier, our business continuity plan actually mentioned that we should have multi sourcing for key components but we did not implement that"* This example highlights one of the crucial errors in choosing to not do anything regarding the risk until it is too late to respond. The organizational risk propensity and perceptions of perceived threats are what forces an organization to take action or just accept the risk.

5.3 DISCUSSION OF 3RD RESEARCH SUB PROBLEM

The 3rd research question was to: **Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector?**

The research instrument was designed with some questions that delved into finding out if strategic risk management practices, tools, methodologies and techniques mentioned are actually working and why they are working.

Question 12 in the research instrument highlights the themes that came out from the participants that were questioned. The themes are those that aid them in risk mitigation and choosing the appropriate contingency planning that came out include:

- Workshops & conferences
- Big Data analytics
- Cross learning
- Root cause Investigations

- Preventative and corrective action
- Recovery capability
- Equipment maintenance planning
- Scenario Development
- Process FMEA Analysis
- Desk based Internet research

Supply chain analysis provides insight into how each of these are working and contributing to supply chain networks for the automotive industry. Participant 14, 12, 4, 5 and 7 mentioned that supplier development through workshops, cross learning and equipment and maintenance planning is actually working exceptionally well in the industry. This normally an initiative which is implemented by the OEMs or industry experts like the AIDC, NAAMSA and NAACAM to ensure that knowledge is shared amongst the different industry players. In these workshops, there is emphasis on value chain analysis which overcomes weaknesses of traditional sector by sector observations that are more static and suffer from the limitations of their own bounded parameters.

Most respondents highlighted that process FMEA analysis is becoming very helpful in the industry when it is tied in with root cause analysis and preventative and corrective actions to countermeasure risks. Through concentrating on inter linkages of these approaches there emerges easy uncovering of the dynamic flow of actions that can successfully mitigate, control or eliminate risk. Efficient allocation of resources was also mentioned as a benefit of full process analysis thus guaranteeing cost effective, energy efficient, more flexible, productive, profitable and reliable processes and quality products.

Participant 5 stated that: *"I think at project level when we do project we always do FMEA to try and identify risks of the whole project so beyond that it becomes a supply chain function." Every time we launch a model we have done a thorough analysis of the whole supply chain end to end, basically."* Previous research studies mentioned in the literature review stress that there is positive correlation between strong supply chain performance and flexibility in the organization for example (Thomé, Scavarda, Pires, Ceryno, & Klingebiel, 2014) It was also noted in this research that those OEMs which have well running supply chains have also adopted and started accentuating on being agile and flexible. The interlinkages of solutions cannot be conducted in a rigid focal company with huge inertia and indoctrinated philosophies that lack continuous improvement implantation.

Most participants from interviewed OEMS have ERP systems installed at their production bases. These systems are carrying and generating vast amounts of data that can be tapped into so that big data analytics and insights are constructed. Therefore, big data analytics is another differentiating dimension. Supply chain practitioners in Gauteng are only recently starting to realise the power that big data analytics are starting to provide to their strategy and decision making. However, due to the high cost of investment and maintenance of such ERP systems, some suppliers find it beyond their budgets to implement such good ERP systems. Through sharing some of these insights with their component suppliers, car manufacturers are achieving greater value chain performance.

Respondents 3,4,8,9,10,12,13 and 14 highlighted that they are seeing the benefits of conducting roots cause investigations in their logistics and value chain. Root cause investigations give magnifying lenses on clear understanding of undesirable events that may take place in the supply chain and the associated consequences. It also allows the ongoing mapping out the propagation of events of the supply chain due to supplier non-performance and appropriate corrective action.

5.4 CONCLUSION:

The findings of this research study show that risk identification methods and tools are in place for Gauteng car manufacturers, however the risk analysis and proactive selecting of appropriate, integrated and strategic solutions is lacking to a moderate extent. It is a vital step in the full strategic risk management of risk to develop inter-company risk analytic models to eradicate the effects and impacts of risk events. There is a high degree of commonality and uniformity in the risk events that are making the Gauteng automotive supply chains vulnerable and susceptible.

The upcoming chapter sets the stage for recommendations that can be practically applied by Gauteng automotive supply chain practitioners and decision makers to optimize and integrate their supply chains to make them more resilient to risk and its devastating consequences.

CHAPTER 6 CONCLUSION & RECOMMENDATIONS

6.1 INTRODUCTION

The research incorporated qualitative research and thematic content analysis from the research instrument responses, in order to establish an understanding of the practices in strategic supply chain management for the Gauteng automotive sector. Therefore, the current section now concludes the findings of the research and puts forward or suggests, possible and practical solutions that can be implemented by supply chain practitioners and industry experts in Gauteng.

6.2 RISK MANAGEMENT DILEMMAS

Even though many risks can be effectively addressed with risk management strategies, it is impossible to completely eliminate supply risks (Zsidisin et al., 2000). Therefore, it is critical for managers in Gauteng to understand the options that they have in their scope of operations, especially when these options are implemented in isolation or as a collective of solutions or options on operational performance. Accordingly, at this juncture, the decisive success factor could be how well different but complementary solutions can gel together to become a powerful risk mitigating and management strategy.

Individual risks are often interconnected: actions that mitigate a particular type of risk can in fact increase another type of risk (Chopra and Sodhi, 2004). This recognized that through thorough risk assessment such these contradicting effects can be predicted in time and necessary action can be taken to ensure that no negative risk is exacerbated by the implementation of another. Through the research instrument, it was also established that depending on the level of risk that a firm is facing, supply

chain managers should decipher the best integration approach fitting the environment.

Risk mitigation usually requires considerable investments and can sometimes come at the price of eroding profits (Chopra and Sodhi, 2004). Although profits will be slightly eroded momentarily, the end justifies the means because that investment will help safeguard the future operations and business viability of the focal company and its supply chain members. However, costs that the companies will face in case a disruption occurs are very likely much more than the costs incurred by the SCRM activities (Kırılmaz & Erol, 2016).

The overwhelming influence of policy development to the automotive industry is profound and should be handled as a delicate situation by the policy makers and also industry players. Inclusive growth and transformation should benefit all intended beneficiaries. Currently we seem to have policies that seem to be benefitting the elite few and leaving the rest of the majority of workers and citizens with reduced investment, shrinking growth and less jobs. New growth and investment boosting incentive programmes and policies should be established for the automotive industry. The APDP is expiring in 2020 and deliberations, action plans strategies should be well underway to see what needs to be done to deepen localisation through more component manufacturing so that more jobs are created.

Sub-component manufacturers expressed mild dissatisfaction with the APDP as compared to the OEMs and hopefully the new programme will also see more incentives and benefits being cascaded down to them. It is important to strike a balance between the needs of sub-component manufacturers and OEMs. Though government cannot provide significant financial support to the automotive industry, it can provide mechanisms and policies to increase profitability and development of the entire sector. The AIS, for example, provides a non-taxable cash grant of between 20% and 30% for vehicle manufacturers and 25% to 35% for component manufacturers, paid over three years and based on qualifying investments, plus a performance element.

The intensity of risk management efforts in the Gauteng automotive supply chain can definitely be enhanced. Supply chain practitioners need to proactively plan and

control supply chain activities with the important objective of creating and adding value to sustain competitive systems, leveraging cross collaborative relationships and successfully synchronizing supply with demand in Gauteng. In order to understand the challenging environment and the evolving risks, there needs to be a way to see and observe the whole system that generates these issues, in other words, critical systems thinking needs to be in place for every supply chain member.

Lean Manufacturing methodologies, Just in Time and just in Sequence and quality management systems like ISO 9001 assist the planners, engineers and managers to view and run the supply chain as an efficient and well-coordinated system. Such methodologies should be applied with “risk thinking” in place to ensure that strategic risk management is subsequently achieved.

Our economy has recently been exposed to shockwaves due to the recent downgrades, corruption, foreign currency fluctuations amidst political turmoil and also to top it off, the fact that the economy is in a technical recession. Consequently, both sub component suppliers and OEMs are under intense pressure to operate profitably and guarantee future business sustainability. It is good to note that several billions of Rands have been invested by OEMs strengthening their presence in South Africa for example Ford Motor Company SA invested R2.5 Billion for the production of the Everest special utility vehicle at its plant in Silverton in Pretoria, furthermore, BMW is investing R6 Billion for the manufacture of the new generation of the BMW X3. However, the exit of General Motors from the automotive sector indicates that the current operating environment is under falls short of expectations, is strain and needs urgent intervention to stop more OEMs and sub suppliers exiting.

6.3 RECOMMENDATIONS

6.3.1 INTRODUCTION

Following the recent downgrades of South African banks and institutions it is more critical than ever for automotive companies to reduce the impact and probability of different risks in their supply chains to remain competitive and operate from an efficient, robust low-cost base. The study explored and discovered how multiple players in the automotive industry are implementing strategic risk management

practices to a reasonable degree, however there is potential for improvement on the application of strategic risk management and to ensure that their supplier chains are positioned to provide a competitive advantage.

6.3.2 RECOMMENDATIONS FOR OEMS:

An underperforming supply chain that cannot mitigate and remedy different types of risk is detrimental to business especially in a highly uncertain environment like Gauteng. Based on the findings of this explorative study the following recommendations are presented to ensure that the focal company interacts with its suppliers, assembly plants, distributors, retailers, inbound and out-bound logistics providers to facilitate the easy movement of information and goods.

6.3.3 PROCUREMENT MANAGEMENT RECOMMENDATIONS:

Strategic plans should be developed with suppliers to support the manufacturing flow management process and development of new products as agreed by (Lambert & Cooper, 2000) Effective communication guarantees coordination between various stakeholders hence buyers should focus their efforts on managing suppliers as opposed to placing orders and expediting.

Buyers and procurement managers should implement systems or strategies:

- Safeguard the supplier selection process through robust risk assessments of the suppliers' capabilities to meet the demand, price and lead-times of the required product or service.
- Use data analytics to carry out informed risk assessments that can accurately predict the impact of risks occurring in their organizations.
- Low probability risks with high impacts should always be monitored and traced with high vigilance.
- Procurement managers should assign responsibilities for the management of risks to the people and departments best suited to manage them.
- Supplier performance monitoring should be implemented throughout the lifecycle of the business contract. Suppliers KPIs that should be monitored can include lead-time achievement, quality non-conformances, pricing and implementation in continuous improvement.

- Subscribe for insurance for risks that cannot be easily monitored or controlled.
- Renegotiating contracts where suppliers are not performing or posing too much risks.
- Make a concerted effort to find and eliminate hidden costs in a supply chain.

6.3.4 ORDER FULFILLMENT RECOMMENDATIONS:

On time delivery of orders from customers through seamlessly streamlining all internal processes is paramount to reducing risk. Performing the order fulfilment process effectively requires integration of the firm's manufacturing, distribution, and transportation plans as described by (Lambert & Cooper, 2000)

By implementing the following recommendations, the objective is to also reduce the total delivered cost to the customer.

- Conduct cause analysis when late deliveries are realized, this can be done through process failure effects and modes analysis (PFMEA). Corrective actions should be implemented to reduce risk of recurrence.
- Planners must renew their forecasts for future demand by extrapolating from small fluctuations in current demand to reduce large bullwhip effects.
- Where possible instead of making frequent, small orders, companies must batch their orders into less frequent, large ones so as to reduce product, logistics, or order-processing costs and rand fluctuations on imports.

6.3.5 DEMAND MANAGEMENT RECOMMENDATIONS:

It is essential to manage inventory variability together with real-time customer demand. Several participants in the research showed a high level of demand analysis in their operations through various systems.

- Irregular order patterns must be dealt with through the supplier's capabilities to supply (Peck, 2006).
- Running forecasting processes jointly with key suppliers, can reduce demand variations and improve stability and maintain inventory levels.

- Invest more analytics in understanding demand volatility and what can influence it.
- Identify the optimal distribution network for raw materials, intermediates and finished goods inventory to support production.

6.3.6 MANUFACTURING FLOW MANAGEMENT RECOMMENDATIONS:

(Sheffi & Rice Jr, 2005) affirmed that a rapid and flexible manufacturing process able to meet customer demand will reduce cycle times and perform rapid changeover to accommodate mass customization and improved responsiveness to customers.

- Facilitating a customer order pull process instead of making to stock is ideal to avoid excess inventory costs.
- Establishing safety and target stock levels and optimizing actual stock levels based on expected customer-demand profiles.
- Reducing suboptimal sourcing and routing decisions.
- Eliminating excess product movement and waste through the network.
- Understand current operating model, including configuration of key processes and technology that can have a positive impact.

6.3.7 SUPPLIER RELATIONSHIP MANAGEMENT RECOMMENDATIONS:

Recognising key suppliers which the focal to the company works with is critical to its operations and how to guarantee maximum customer satisfaction. Complexities of interdependencies between supply chain members and the focal company can be reduced by:

- Making sure that every player in the supply chain understands what the end customers requires through enhancing visibility and share information with suppliers.
- Integrating customer facing functions on both ends of the supply chain so that the end result is always favourable to the customer.
- Foster open collaboration with suppliers to boost responsiveness and try to align corporate strategies with supplier performance metrics and ratings.

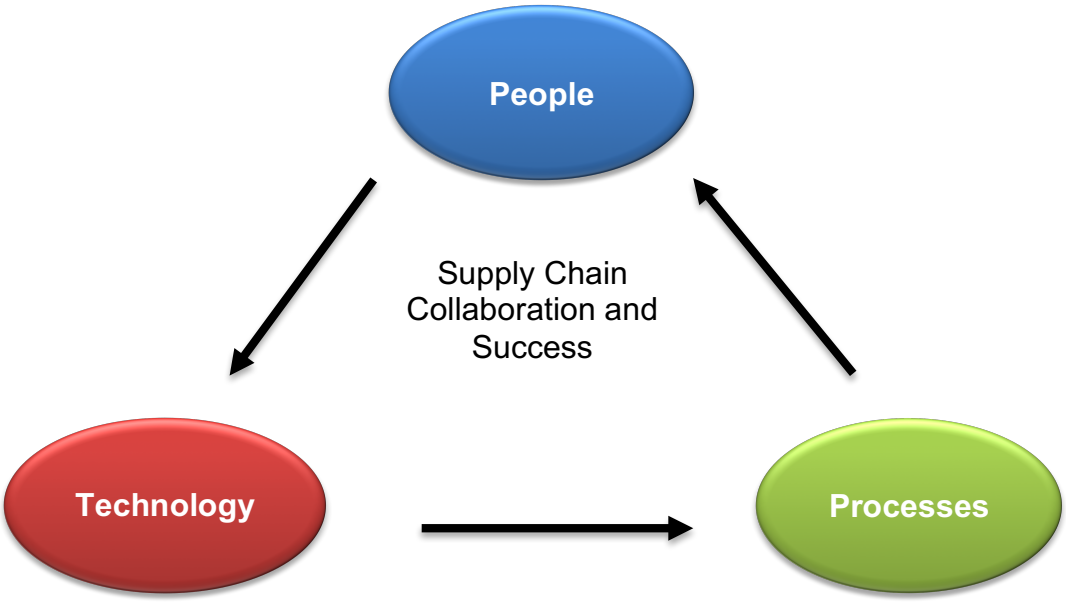


Fig 6.1: Image showing radial chart from Question 19 coding analysis of responses

The figure above shows the recommended synergistic relationship that should exist between people, technology and process in order to have the optimum levels of collaboration, integration and performance.

6.4 SUGGESTIONS FOR FUTURE RESEARCH:

The purpose of this study has been to qualitative analyse the strategic risk management practices in the Gauteng automotive industry. In addition to identifying the inherent risks and exploring which risk mitigation and control strategies are employed, further effort was invested in finding out whether some of these strategies are reaping the intended benefits. The report has shown that there is a fair level of applied strategic risk management which can definitely be improved. Therefore, further research can be proposed to be conducted in other geographical areas in South Africa where other automotive companies are set up for example Durban and East London. This can be done to benchmark and compare the risks faced and the practices in different geographical locations and contexts. Further research in cross

collaboration of sub component suppliers with OEMS and also in risk detection systems and methods could yield more insights as well as a focus on green supply chain and implementation of environmentally friendly supply chains in Gauteng.

APPENDIX A: RESEACH INSTRUMENT

Question guidelines of inquiry:

20. How has the Automotive supply chain evolved over the past 5 to 10 years
21. Do you have some sense of the different ways in which the automotive supply chain environment might evolve over the next five to ten years?
22. Do you know which factors, or drivers of change, are most likely to dominate how the industry will evolve? How do you integrate this with supply chain strategies?
23. Please identify key environmental externalities that could impact future strategies in the automotive supply chain?
24. How do the automotive supply chain capabilities assist players to be competitive? How do you identify these capabilities?
25. Could you indicate significant manifested risk factors involving the supply chain that impacted production in Gauteng?
26. How did you identify the main sources and drivers of the risks mentioned before?
27. Please describe the main consequences for the OEMs as a result of the occurrence of the risks.
28. How did the OEMs deal with these effects or consequences in your organization and also with your supply chain member firms?
29. What tools, techniques or methodologies make it easy (or difficult) for OEMs to deal with risk within the automotive supply chain perspective in Gauteng?
30. What helps you to deal and advise on supply chain risk? How do you employ strategies for risk management?
31. How do you conduct risk mitigation / contingency planning for the automotive supply chain?
32. Are there any trigger events or signals in the automotive supply chain that prompt you to respond?
33. What future surprises could really help / hurt the automotive supply chain?
34. Kindly describe the facilitators / impediments / constraints in your supply chain risk management process.

35. How do you conduct Future Strategy development process for the automotive supply chain?
36. Please explain how you conduct Strategic decision making under uncertainty for the automotive supply chain and logistics.
37. Are there any key pieces of infrastructure or system elements that seem to be missing in the automotive supply chain?
38. What core systems or strategies would you like to see driving change in the industry?

APPENDIX B: CONSISTENCY MATRIX

Setting up a strategic supply chain management system is challenging due to certain significant supply chain risk factors inherent in the complex manufacturing sector in Gauteng.					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
Supply chain practitioners need to be competent in identifying significant supply chain risks in the Gauteng automotive sector regardless of the inherent complexity to ensure businesses perform well.	(Thun & Hoenig, 2011), (Lavastre et al., 2012)	Identify which significant supply chain risks in the Gauteng automotive sector are critical to business success and high performance?	•Could you indicate significant manifested risk factors involving your supply chain that impacted your production in Gauteng? •How did you identify the main sources and drivers of the risks mentioned before?	Qualitative descriptive data	Phenomenology and Interpretivist approach and Thematic Content Analysis.

Setting up a strategic supply chain management system is challenging due to certain significant supply chain risk factors inherent in the complex manufacturing sector in Gauteng.					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
Once the comprehensive risk drivers and sources are identified in the Gauteng Automotive manufacturing sector, how do supply chain professionals select which effective strategic risk management methods and systems, have the best intended positive impact on their business objectives and targets.	(Miller, 1992), (Lavastre et al., 2012)	Understand which effective strategic risk management practices have greatest positive impact on automotive firm performance in Gauteng?	•How did you deal with these effects or consequences in your organization and also with your supply chain member firms? •What tools or techniques make it easy (or difficult) for you to deal with risk within the automotive supply chain perspective in Gauteng?	Qualitative descriptive data	Phenomenology and Interpretivist approach and Thematic Content Analysis.

Setting up a strategic supply chain management system is challenging due to certain significant supply chain risk factors inherent in the complex manufacturing sector in Gauteng.					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
Due to the uncertainty and complexity surrounding the automotive environment in Gauteng, have supply chain professionals gained insight on why the selected strategic risk management practices are effective, is it possible that these strategies have evolved over time?	(Miller, 1992), (Lavastre et al., 2012), (Shao, 2013), (Manuj & Mentzer, 2008), (Giunipero & Aly Eltantawy, 2004), (Zsidisin & Wagner, 2010)	Understand why the identified strategic risk management practices are effective in ensuring high supply chain performance in the Gauteng automotive sector?	•What may help you to deal with supply chain risk? How do you employ strategies for risk management? •How do you conduct risk mitigation / contingency planning? •Kindly describe the facilitators / impediments / constraints in the risk management process.	Qualitative descriptive data	Phenomenology and Interpretivist approach and Thematic Content Analysis.

APPENDIX C: THEMATIC CONTENT ANALYSIS

Question 1:

1. How has the Automotive supply chain evolved over the past 5 to 10 years?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Technology and systems	1	1			1	1	1	1	1	1	1	1	1	1	1	13	87%
Social Environment																0	0%
Political Environment			1				1		1	1	1	1	1			7	47%
Policy Development (APDP & BBBEE) and legislation	1	1	1		1	1	1	1	1	1	1		1	1	1	13	87%
Infrastructure and transport systems										1		1	1	1		4	27%
Industry Volumes		1									1	1	1	1		5	33%
Research, teaching & innovation			1			1	1	1	1							5	33%
Environmental and Green Technology awareness				1					1	1	1		1	1	1	7	47%
Local Content %	1	1		1								1		1		5	33%

Question 2:

2. Do you have some sense of the different ways in which the automotive supply chain environment might evolve over the next five to ten years?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Technology and systems	1		1	1	1	1	1	1	1	1	1	1	1	1	1	14	93%
Social Environment																0	0%
Political Environment					1					1				1		3	20%
Policy Development (APDP & BBBEE) and legislation		1	1	1	1	1	1	1	1	1	1	1	1		1	13	87%
Infrastructure and transport systems (distance from nearest port, railway)		1						1			1				1	4	27%
Consumer preferences	1	1		1	1	1		1	1	1	1	1	1	1		12	80%
Research, teaching & innovation					1						1					2	13%
Environmental and Green Technology awareness				1	1				1	1	1	1	1	1	1	9	60%
(Localization) Local Content %		1	1				1									3	20%
Economic (Downgrades Recession Radical Economic transformation)				1	1		1			1	1		1			6	40%

Question 3:

3. Do you know which factors, or drivers of change, are most likely to dominate how the industry will evolve? How do you integrate this with supply chain strategies?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
ERP Systems and Big Data Analytics	1	1	1	1		1	1	1	1	1	1	1		1	1	13	87%
Poverty, Unemployment Economic strife						1	1		1		1		1			5	33%
Political Influence					1								1			2	13%
Policy Development (APDP & BBBEE) and legislation		1	1	1			1		1	1	1	1	1		1	10	67%
(Globalization) Head Office strategies and plans		1		1	1			1	1		1				1	7	47%
Research, teaching & innovation			1				1	1				1				4	27%
Environmental and Green Technology awareness		1		1	1	1	1	1	1	1	1	1	1	1		12	80%
Consumer Preferences (Fuel economy, digitization)		1			1			1	1	1		1		1	1	8	53%

Question 4:

4. Please identify key environmental externalities that could impact future strategies in the automotive supply chain?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Sea port access	1	1						1	1							4	27%
Import Duty and other costs		1	1		1				1			1	1		1	7	47%
Lean capabilities and operational waste	1		1			1	1	1		1		1	1		1	9	60%
Policy Development (APDP & BBBEE) and legislation	1	1	1	1			1	1		1	1		1	1		10	67%
(Globalization) Head Office strategies and plans	1			1	1	1		1	1	1	1		1			9	60%
Rand Exchange rate flactuation			1	1	1			1	1		1	1		1	1	9	60%
Environmental and Green Technology awareness	1	1	1			1	1	1		1	1			1	1	10	67%
More electrical integration on vehicles					1											1	7%

Question 5:

5. How do the automotive supply chain capabilities assist players to be competitive? How do you identify these capabilities?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Technology integration in SCM	1				1	1	1	1	1							6	40%
Customer relationship management and cross collaborative partnerships		1		1		1	1	1	1	1	1	1	1	1		11	73%
Supply chain agility	1	1	1					1			1				1	6	40%
Policy Development (APDP & BBBEE)		1					1					1				3	20%
Organizational Flexibility	1			1	1				1	1	1	1		1	1	9	60%
Demand management	1			1					1	1				1	1	6	40%
Continuous Improvement	1		1	1	1	1	1	1	1	1			1		1	11	73%
Supplier Development		1	1		1	1	1			1		1	1	1		9	60%
Skills development						1	1	1		1		1	1		1	7	47%

Question 6:

6. Could you indicate significant manifested risk factors involving the supply chain that impacted production in Gauteng?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Labour Strikes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	100%
Civil Unrest	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	100%
Supplier relocation	1		1	1			1				1	1		1		7	47%
Transport Strikes	1		1	1	1	1		1	1	1						8	53%
Chronic Energy Shortage	1	1			1		1			1	1			1	1	8	53%
Theft of Equipment							1		1			1				3	20%
Parts Shortage			1	1				1		1	1	1				6	40%
System Shutdown	1			1									1			3	20%
Skills Development		1				1	1		1				1			5	33%
Harsh Weather (Hail)								1						1		2	13%

Question 7:

7. The main sources and drivers of the risks mentioned before?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Poverty	1		1	1	1	1	1			1	1	1				9	60%
Globalization	1	1	1	1	1				1		1	1		1	1	10	67%
Political Environment			1	1	1	1				1		1	1			7	47%
Policy Development (APDP & BBBEE)	1	1	1	1	1	1	1		1		1	1	1	1	1	13	87%
Supplier Relationships		1	1			1	1	1	1	1			1			8	53%
Demand Volatility	1								1			1	1		1	5	33%
Research, teaching & innovation		1				1	1				1					4	27%
Environmental and Green awareness	1	1		1				1	1	1	1		1	1	1	10	67%
Developing partnerships	1						1	1		1	1			1		6	40%

Question 8:

8. Please describe the main consequences for the OEMs as a result of the occurrence of the risks.																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Loss in Production	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	100%
Declining Supplier relationship	1		1	1					1		1					5	33%
Organizational relationships disruption	1			1				1		1						4	27%
Quality problems	1	1	1	1	1	1	1	1	1		1	1		1	1	13	87%
Loss in Sales		1	1	1	1				1	1		1	1			8	53%
Profit Eroded		1	1	1	1		1	1	1	1			1			9	60%
Production efficiency losses			1				1				1		1			4	27%
Cost Increases due to rebalancing and rework	1			1	1			1		1	1	1	1	1	1	10	67%
Industry reputational damage	1			1	1		1		1					1	1	7	47%

Question 9:

9. How did the OEMs deal with these effects or consequences in your organization and also with your supply chain member firms?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Rework	1		1	1	1			1	1	1		1	1	1	1	11	73%
Line Balancing			1	1	1					1		1		1		6	40%
Capital spend on extra buffer stock	1	1	1	1	1	1	1		1		1		1		1	11	73%
Contingency planning	1		1			1	1			1	1	1			1	8	53%
Overtime costs to catch up	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	100%
Promoting flexibility		1		1		1	1	1		1		1		1		8	53%

Question 10:

10. What tools, techniques or methodologies make it easy (or difficult) for OEMs to deal with risk within the automotive supply chain perspective in Gauteng?																SUM	%
	Donavan	Norman	Tumi	Happson	Patryk	Sibusiso	Nkumbuzi	Wayne		Ezekiel	Richard	Lovemore	Benjy	Farai			
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
FMEA Analysis	1	1		1	1		1		1	1				1		8	53%
5S Implementation			1	1				1			1					4	27%
Corrective Action	1		1	1	1			1	1		1		1	1	1	10	67%
Preventative Action	1	1	1	1		1	1	1		1			1	1	1	11	73%
Risk Mitigation	1	1	1	1	1	1	1					1	1		1	10	67%
Risk Elimination								1		1	1	1				4	27%
Big Data analytics	1				1			1			1				1	5	33%
Contigency planning			1	1	1	1	1	1	1	1		1				9	60%
Demand Forecasting	1	1	1		1	1			1	1	1	1		1	1	11	73%
Root Cause analysis	1	1		1	1		1	1	1			1	1	1	1	11	73%

Question 11:

11. What helps you to deal and advise on supply chain risk? How do you employ strategies for risk management?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Demand Forecasting	1		1	1	1	1		1	1	1	1	1	1	1	1	13	87%
Research		1					1			1			1			4	27%
Supplier cross collaboration	1	1	1	1	1	1		1	1	1				1	1	11	73%
Body of Knowledge (NAACAM, NAAMSA & AIDC)	1	1			1		1	1					1	1		7	47%
Risk monitoring	1			1				1	1		1					5	33%
Global Office Strategy			1	1	1			1	1		1	1	1	1		9	60%
Supplier Performance Ratings	1		1		1	1	1	1	1	1	1				1	10	67%
Supplier Efficiency Development	1			1	1	1	1			1		1			1	8	53%
Continuous Improvement		1	1	1	1	1	1	1		1		1	1		1	11	73%

Question 12:

12. Risk mitigation / contingency planning for the automotive supply chain?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Process FMEA Analysis	1			1	1		1		1			1		1	1	8	53%
Root cause Investigations	1		1	1				1	1	1		1	1	1		9	60%
Scenario Development		1			1		1			1			1			5	33%
Cross Learning			1			1		1	1		1	1			1	7	47%
Desk based and Internet research	1	1			1		1				1		1	1	1	8	53%
Workshops, conferences and workgroups	1		1	1			1	1	1	1	1			1	1	10	67%
Big Data analytics	1	1			1			1						1		5	33%
Preventative and corrective action	1	1	1	1	1	1		1	1	1		1		1		11	73%
Recovery capability				1	1								1		1	4	27%
Equipment and maintenance planning	1			1	1		1			1	1	1	1		1	9	60%

Question 13:

13. Are there any trigger events or signals in the automotive supply chain that prompt you to respond?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Strike Negotiations	1		1	1	1			1		1	1		1	1	1	10	67%
Policy vision and incentives	1	1		1	1	1	1	1	1	1	1	1	1	1	1	14	93%
Local content requirements		1	1		1		1			1			1	1		7	47%
Endogenous factors	1			1	1							1				4	27%
Exogenous factors	1	1				1	1	1	1	1	1	1	1	1	1	12	80%
Raw material resourcing	1		1	1				1		1					1	6	40%
Market tubulence		1			1	1	1	1	1	1	1	1		1		10	67%
Vulnerability and susceptibility	1	1					1				1					4	27%
Complexity of suply chain		1		1			1	1			1		1		1	7	47%
ISO Management System Implemetation	1		1			1		1			1	1		1		7	47%

Question 14:

14. What future surprises could really help / hurt the automotive supply chain?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Sub supplier Exit	1		1	1	1		1		1	1		1		1		9	60%
Sub supplier Entry							1				1	1				3	20%
Policy development	1	1	1	1	1	1	1	1		1	1	1	1		1	13	87%
New disruptive technology and Innovation	1	1			1	1	1	1	1	1	1	1		1		11	73%
Foreign direct investment			1				1									2	13%
Political issues (eg BREXIT)	1	1		1	1		1		1		1		1		1	9	60%
Oil price and exchange rate flactuations			1		1			1	1	1		1	1		1	8	53%
OEM entry or Exit	1	1	1	1	1	1	1			1	1			1		10	67%

Question 15:

15. Kindly describe the facilitators / impediments / constraints in your supply chain risk management process.																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Organizational risk propensity			1	1	1			1	1		1			1		7	47%
Strategic foresight	1	1			1		1			1		1		1		7	47%
Skills			1			1	1			1						4	27%
Global Head office Influence	1		1	1	1	1		1	1			1			1	9	60%
Flexibility	1	1		1			1	1			1		1	1	1	9	60%
Speed of reaction	1	1		1	1			1	1				1			7	47%
Outsourcing strategies	1	1		1	1		1	1	1			1	1		1	10	67%
Relationship building		1				1	1			1	1		1	1	1	8	53%
Economies of scale			1	1	1		1				1				1	6	40%

Question 16:

16. How do you conduct Future Strategy development process for the automotive supply chain?																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Workshops and workgroups	1	1		1	1	1	1	1	1	1				1	1	11	73%
Attending conferences		1			1		1		1			1		1		6	40%
Enviromental scanning		1			1		1			1	1		1	1		7	47%
Systems thinking	1		1	1	1			1		1					1	7	47%
Heuristics	1		1													2	13%
Delphi technique			1									1				2	13%
Competencies and capabilities analysis		1	1	1	1	1	1	1		1	1	1			1	11	73%
Deciphering value chain	1		1	1			1				1		1		1	7	47%
Lessons learnt	1		1	1		1		1	1	1	1	1	1	1	1	12	80%
Business continuity	1	1		1	1		1	1		1			1			8	53%

Question 17:

17. Please explain how you conduct Strategic decision making under uncertainty for the automotive supply chain and logistics.																SUM	%
Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Sustaining Competitive advantage	1	1		1	1		1	1			1		1		1	9	60%
High performace	1		1	1		1	1	1	1					1		8	53%
Risk driver analysis	1									1		1	1		1	5	33%
Methodological coherence				1						1						2	13%
Synchronizing objectives with performance KPIs	1		1	1	1	1		1	1	1	1		1		1	11	73%
Macro-economic perspetive considerations		1		1	1		1	1		1			1	1	1	9	60%
Streamlining value chain	1	1			1		1					1			1	6	40%
JIT & Lean manufacturing Methodology	1		1	1		1	1	1	1	1	1	1	1	1	1	13	87%
Product Lifecycle Phases		1		1	1				1			1		1		6	40%

Question 18:

18. Are there any key pieces of infrastructure or system elements that seem to be missing in the automotive supply chain?																	SUM	%
Participant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**			
Reliable railway network	1								1	1	1		1	1	1		7	47%
RFID										1							1	7%
Local market competitiveness									1	1		1		1			4	27%
Pre-Feasibility Studies										1							1	7%
Appropriate skills						1	1	1				1	1		1		6	40%
ISO 9001 and QMS Systems			1	1	1		1				1	1	1	1			8	53%

Question 19:

19. What core systems or strategies would you like to see driving change in the industry?																	SUM	%
	Donavan	Norman	Tumi	Happson	Patryk	Sibusiso	Nkumbuzi	Wayne		Ezekiel	Richard	Lovemore	Benjy	Farai				
Participant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**			
Skills Development	1	1	1			1	1	1	1		1		1				9	60%
Industry 4.0	1		1	1	1		1		1	1					1		8	53%
Automated Robot manufacturing	1			1					1	1		1			1		6	40%
CAPEX Decision making	1			1	1							1		1			5	33%
Decentralization of Strategy from Global Office	1		1	1	1					1		1			1		7	47%
BBBEE Transformation		1	1			1	1		1				1				6	40%
Digitization	1	1	1	1	1		1	1		1	1			1			10	67%
People before Profit						1							1				2	13%
Innovation by all parties		1		1	1	1	1	1	1		1	1		1	1		11	73%
System Integration								1			1			1	1		4	27%

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