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Growth within the South African automotive manufacturing industry

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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

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ABSTRACT

The South African automotive manufacturing industry is of strategic importance to the economy due to the industry's significant contribution to GDP, employment and foreign trade. Therefore, it is essential that the automotive manufacturing industry continue to grow sustainably in order to support South Africa's ambition with regards to economic growth. This research study aims to identify and model the impact of factors which inhibit or enable growth in vehicle production within the South African automotive manufacturing industry. This study also attempts to recommend measures to mitigate the impact of the identified inhibiting factors. The unintended consequences that may occur due to the impact of the identified inhibiting and enabling factors have also been addressed in the research study.

This study adopted a semi-quantitative research methodology which involved the simulation of a fuzzy cognitive mapping study in conjunction with qualitative data collected during the research process whereby semi-structured interviews were conducted with selected stakeholders from the local automotive industry. An initial fuzzy cognitive map was constructed from literature and then enhanced and validated with insights and perspectives from respondents. The enhanced fuzzy cognitive map was then used to conduct simulations of various scenarios which yielded results that were analysed and used to address the research propositions that are presented in this study.

The research study found that dominant enablers for growth in vehicle production include national development plans to upgrade infrastructure and government policy favourable to the South African automotive manufacturing industry; in particular the Automotive Production and Development Programme (APDP). Furthermore, the existing network of local automotive component suppliers, forecasted export and local vehicle demand and the overall political stability in South Africa were found to be other dominant factors which enable growth in vehicle production. In contrast, the relatively high cost of labour in South Africa; the existence of competing emerging market OEMs; the influence

of trade unions; and the current state of the global and local economy were found to be dominant inhibiting factors for growth in vehicle production.

The research study found that the impact on natural resources; the socioeconomic environment; the cost of living and overall quality of life were unintended consequences that may occur due to the impact of the abovementioned inhibiting and enabling factors on growth in vehicle production. Furthermore, an influx of foreign labour, job creation in related and unrelated industries and further changes to the APDP have also been identified as unintended consequences by respondents during the research process.

A key recommendation of this research study is to implement several specific measures to mitigate the impact of inhibiting factors on growth in vehicle production. Creating certainty with regards to the continuity of the APDP is crucial since favourable government policy found to be a dominant enabler to growth in vehicle production. Furthermore, history has shown that in the absence of a government-led, automotive industry incentive and development programme, growth in vehicle production volumes may decline and investment in infrastructure by OEMs may be constrained or discontinued.

DECLARATION

I, Amit Rupee, 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.

Amit Rupee

Signed at ……

On the …….. day of …… 20…..

DEDICATION

This research study is dedicated to the memory my late grandmother, Ramdulari Rupee, who has been my guide and inspiration.

ACKNOWLEDGEMENTS

I would like to thank my parents, Arrbindh and Nadhera Rupee, who have always encouraged me to further my studies.

To my siblings, Roma, Kerishma and Avishkar; your unconditional support has been invaluable to me.

I owe a sincere depth of gratitude to Professor Anthony Stacey, who has been an ideal supervisor. Thank you for your valuable assistance, time and guidance.

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CHAPTER 1. INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to model the effect of inhibiting and enabling factors on growth in vehicle production within the South African automotive manufacturing industry.

1.2 Context of the study

1.2.1 The South African automotive manufacturing industry

The South African automotive manufacturing industry is comprised of seven major local OEMs which includes Toyota, BMW, VWSA, GMSA, Nissan/Renault, Ford and Mercedes-Benz (Automechanika, 2011). These OEMs have manufacturing facilities located in various regions within South Africa. In addition to manufacturing vehicles locally, OEMs also import a wide range of models into South Africa (Lamprecht, 2015).

There are other major automotive manufacturers that fully import all models of vehicles and have no manufacturing facilities within South Africa. These include European (Seat, Citroen, Peugeot), Chinese (Geely, GWM, BAW), Japanese (Honda, Subaru), Indian (Mahindra, Tata) and Korean (Kia, Hyundai) manufacturers (Department: Trade and Industry, 2015).

In support of local OEMs, there are approximately 400 local automotive component suppliers operating within South Africa (Automechanika, 2011). Component suppliers may be categorised in tiers whereby high-tiered suppliers, for example Tier 1 suppliers, supply components directly to local OEMs. Tier 2 suppliers would in turn supply sub-components to Tier 1 suppliers. Tier 2 suppliers are supplied by lower-tiered suppliers (Tier 3). Similarly, customers may also be categorised in tiers. For example, a Tier 1 customer may be a local OEM’s dealer network and a Tier 2 customer may be a dealership.

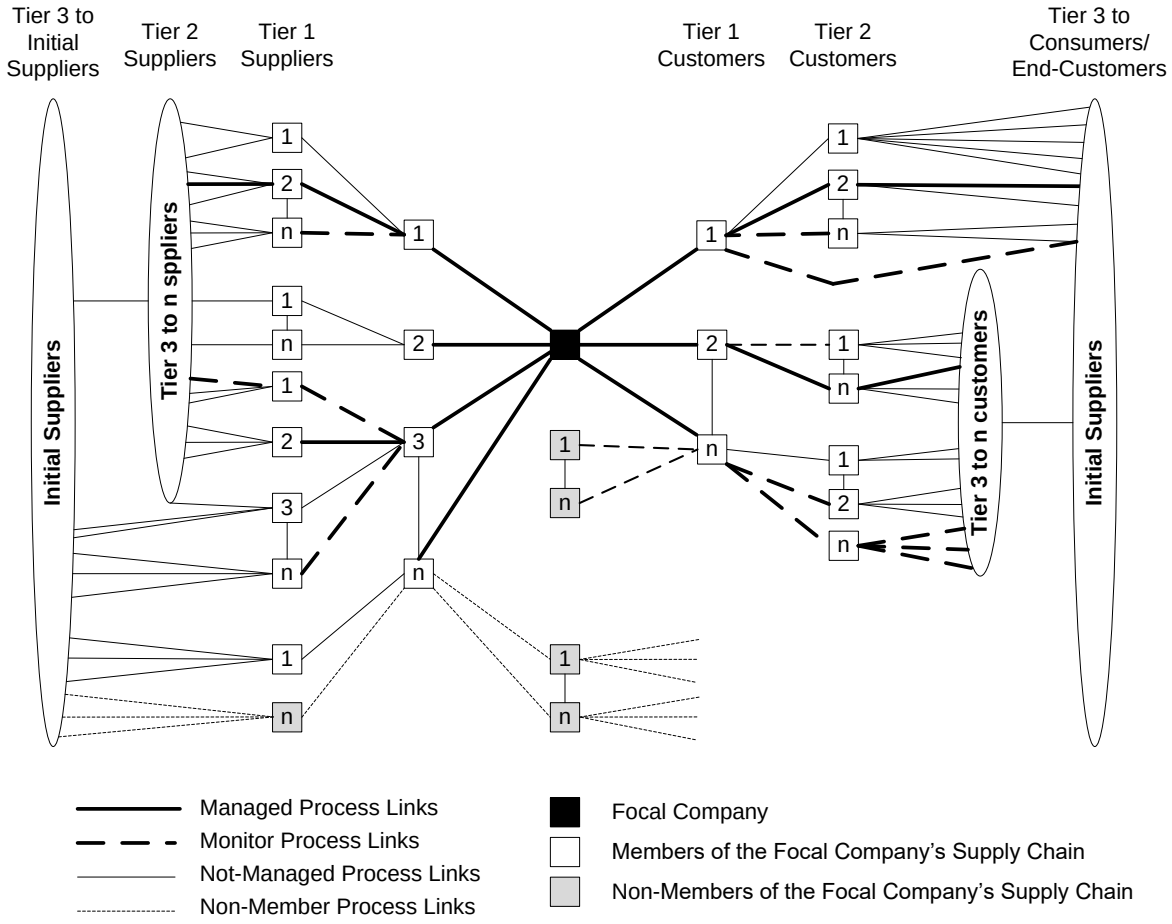


Figure 1: Types of intercompany business process links (Rossen, 2011)

This research will focus on the identification and modelling of inhibiting and enabling factors affecting growth in vehicle production among local OEMs and supporting automotive component suppliers.

1.2.2 Growth within the South African manufacturing industry

The South African economy has experienced modest growth given that year-on-year real GDP growth in 2014 was approximately 1.5 percent (StatsSA, 2015). Several factors affected economic growth in the past year. These factors include labour unrest due to prolonged industrial strike action within the mining industry (and the resulting low investor confidence), electricity supply constraints and tariff increases, skilled labour shortages, unemployment, European economic spend reforms and China's slowing growth and demand for South African mineral resources (International, 2015; Risk, 2015; Zhou, 2015).

As at the end of the fourth quarter in 2014, the manufacturing sector contributed approximately 13.7 percent to South Africa's GDP but experienced no annual growth by the end of the 2014 fiscal year (StatsSA, 2015). The mining and steel industry supplies the automotive manufacturing industry with essential raw materials which includes sheet steel for car panel and vehicle chassis production.

Haller (2012) proposes that economic growth may be achieved by the efficient use of available resources and increasing the production capacity of a country. The South African government aims to lower unemployment and accelerate economic growth by spending on public infrastructure development and job creation (National Planning Commission, 2011). In the short term, the government has committed to spend approximately USD 80 billion between 2013 and 2016 on public infrastructure development (Risk, 2015).

Some of the macroeconomic factors which affects economic growth in South Africa includes the availability of skilled labour, growth in exports (Logan Rangasamy, 2009), demand for imports, foreign trade policy, government policy and strategic development plans, supply chain strategies, infrastructure constraints, commodity prices (e.g. oil), interest rates, consumer spend and investor confidence (International, 2015; MarketLine, 2014; Risk, 2015). Therefore, taking the abovementioned challenges into consideration, effective and efficient supply chain strategies within the South African automotive manufacturing industry become crucial since lean and agile supply chains may ensure local OEMs are proficient in respect of costs and flexible enough to respond to customer demand (Ambe & Badenhorst-Weiss, 2010).

There is a significant amount of literature available which elaborates on the extent to which the above mentioned macroeconomic factors affects growth within the manufacturing industry and overall economy. However, this research will attempt to determine and validate the extent to which the abovementioned macroeconomic factors affect growth specifically within the South African automotive manufacturing industry.

1.3 Problem statement

1.3.1 *Main problem*

The Research Problem is to model the effect of inhibiting and enabling factors on growth in vehicle production within the South African automotive manufacturing industry. Possible unintended consequences which may occur due to the impact of the above identified factors and measures to mitigate the impact of inhibiting factors will also be considered in this research.

1.3.2 *Sub-problems*

The first sub-problem is to model the effect of inhibiting and enabling factors on growth in vehicle production within the South African automotive manufacturing industry.

The second sub-problem is to identify measures to mitigate the impact of the identified inhibiting factors.

The third sub-problem is to determine if the effect of the identified inhibiting and enabling factors have unintended consequences.

1.4 Significance of the study

This study addresses the concern that there is a limited amount of industry specific research and literature available with regards to the identification of factors affecting growth in vehicle production within the South African automotive manufacturing industry. Available literature is largely focused on the overall South African manufacturing industry and economy.

This study may provide guidance to policy makers, local OEMs, component suppliers, automotive industry associations and those involved in strategic planning, for and on behalf of the government. These stakeholders may use this

research to develop strategic plans and initiatives; and inform policies which may be more specific to the South African automotive manufacturing industry.

The automotive industry is of strategic importance to both the South African and global economy. Tax revenues are generated from the sale of vehicles, automotive components and accessories (Lamprecht, 2015; StatsSA, 2015). Furthermore excise and local duties are incurred from imports and exports which contribute towards overall national revenue. In addition to revenue generation, the automotive industry contributes towards GDP growth and development of the workforce from a skills perspective (AT Kearney, 2013).

The automotive industry supports job creation in related and unrelated industries and offers diversified employment by providing jobs to workers of various skill levels. From a socioeconomic perspective, automobiles improve the quality of life through increasing the mobility of the general population and supports upstream and downstream industries which are of significant importance to the economy (AT Kearney, 2013). Furthermore, the automotive industry has a large multiplier-effect since final sales of locally produced vehicles support several other sectors of the economy.

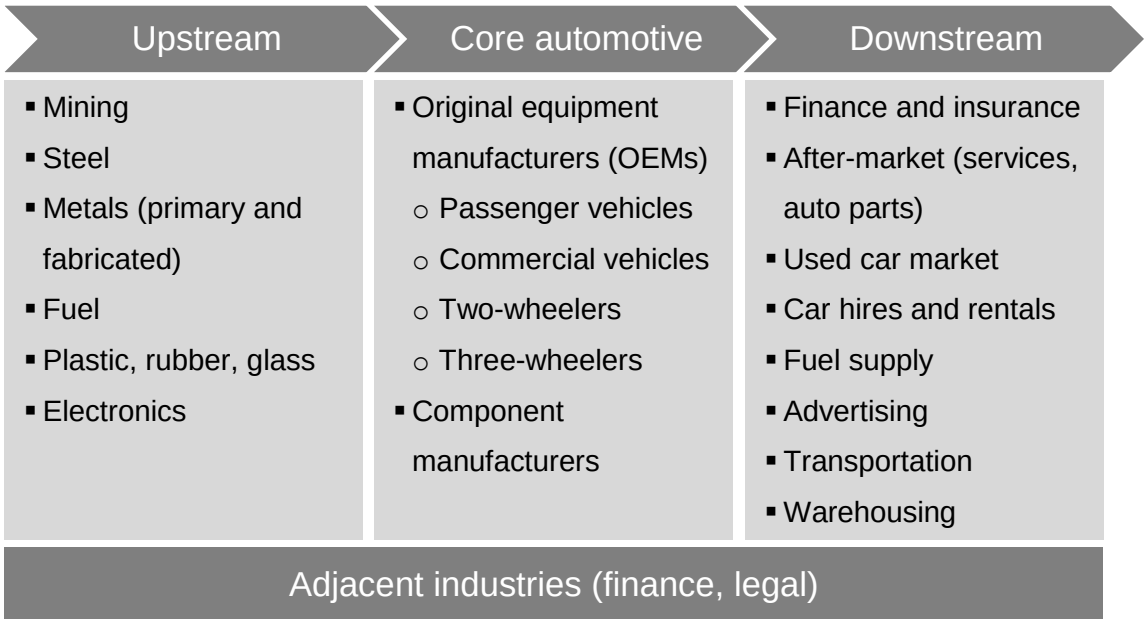


Figure 2: The automotive industry supports various upstream and downstream industries (AT Kearney, 2013)

It is therefore important to identify and understand factors which challenge growth within the local automotive manufacturing industry since no growth in the industry may impact GDP, employment and overall growth of the South African economy. Furthermore, an absence of economic growth may have negative socioeconomic implications.

By identifying factors which challenge and inhibit growth within a specific industry, bespoke strategies and interventions may be developed and implemented between government, businesses and other relevant stakeholders. This approach will assist in mitigating industry specific challenges, thereby improving growth within the industry of concern. To substantiate this view, Rodrik (2008) proposes that policy interventions should target identified market failures rather than vague economic objectives.

This research may therefore benefit government strategy planning departments, national policy making institutions, development finance institutions, OEMs, component suppliers, supply chain organisations within the private sector and major players within the South African steel industry.

1.5 Delimitations of the study

This research is limited to the South African automotive manufacturing industry. This includes high-tiered automotive component suppliers and local OEMs who have manufacturing facilities within South Africa.

This research is limited to the identification and analysis of factors which directly affects growth within the South African automotive manufacturing industry from a vehicle production volume perspective.

This study is focused at both a macroeconomic and microeconomic level since the identified factors affecting growth in vehicle production may be specific and relevant to both the local automotive manufacturing industry and the overall South African manufacturing industry.

1.6 Definition of terms

- AIDC: Automotive Industry Development Centre
- APDP: Automotive Production and Development Programme (Republic of South Africa, 2013). The APDP is aimed at creating an environment to grow production volume output of local light weight vehicle manufacturers and component suppliers, thereby promoting job creation and employment across the automotive value chain (Republic of South Africa, 2013)
- FCM: Fuzzy Cognitive Map/Mapping
- GDP: Gross Domestic Product (Logan Rangasamy, 2009)
- GGDA: Gauteng Growth and Development Agency
- High-Tiered Suppliers: These include Tier 1 and Tier 2 component suppliers. Tier 1 suppliers supply components directly to a local OEM and Tier 2 suppliers supply sub-components to Tier 1 suppliers
- ICT: Information and Communications Technology (National Planning Commission, 2011)
- LCV: Light Commercial Vehicles
- Low-Tiered Suppliers: These include Tier 3 and Tier 4 component suppliers. Tier 3 suppliers supply Tier 2 suppliers and Tier 4 suppliers in turn supply Tier 3 suppliers
- MIDP: Motor Industry Development Plan (Automechanika, 2011)
- NAAMSA: National Association of Automobile Manufacturers of South Africa
- OEM: Original Equipment Manufacturer (Ili, Albers, & Miller, 2010). In context of this research, OEM means a registered automobile manufacturer. Within the South African automotive manufacturing industry, there are seven local OEMs (Toyota, BMW, VWSA, GMSA, Nissan/Renault, Ford and Mercedes-Benz)

1.7 Assumptions

The following assumptions have been made with regards to this research:

- Identifying factors affecting growth in vehicle production within the South African automotive manufacturing industry may benefit key stakeholders within the industry (i.e. government, OEMs, local businesses and component suppliers)
- The number of respondents will be sufficient to gather the required information for this research
- The respondents will actively participate and share relevant information
- The respondents will be truthful and offer normal perspectives in respect of the information they will provide

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

The aim of this literature review is to identify inhibiting and enabling factors which affect growth in vehicle production within the South African automotive manufacturing industry. This chapter will review in greater detail, specific factors identified in literature which may affect growth in vehicle production.

By identifying potential factors which may affect growth in vehicle production, the researcher may be able to construct a model which may assist in understanding the resulting impact of each identified factor. Interviews with respondents and findings in literature may also be of benefit with regards to understanding the relative effect of each factor on growth in vehicle production within the South African automotive manufacturing industry.

2.2 Background discussion

The South African automotive manufacturing industry is of strategic importance since the industry significantly contributes to GDP, employment and economic growth (Williams, 2014). Furthermore, recent studies have shown that growth in manufacturing output has a considerable positive impact on total real GDP (Elhiraika, Aboubakar, & Muhammad, 2014). The Automotive Production and Development Programme (APDP) is an example of government's intent to grow the local automotive industry and create an environment for local OEMs and automotive component suppliers to further develop and improve the sustainability of their operations.

For the South African economy, manufacturing vehicles is more valuable than importing fully assembled vehicles since the local economy may benefit from job creation and demand for commodities (e.g. steel). Local OEMs support automotive component suppliers who are also key stakeholders within the industry.

Increasing the local manufacturing footprint may provide several benefits to the economy which will be discussed later in detail. Historical data presented below illustrates the volume of vehicles (i.e. Cars and Light Commercial Vehicles (LCV)) produced in South Africa in comparison to the volume of fully imported vehicles over the past decade:

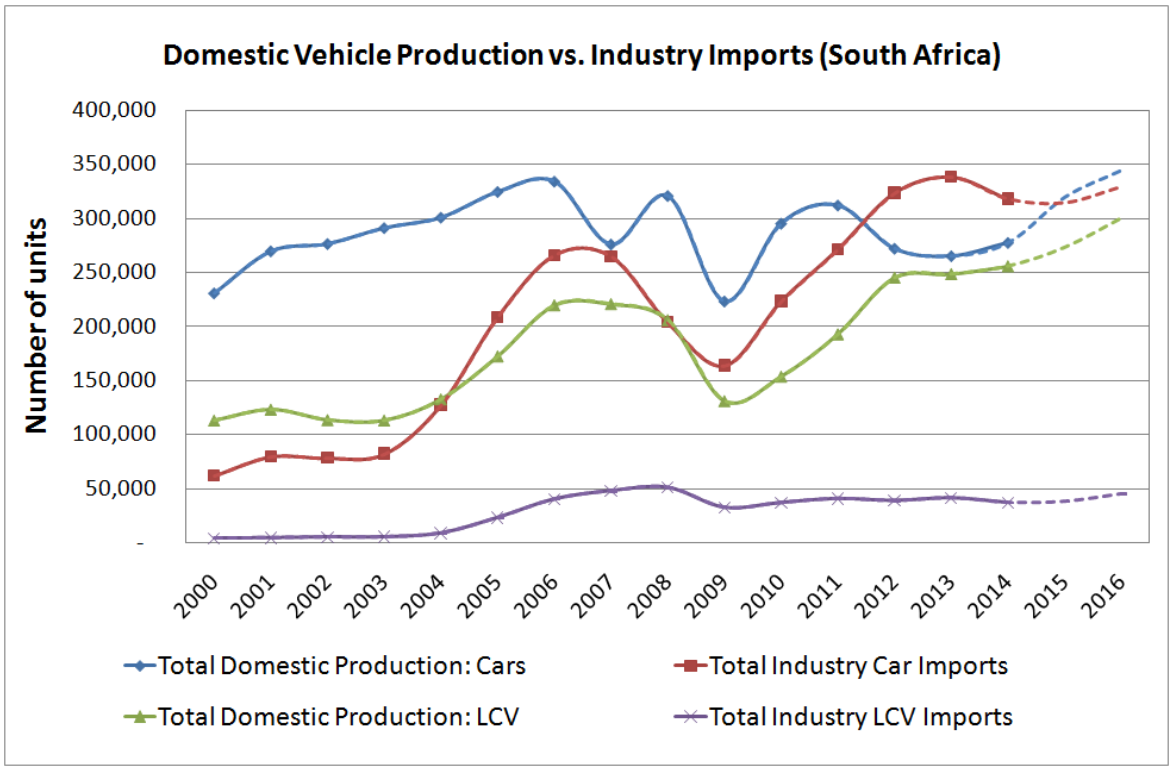


Figure 3: Domestic vehicle production and imports of vehicles into South Africa including forecasted volumes for 2015 and 2016 (NAAMSA, 2015)

It is evident that the popularity of fully imported vehicles has grown in the South African market, to the extent that in 2012, more cars were imported than domestically produced (NAAMSA, 2015). This trend has continued for the past three years. However in 2014, there has been a decline in imports and an increase in domestically produced cars and light commercial vehicles (NAAMSA, 2015). NAAMSA (2015) has forecasted both domestic vehicle production and import volumes to grow in 2015 and 2016 respectively.

Domestic growth in vehicle production is affected by various factors. This research will endeavour to identify and model the effect of these factors on growth in vehicle production within the South African automotive manufacturing industry.

2.3 Inhibiting and enabling factors affecting growth in vehicle production within the South African automotive manufacturing industry

This section will focus on factors identified in literature which may affect growth in vehicle production within the South African automotive manufacturing industry. In context of this research, these factors may be considered as constraints (i.e. inhibiting factors) and enablers (i.e. enabling factors) to growth in vehicle production. Furthermore, unintended consequences which may occur due to the impact of each of the abovementioned factors will also be addressed in the following literature review.

2.3.1 *The current state of the South African and global economy*

The current state of the South African economy is moderately stable and marginal economic growth was experienced in 2014. However, economic growth has declined over the past two years and real consumer spend has also decreased over the same period (IHS, 2015a). Furthermore, total vehicle sales have not grown substantially over the past four years (NAAMSA, 2015).

The levels of real consumer spend and amount of disposable income available to consumers may be a contributing factor to the prevailing stagnant trend in total annual vehicle sales. From a global economy perspective, the recent slowdown in Chinese economic growth (Deloitte, 2013; IHS, 2015b) may adversely affect the demand for bulk commodities from Africa and may therefore impact overall economic growth within the African continent. Therefore export demand from African markets for domestically produced vehicles may be constrained by lower levels of consumer spend due to a potential slowdown in economic growth.

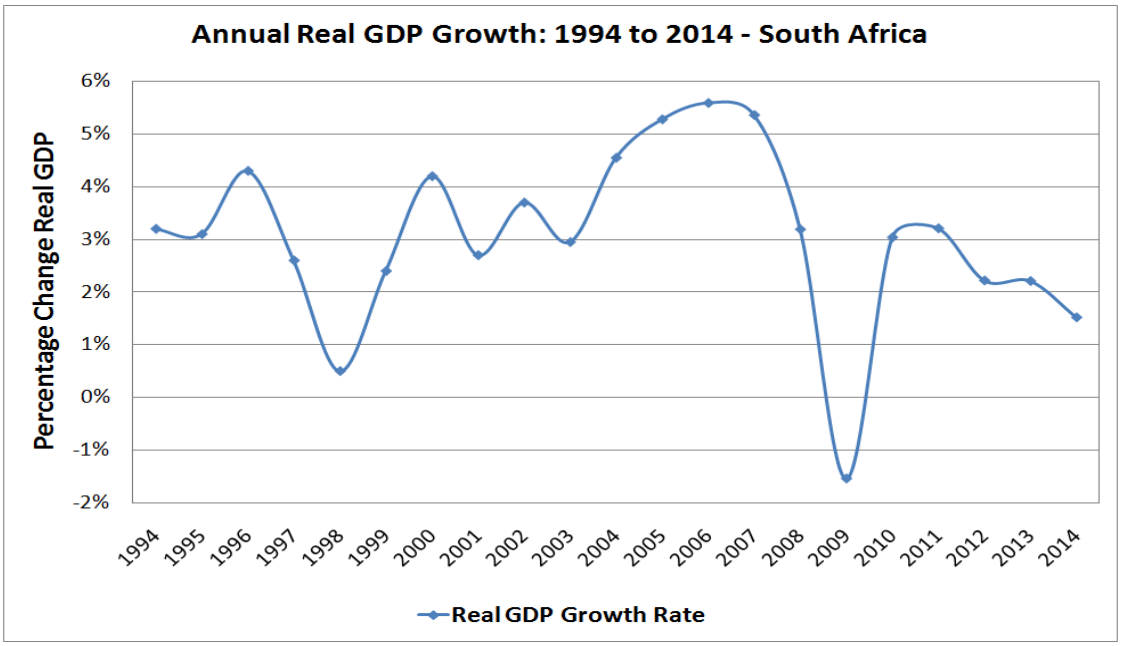


Figure 4: Annual real GDP growth: 1994 to 2014 - South Africa (The World Bank, 2015)

In contrast to the above, a rapidly growing South African and global economy may have a positive impact on growth in vehicle production. Since consumer spend is a component of GDP, a higher GDP is often associated with higher real consumer spend and a greater demand for goods and services (Toossi, 2002). This demand may include passenger and commercial vehicles. Commercial vehicles in particular are used extensively in the distribution and logistics industry which facilitates the transportation of consumer goods. A greater overall demand for vehicles may therefore drive growth in local vehicle production volume.

The state of the global economy in terms of growth, GDP and consumer spend is also a driver of export demand for South African goods and services (IHS, 2015b). South Africa exports both passenger and light commercial vehicles to many countries globally and within the African continent (Lamprecht, 2015). A growing African economy may stimulate demand for more vehicles produced in South Africa, assuming that international OEMs do not setup production facilities across various other regions in Africa to mitigate logistics costs. The foreign exchange rate is also a driver for exports since a weaker local currency may induce higher volumes of exports from South Africa.

Apart from the abovementioned drivers for growth, another determinant of economic growth is bank cost effectiveness as a result of financial sector reforms and development (Mwenda & Mutoti, 2011). It is therefore necessary to consider the effect of financial sector development on the manufacturing industry in terms of output. A study has shown that development of the financial sector in the form of money supply and credit to the private sector may increase output from the manufacturing sector (Raphael & Gabriel, 2015).

2.3.2 *Availability of skilled labour in South Africa*

While there may be a concerns with regards to the existing high levels of unemployment, the current shortage of skilled labour in South Africa (Horwitz, 2013) is still a significant challenge to the growth and competitiveness of the economy. Even though there has been a marginal increase in skilled labour since 1994, the majority of South Africa's workforce is still semi-skilled and unskilled (StatsSA, 2014b). Therefore, the employability of the workforce therefore remains constrained and the number of skilled jobs occupied by South Africans is limited. The NDP 2030 does address the concern of unemployment, but primarily with regards to semi-skilled labour. Jobs expected to be created from the planned infrastructure development programmes require more unskilled labour than skilled labour.

The automotive manufacturing industry relies on the availability of both semi-skilled and skilled labour. Manufacturing automotive components and assembling passenger and light commercial vehicles requires a degree of technical skill and expertise. Although there is a high level of unemployment in South Africa, the automotive manufacturing industry may not be able to fully capitalise on the availability of the existing unskilled workforce since many jobs at a factory or plant level requires a basic level of technical skill.

Local OEMs have endeavoured to educate and train the workforce by administering and facilitating various internship and apprenticeship programmes. However, local OEMs may benefit further from recruiting workers who have already completed both secondary and tertiary education. Employing workers who

already possess a basic level of technical skill may not require the same intense in-house training and development programmes undergone by employees who have had no prior training and education. Workers who are skilled and have relevant technical knowledge may be able to assimilate their roles in a shorter time period in comparison to workers with no prior training, relevant skill-set and work experience. A shortage in skilled and semi-skilled labour would mean that local OEMs and component manufacturers may be constrained in terms of production capacity since labour is required to operate production and assembly lines. A constraint in production capacity would directly impact and inhibit growth with regards to vehicle production volume within the South African automotive manufacturing industry.

2.3.3 *Imports of fully assembled vehicles and automotive components*

Over the past decade, there has been a significant increase in the range of passenger and light commercial vehicles available to South African consumers. Industry data for passenger vehicles has shown that in the past 5 years, total industry imports have experienced year-on-year growth while volumes of domestically produced vehicles have grown marginally since the economic downturn in 2008; and in recent years has remained essentially static with minimal growth (NAAMSA, 2015).

In comparison to the 1990's, the South African consumer now has a wider variety to choose from in terms of passenger and light commercial vehicles and as a result may not always decide to purchase a vehicle produced in South Africa. This may impact production volume growth since demand for locally produced vehicles may be negatively impacted by consumers choosing to purchase imported vehicles. *In context of this research, fully imported vehicles may be considered as a substitute to locally produced vehicles.*

Recent studies have proposed that developing countries should persist with research and development, innovation and investment in new industries since China poses a significant competitive challenge with regards to the supply of substitute medium and high-tech products (Chan-Yuan, Gladys, Ran, & Kian-

Teng, 2013). Furthermore, in 2011, China has been recognised as the largest exporter of manufactured goods in terms of revenue (World Economic Forum & Deloitte, 2013). A practical implication of the above proposition may be that Chinese automotive components, if competitively priced and of a high-quality, could be a substitute for locally produced components. This may adversely affect employment and production volume growth among local automotive component suppliers since less labour would be required should local OEMs import components from China.

In contrast to the negative outlook mentioned above, levels of research and development and management quality in some firms has been known to increase when exposed to competition from Chinese imports (Bloom, Draca, & Van Reenen, 2011). Employment and survival of low-tech firms, which have lower patenting intensity, are at more risk in comparison to higher-tech firms when exposed to competition from Chinese imports (Bloom et al., 2011). This risk is therefore relevant to local component manufacturers who produce low-tech components (e.g. brackets and clips) by manufacturing processes which require relatively less technology and infrastructure.

2.3.4 *Local and export demand for domestically produced vehicles*

There is a significant volume of locally produced vehicles and automotive components that are sold domestically and exported from South Africa to various countries in Africa, Europe, North and South America, Asia, Australia and the Middle-East (Lamprecht, 2015). Local and export demand for vehicles and automotive components drives production volume output from local OEMs.

South Africa's geographical positioning from a supply chain perspective facilitates a cost effective and efficient supply of vehicles to the African market. The export market is of significant importance to South Africa since studies have found a positive causal relationship between exports and growth (Ahmed, Cheng, & Messinis, 2011). Total local car sales and exports data indicates that vehicle sales volumes have been increasing since the global financial crisis in 2008. Demand for light commercial vehicles and cars has steadily increased since 2009,

however, in the past two years, local car sales have stagnated. NAAMSA (2015) has forecasted growth in local car sales and light commercial vehicles for the near term (i.e. 2015 and 2016), but has been cautious about the industry achieving forecasted sales volumes (IHS, 2015b).

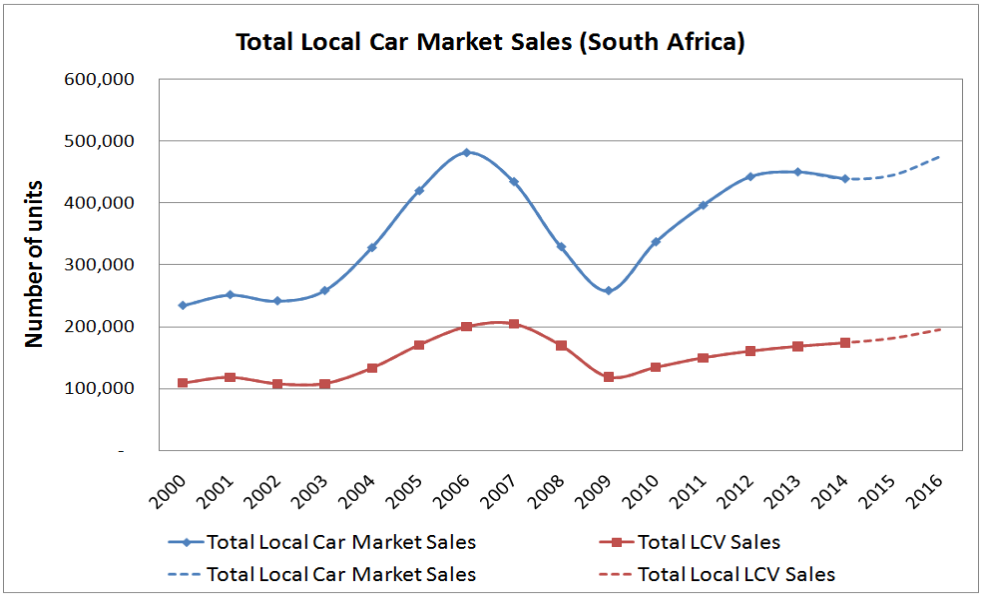


Figure 5: Total South African local car market sales (NAAMSA, 2015)

Total vehicle exports, including cars and light commercial vehicles are also forecasted to increase in the near term (NAAMSA, 2015):

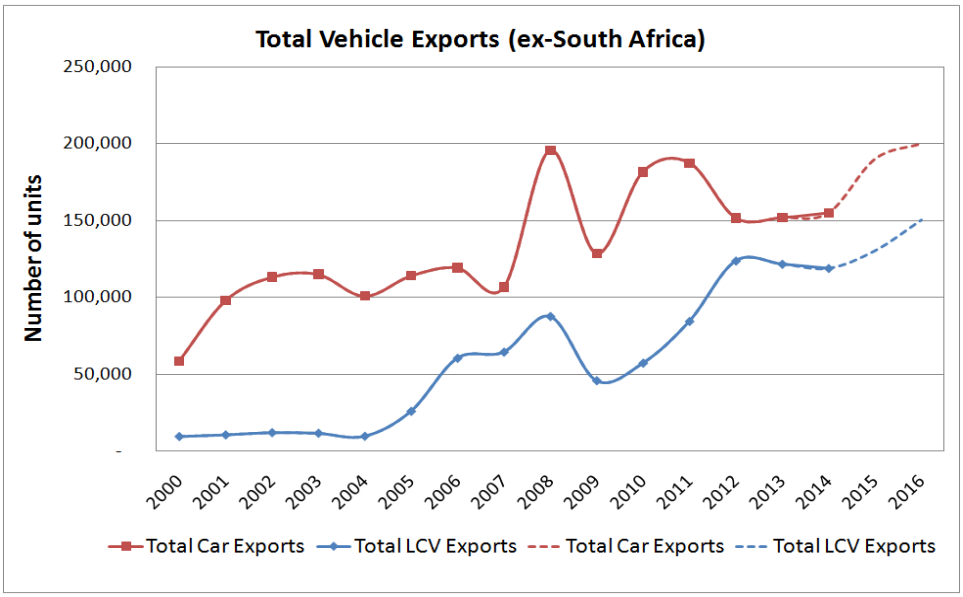


Figure 6: Total vehicle exports (NAAMSA, 2015)

There are apparent threats with regards to export markets in equatorial and northern Africa where Asian and European suppliers may have similar, if not superior logistical access to the these specific markets. Furthermore, local OEMs are inherently in competition with other global and emerging market OEMs producing the similar models of vehicles (Peridy & Abedini, 2008). Since South Africa has become more globalised due to an increase in foreign trade activity since 1994, the economy has therefore become more susceptible to external trade shocks with foreign trade partners (L. Rangasamy & Blignaut, 2005). Should export demand for locally produced vehicles stagnate or decrease, then vehicle production volume output may also decrease. Unless a decrease in export demand for locally produced vehicles and automotive components is supplemented by a significant increase in local demand, overall growth in production volume may be constrained.

Therefore, there is an incentive for local OEMs and automotive component manufacturers to improve the value proposition (i.e. cost, quality and reliability) for export customers to import vehicles and automotive components produced in South Africa since export demand may enable growth within the South African automotive manufacturing industry.

2.3.5 *The current state of South Africa's existing infrastructure*

In context of this research, the following are key infrastructure categories which form the existing national infrastructure network that supports the South African automotive manufacturing industry (Bigotte & Antunes, 2007):

- Technical Infrastructure: energy, water supply, ICT and supply chain or transport (i.e. road, rail and port)
- Social Infrastructure: housing, hospitals, secondary and tertiary education institutions and municipal services

Infrastructure has been known to enable economic growth in developing countries (Sahoo, Dashban, & Nataraj, 2012). Conversely, a lack of infrastructure may constrain economic growth and inhibit poverty reduction (Dash & Sahoo, 2010).

Since there is an apparent link between infrastructure and economic growth, it may be appropriate to consider the impact of both technical and social infrastructure on growth and productivity within the South African automotive manufacturing industry.

With regards to energy infrastructure, South Africa is currently constrained in terms of power generation to the extent that the national electricity public utility, Eskom, has implemented a programme of load-shedding in order to regulate the amount of electricity available within the South African power grid (Eskom, 2015). Furthermore, there has been lower production output of electricity in 2014 in comparison to 2013 (StatsSA, 2014a). This has adversely affected the general public and in particular manufacturing operations that rely on electricity to power production lines and manufacturing equipment.

The South African government and Eskom have announced plans to improve the existing energy infrastructure in the mid-to-long-term (National Planning Commission, 2011). However, in the short-term, power outages are expected to continue (Eskom, 2015). This may impact local OEMs including automotive component suppliers who may not have a secondary power supply from stand-alone, back-up generators which are costly to purchase, operate and maintain.

A constraint in electricity supply due to inadequate energy infrastructure may therefore constrain growth in vehicle production within the South African automotive manufacturing industry since local OEMs may not be able to assemble vehicles if the supply of electricity is insufficient to power production lines, manufacturing equipment and support automotive component suppliers. If automotive component suppliers do not have an adequate supply of electricity, then they may not be able to produce the volume of components required by local OEMs (assuming component suppliers do not have the means or access to an alternate or secondary power supply, i.e. generators).

With regards to this research; rail, road and port infrastructure is classified as transport infrastructure (Deng, 2013). Transport infrastructure plays An important role in economic development (Rust, Van Wyk, Ittmann, & Kistan, 2008) and

investment in infrastructure is of significance to short and long-term growth strategies (Calitz & Fourie, 2010). Inadequate transport infrastructure is known to inhibit economic performance by constraining workforce migration, material handling and market expansion (Deng, 2013). This is particularly relevant to manufacturing operations where transport infrastructure is required to move raw materials to production facilities and distribute finished goods or products to customers.

Similarly, with regards to the South African automotive manufacturing industry, road, rail and port infrastructure is used to transport raw materials, parts and larger components to local OEM production facilities, and distribute assembled vehicles both nationally and abroad (i.e. exports). Therefore if transport infrastructure were to be constrained in terms of capacity, the automotive manufacturing industry may also become constrained with regards to growth in vehicle production. Delays in the shipment of raw materials, parts and large components may slow down production volume output and bottlenecks in transport infrastructure that are used to distribute vehicles to consumers may decrease sales volumes of domestically produced vehicles.

South Africa's existing transport infrastructure is constrained in terms of capacity and is due for upgrade and expansion (Economic Development Department, 2011; National Planning Commission, 2011). The South African government has highlighted that existing infrastructure requires upgrading in order for the goal of job creation to become a reality (National Planning Commission, 2011). Furthermore, government has begun to implement several key strategic projects to improve and upgrade existing infrastructure which is expected to be a driver for job creation (Economic Development Department, 2011; National Planning Commission, 2011).

Adequate ICT infrastructure is critical to improve productivity since businesses and society are dependent on ICT infrastructure to carry-out daily operations and to maintain global competitiveness (National Planning Commission, 2011). Similarly, modern manufacturing operating systems are to an extent facilitated by ICT infrastructure. A deficiency in ICT infrastructure may constrain the

performance of such systems, impact production output and the potential for volume growth. The South African government has identified ICT infrastructure as an area of concern and has dedicated resources and developed strategic plans to improve and upgrade existing ICT infrastructure (National Planning Commission, 2011).

The National Development Plan 2030 states that adequate economic infrastructure, including social infrastructure is needed to support South Africa's medium and long-term economic and social objectives (National Planning Commission, 2011). The National Planning Commission has recognised that existing social infrastructure is inadequate and does not meet the needs of many South Africans (National Planning Commission, 2011). High labour productivity may be driven-by and attributed to adequate social infrastructure (Hall & Jones, 1999). Therefore poor social infrastructure may inhibit labour productivity, thereby negatively affecting growth in vehicle production within the automotive manufacturing industry.

2.3.6 *Government policy and development plans*

The APDP has replaced the MIDP in January 2013 with the objective of further growing production volume output of vehicle manufacturers and component suppliers, thereby increasing job creation and employment within the automotive industry (NAACAM, 2014). An objective of the programme is to steer the industry to produce 1.2 million vehicles by 2020 (NAACAM, 2014). The APDP consists of four pillars which forms the foundation of the programme (NAACAM, 2014):

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

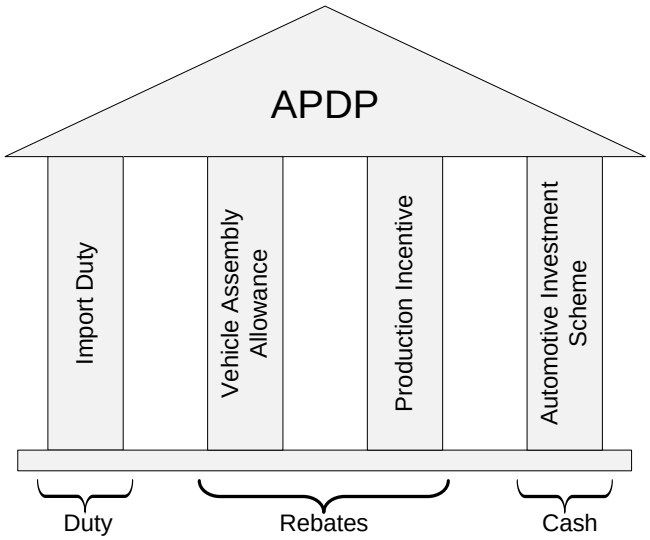


Figure 7: A framework of the APDP (NAACAM, 2014)

The Vehicle Assembly Allowance (VAA), Production Incentive (PI) and Automotive Investment Scheme (AIS) are pillars which upon further investigation provide relief to local OEMs and component suppliers by means of rebates which reduces costs of production; and grants or cash may be used by local OEMs and automotive component suppliers for investment in productive assets (NAACAM, 2014). However, there may be a concern with regards to the current freeze on vehicle import duty (until 2020) which may result in an increase in volumes of fully imported vehicles (NAACAM, 2014). If import duties do not increase, imported vehicles in terms of pricing may become more competitive and attractive to the consumer. This may therefore negatively impact demand for locally produced vehicles and inhibit growth within the local automotive manufacturing industry.

Export trade policy has an impact on growth within the South African automotive manufacturing industry. A decrease in trade tariffs results in an increase in foreign trade growth (Shendy, 2012). If export trade terms, duties, levies and taxes are unfavourable, local OEMs may struggle to compete globally from a product pricing perspective since high export duties, levies and taxes may raise export prices for domestically produced vehicles (assuming the exchange rate remains constant). Higher vehicle prices may deter export customers from purchasing vehicles produced in South Africa thereby decreasing export demand. Therefore local OEMs may be compelled to reduce production volume output in order to align with

a lower total demand for vehicles. This may impact production volume output and the potential for growth within the South African automotive manufacturing industry.

Government's fiscal and monetary policies are particularly relevant to growth within the South African automotive manufacturing industry. Contractionary fiscal policy, by way of a decrease in government spend and an increase in taxes may increase unemployment (Gravelle & Hungerford, 2011). This may adversely affect demand for new vehicles since higher unemployment levels may result in lower disposable income for the consumer. Furthermore, the automotive industry may be constrained from a supply chain and transport infrastructure perspective should there be a decrease in spend on rail, road and port infrastructure.

In contrast, expansionary monetary policy in the form of creating price stability by means of reducing interest rates (Christiano & Eichenbaum, 1992), may increase consumer affordability levels and as a result may increase demand for new vehicles. A greater demand for new vehicles would require higher production volumes and overall growth within the South African automotive manufacturing industry.

The South African government's policy with regards to Broad-Based Black Economic Empowerment (BBBEE) may have negative implications with regards to the retention of skilled and experienced white workers who are currently employed within the automotive manufacturing industry. As mentioned earlier, the industry depends on skilled labour and any potential loss of technically proficient workers may negatively impact productivity unless more skilled workers are readily available as replacements. From a component supplier perspective, government's BBBEE policy may increase competition within the industry as black entrepreneurs may be encouraged to enter the industry through enterprise and supplier development programmes. This may increase the scale of the automotive component supplier base within South Africa and support local OEMs including export customers.

The South African government has implemented several policies, and is in the process of developing further strategies to stringently regulate legal requirements pertaining to carbon emissions and the natural environment in order to transition to an environmentally sustainable, low-carbon economy (National Planning Commission, 2011) . While these policies may have compelled organisations to comply or face legal consequences, more cost may be incurred by manufacturing oriented businesses since more technologically advanced infrastructure may be required to optimise production processes to ensure that carbon emissions and industrial waste may be reduced.

The cost incurred to maintain compliance with regards to environmental and emissions bylaws may deter organisations from investing in infrastructure to expand their production footprint and increase productivity. A plausible counter-argument may be that by optimising existing production infrastructure, manufacturing businesses may be able to derive a similar volume of production output with a lower consumption of natural resources (i.e. less water and electricity consumed per unit of production), discharge of effluent and carbon emissions. The savings generated from a more efficient and environmentally sustainable operation may pay back the infrastructure investment in the long-term.

2.3.7 *Current state of the South African socioeconomic environment*

The state of the existing socio-economic environment may have an influence on the productivity and economic growth of a country (Mauro & Carmeci, 2007). A workforce exposed to several socioeconomic issues including abject poverty, crime, disparities in healthcare and access to education may not be productive and readily employable to organisations (Nilsen, 2007).

This is relevant to the South African automotive manufacturing industry since the industry requires a large, robust workforce to sustain and grow existing manufacturing operations. A poor socioeconomic environment, plagued by some of the issues mentioned above may constrain the availability of labour needed to grow the South African Automotive manufacturing industry.

In light of the existing socioeconomic concerns regarding unemployment, crime, income inequality, education and healthcare (IHS, 2015b; National Planning Commission, 2011), the current state of the South African socioeconomic environment may be perceived as a constraint to economic growth and productivity.

2.3.8 *New production methods, automation and technology*

The evolution of car-making from a mass production perspective may be expected to continue as OEMs look to gain a competitive advantage in respect of cost of production. Advancements in technology may improve the ability to automate production processes which thereby increases production volume output per unit time, and reduces the overall cost per unit. Higher economies of scale reduce costs of production (Truett & Truett, 2006, 2009). Essentially, more volume may be produced in shorter period of time, with a similar, if not lesser amount of resources.

In addition, manufacturing oriented businesses are increasingly aware of the benefits associated with lean-manufacturing methodologies and continually look to optimise operations to reduce costs, improve customer service levels and increase production volume output (Pycraft, 2010). Just-In-Time systems for inventory management are well entrenched by many automotive manufacturers and further enhancements to the application of these methodologies can be expected in future (Pycraft, 2010).

With regards to the South African automotive manufacturing industry, should there be no steady advancement in technology and production process methodology, local OEMs and component manufacturers may be exposed to the risk of becoming increasingly uncompetitive from a cost of production, pricing, efficiency and customer service level perspective in comparison to international competitors. This may therefore constrain growth in vehicle production since the demand for locally produced vehicles may shift to more efficient, economical and reliable international OEMs and component manufacturers.

2.3.9 *Demand for hybrid vehicles (local and international)*

The growth in demand for hybrid vehicles has increased in the past decade (Deal Iii, 2010) . The consumer has recognised the benefits associated with driving a hybrid vehicle, which includes lower consumption of fossil fuels and lower carbon emissions (Deal Iii, 2010). In order to support the growth in hybrid vehicle demand, production infrastructure may need to be adapted to suit the production of vehicles which have a hybrid power train.

Local OEMs in South Africa currently do not produce any model of hybrid vehicles. These models are currently fully imported into South Africa. Should demand shift significantly away from existing traditional internal combustion engine vehicles to hybrid vehicles, local OEMs and automotive component suppliers may be at risk of a decline in vehicle demand, and as a result, production volume output may therefore decrease.

However, there are several studies which debate the feasibility and appropriateness of hybrid vehicles since these types of vehicles are currently more expensive in terms of pricing in comparison to equivalent internal combustion engine vehicles; and the associated costs of production and carbon footprint linked to mass production of hybrid vehicles is rather significant.

2.3.10 *The existing political stability in South Africa*

There may be a positive relationship between political stability and economic growth since investment by foreign investors and the private sector may increase during a period of sustained political stability, and this may lead to greater infrastructure development which is a driver for economic growth (Sahoo et al., 2012). Under a stable political climate, local OEMs may choose to expand operations by increasing production capacity which will support growth in vehicle production volume.

From a raw material sourcing perspective, the automotive manufacturing industry is considerably dependent on steel which is a natural resource mined in South

Africa and processed into sheet steel which is used by local OEMs to produce panels and chassis for vehicles. Furthermore, steel is used as a raw material in tool and die manufacturing which is required to fabricate moulds and presses which are used for component and vehicle panel production. An unstable political environment, including the threat of nationalisation of mines or expropriation of land, may deter mining companies from investing in infrastructure to increase the output from mines which may in turn constrain local OEMs with regards to the availability of raw materials.

Although there may be concerns with regards to land reforms, the high degree of unionisation and threat of industrial action that may inhibit or disrupt business activity (IHS, 2015b), overall political stability is expected to continue in South Africa due to the ruling party's dominance at provincial and national level, and the perceived low risk of civil war (IHS, 2015b). Furthermore, South Africa is still considered to have one of the most sophisticated political systems in Africa (IHS, 2015b).

2.3.11 *Other potential inhibiting and enabling factors*

Apart from the abovementioned factors, there may be other factors that either inhibits or enables growth in vehicle production. The following potential inhibiting and enabling factors will be addressed in more detail during the research process to determine if they have any material impact on growth in vehicle production.

Labour costs may inhibit or enable growth in vehicle production if OEMs decide to allocate more vehicle production volumes to countries which have comparatively lower labour costs. Similarly, the influence of trade unions may either enable or inhibit growth in vehicle production depending on the relationship and manner in which negotiations are conducted between local OEMs and unions.

The existence of competing emerging market OEMs may serve as an alternate source of supply to local OEMs if price, quality and reliability of supply are not on a par with emerging market OEMs. Therefore, competing emerging market OEMs

that produce vehicles within the similar segments to local OEMs may be seen as an inhibitor to growth in vehicle production.

The existing local automotive component supplier base may also be considered an enabler to production volume growth since local components may reduce overall vehicle production costs and allow local OEMs to benefit from incentives offered by the APDP.

2.3.12 *Proposition 1*

As highlighted in literature, there may be several inhibiting and enabling factors for growth in vehicle production. However, the dominant inhibiting and enabling factors are listed below.

The following are dominant factors which inhibit growth in vehicle production within the South African automotive manufacturing industry:

- The current state of the South African and global economy
- South African imports of fully assembled vehicles and automotive components
- South Africa's existing infrastructure

The following are dominant factors which enable growth in vehicle production within the South African automotive manufacturing industry:

- Local and export market demand for domestically produced vehicles
- Government policy and national development plans
- The existing political stability in South Africa

2.4 Measures to mitigate the impact of the identified inhibiting factors

Factors identified in literature which enable growth in vehicle production within the South African automotive manufacturing industry do to an extent address the impact of the abovementioned inhibiting factors. However, more specific measures need to be identified in order to comprehensively mitigate the impact of the abovementioned inhibiting factors.

The current state of the South African economy may be improved by increasing productivity and economic growth. This may be achieved by addressing the shortage of skilled labour by investing further to improve the education system (Economic Development Department, 2011; Fedderke & Simkins, 2012; National Planning Commission, 2011). Furthermore, government's plans to improve technical and social infrastructure may address constraints to economic growth (Economic Development Department, 2011; IHS, 2015b). Not only will national infrastructure benefit from investment in development plans, but the socioeconomic environment may also improve due to the upgrade of social infrastructure (National Planning Commission, 2011).

With regards to the impact of imported fully assembled vehicles and automotive components, a measure may be to review the current freeze on vehicle import duty. By increasing import duties, prices of imported vehicles may increase and compel consumers to purchase more domestically produced vehicles (NAACAM, 2014). However, a protectionist measure such as the above will require more detailed investigation, consultation and research since it may affect foreign trade relations with other exporting countries and impact customer satisfaction levels if consumers perceive that their options have become far more limited due to higher new vehicle pricing in lieu of higher import duties.

In order to address the concern with regards to the hybrid vehicle market, local OEMs should consider measures which involve the investment in infrastructure from a production perspective in order to be considered as a potential supply source of hybrid vehicles for the South African and global market. This may create

export and local sales opportunities for local OEMs and automotive component manufacturers.

2.4.1 *Proposition 2*

The following measures mitigate the impact of inhibiting factors on growth in vehicle production within the South African automotive manufacturing industry:

- Investment in technical and social infrastructure
- Review of import duties

2.5 Unintended consequences as a result of inhibiting and enabling factors affecting growth in vehicle production

There may be potential unintended consequences of this research which may be either favourable or detrimental and outside the scope of this research. With reference to the five capitals framework of sustainable development (Porritt, 2007), it is possible for unintended consequences to occur in other capitals as a result of this research apart from the capital within which this research is being conducted (Stacey & Stacey, 2012). As opposed to endeavouring to identify unintended consequences as a result of this research; this research attempts to identify unintended consequences that occur due to the impact of the above identified inhibiting and enabling factors on growth in vehicle production.

The above review of literature may have already acknowledged some of the minor unintended consequences that may occur due to the impact of the above identified inhibiting and enabling factors. However, the impact on the socioeconomic environment, natural environment and resources, and the standard of living or quality of life in South Africa are three dominant unintended consequences that may result from the impact of the inhibiting and enabling factors identified above.

An increase in growth in vehicle production may improve the socioeconomic environment by means of increasing employment which may in turn reduce levels

of poverty. This may have a positive effect on the reduction of crime levels which will improve the safety and security of communities.

An increase in growth in vehicle production may impact the natural environment since more natural resources may be consumed in order to produce more vehicles. For example, more steel will be required as raw materials for the production of car panels and chassis. Furthermore, depending on the level of technology available and local OEMs commitment to adhere to emissions policies and guidelines, more vehicle production volume may yield higher carbon emissions assuming that the same production processes and infrastructure is used.

The overall standard of living or quality of life may be expected to improve as a result of the working population earning an income and having the financial means to purchase goods and services that an unemployed population may not be able to afford (e.g. private healthcare and education).

The current state of South Africa's socioeconomic environment is an input to the model to assess its impact on growth in vehicle production and will be reviewed in the following chapter. The resulting socioeconomic environment is essentially impacted by the key model output of concern which is growth in vehicle production.

2.5.1 *Proposition 3*

The following are unintended consequences that occur due to the impact of the above identified inhibiting and enabling factors on growth in vehicle production:

The impact on the:

- Socioeconomic environment
- Natural resources, environment and ecosystem
- Standard of living or quality of life in South Africa

2.6 Conclusion of Literature Review

As identified in literature, there are several factors which could potentially inhibit or enable growth in vehicle production within the South African automotive manufacturing industry. These factors are prevalent at both a macroeconomic and microeconomic level since the identified factors are relevant to both the wider South African economic landscape and in particular, the local automotive manufacturing industry. Furthermore, there may measures which mitigate the impact of the identified inhibiting factors.

It has also been identified in literature that there may be unintended consequences that occur due to the impact of the above identified inhibiting and enabling factors on growth in vehicle production. This research will not only allow for respondents to review the above inhibiting, enabling factors (i.e. inputs) and unintended consequences (i.e. outputs) indentified in literature, but may offer respondents the opportunity to review linkages and weightings between factors; and identify more factors and consequences which may further enhance the model which attempts to simulate the relative effect of these factors on growth in vehicle production within the South African automotive manufacturing industry.

2.6.1 *Proposition 1:*

The following are dominant factors which inhibit growth in vehicle production within the South African automotive manufacturing industry:

- The current state of the South African and global economy
- South African imports of fully assembled vehicles and automotive components
- South Africa’s existing infrastructure

The following are dominant factors which enable growth in vehicle production within the South African automotive manufacturing industry:

- Local and export market demand for domestically produced vehicles
- Government policy and national development plans

- The existing political stability in South Africa

2.6.2 *Proposition 2:*

The following measures mitigate the impact of inhibiting factors on growth in vehicle production within the South African automotive manufacturing industry:

- Investment in technical and social infrastructure
- Review of import duties

2.6.3 *Proposition 3:*

The following are unintended consequences that occur due to the impact of the above identified inhibiting and enabling factors on growth in vehicle production:

The impact on the:

- Socioeconomic environment
- Natural resources, environment and ecosystem
- Standard of living or quality of life in South Africa

CHAPTER 3. RESEARCH METHODOLOGY

A semi-quantitative approach was followed in order to address the research propositions outlined in the previous chapter. Semi-quantitative research is a research approach which integrates both quantitative and qualitative research (Bryman, 2012). Creswell (2007) acknowledged that all research methods have weaknesses and that a semi-quantitative approach which involves the collection of both qualitative and quantitative data would serve to neutralise the weaknesses in each form of data.

Falconer and Mackay (1999) support the view that it may be appropriate to combine quantitative and qualitative research within a positivist paradigm. Furthermore, Falconer and Mackay (1999) acknowledged that positivist approaches search for and establish causal relationships between constituent elements.

Since this research is based on the identification and modelling causal relationships between inhibiting and enabling factors by using both a *quantitative approach* in the analysis of the metrics or numerical analysis together with a *qualitative approach* in the form of open-ended views of respondents with the intent of developing patterns and identifying new causal links with appropriate weightings; the research paradigm may therefore be considered a semi-quantitative approach.

3.1 Research methodology/paradigm

The research methodology used to simulate scenarios for growth in vehicle production within the South African automotive manufacturing industry is Fuzzy Cognitive Mapping (FCM). Fuzzy cognitive maps are used in the assessment of causal relationships between components within the same system by analysing how one component affects other components in the system (Fons, Achari, & Ross, 2004). Furthermore, a FCM approach is used to analyse the overall

complexity of relationships between components in the same system (Fons et al., 2004).

A FCM approach may be a dynamic process since it takes into consideration subjective views and preferences with regards to the causal relationships between components in a system by illustrating these relationships externally by the use of commands or signs (Dodouras & James, 2007). These commands or signs may be represented by simple binary relationships (i.e. increase (+) or decrease (-)) or may be extended to include various degrees of increase or decrease (Fons et al., 2004).

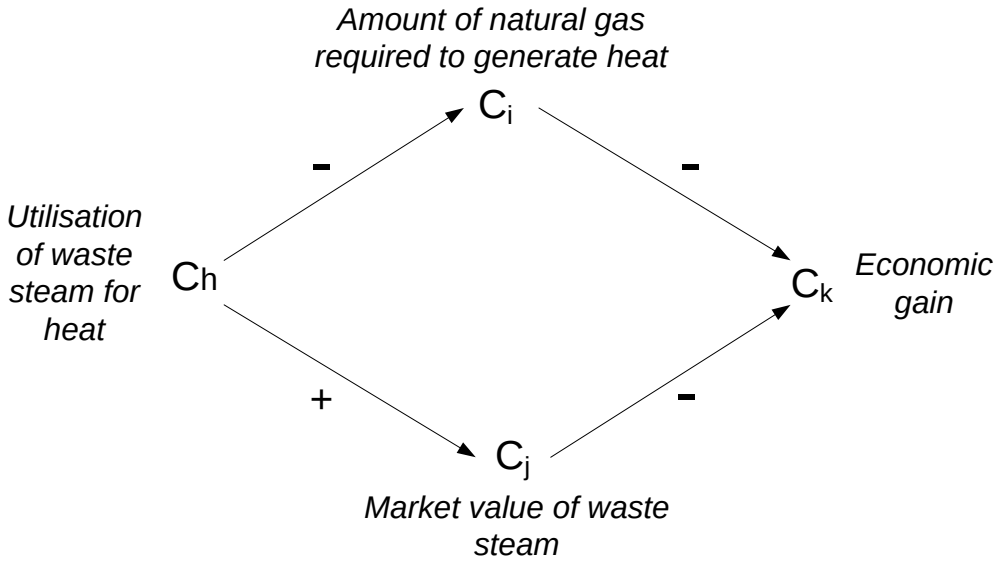


Figure 8: An example of a conventional cognitive map for the utilisation of waste steam (Fons et al., 2004)

A large FCM requires an adjacency matrix which allows for the numerical analysis of causal relationships between concepts in the system (Fons et al., 2004). Nodes represent concept variables which may be cause or effect variables. A concept variable at the origin of an arrow is a *cause* variable while a concept variable at the end of an arrow is an *effect* variable. For example, in the map above, C_h is a cause variable which impacts effect variable, C_i. The cause variables are located in rows and effect variables, or variables which are affected by the cause variables are located in columns in the adjacency matrix (Fons et al., 2004). The

“+1” signifies that the effect is an increase while a “-1” signifies that the effect is a decrease (Fons et al., 2004).

The state of the concept variables are held within defined boundaries by a threshold function which determines the behaviour of a cognitive map (Fons et al., 2004). A bivalent threshold function requires that a node or concept variable be set to a value of “1” or “0” which is equivalent to switching the node “on” or “off” (Fons et al., 2004). A value between 0 percent and 100 percent of “1” will allow for weighting the relationship between a cause and effect variable (Kosko, 1993). By switching nodes “on” or “off”, “what-if” scenarios and analyses may be conducted (Kosko, 1993).

$$E = \begin{array}{c} \\ C_h \\ C_i \\ C_k \\ C_j \end{array} \begin{array}{c} \begin{array}{cccc} C_h & C_i & C_k & C_j \end{array} \\ \begin{pmatrix} 0 & -1 & 0 & +1 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{pmatrix} \end{array}$$

Figure 9: The adjacency matrix for the cognitive map in Figure 8 (Fons et al., 2004)

The ability to switch nodes on or off is key since the identified inhibiting and enabling factors may be characterised as input nodes which may be switched on or off in order to simulate the impact of each inhibiting or enabling factor, or groups of factors on the effect variables or output nodes (i.e. local production volume growth within the South African automotive manufacturing industry and unintended consequences).

3.2 Research Design

A semi-quantitative approach was followed whereby an initial FCM was generated from causal relationships between nodes which are system components or concepts drawn from literature. The initial FCM was then enhanced by input from subject experts or respondents during the research process. The enhanced FCM was validated before being used to simulate various scenarios which were aimed at addressing the research problems outlined in the previous chapter.

Testing and developing the enhanced FCM involved presenting and explaining the initial FCM to respondents in person or via video-conferencing in order to incorporate their input which was used to expand the initial FCM by introducing new causal relationships (i.e. new nodes). Furthermore, respondents provided their recommendations in respect of the individual weightings of the causal relationships between the nodes of the initial and enhanced FCM.

This research is simulation-based since the enhanced FCM was analysed through various scenarios by switching nodes on or off in order to simulate the impact of each inhibiting or enabling factor, or groups of factors on effect variables or output nodes. Furthermore, the new nodes introduced by respondents were also tested via simulation of the enhanced FCM. Advantages and disadvantages of FCM are listed in Table 1 below.

Mental Modeler freeware software was used to construct the initial and enhanced FCMs and the corresponding adjacency matrices. MS Excel was used to simulate scenarios, test results and conduct analyses.

Table 1: Advantages and disadvantages of FCM (Kandasamy & Smarandache, 2003)

Advantages	Disadvantages
Allows for the factual and evaluative representation of concepts in an interactive framework	FCM is susceptible to subject expert's level of knowledge, wisdom, ignorance or bias
Subject experts can agree or disagree with the causal structure and recommend changes where necessary	Subject experts may differ on the relevance and weightings of causal linkages
The FCM can be reduced to simple vector matrix operations	The researcher's biases may be encoded in the FCM
Enables the visibility of a simplified, complete view of a system or model	

3.3 The initial FCM

The following initial FCM was constructed from literature. This map is the basis upon which further developments have been made by taking into consideration builds from respondents during interviews. For ease of reading, the initial FCM shown below has been simplified by showing only the dominant causal relationships identified in literature. A comprehensive initial FCM depicting all causal relationships has been included in the appendices (Appendix C). An enhanced FCM was produced after respondents verified the causal links in the initial FCM and built additional new nodes and linkages where possible. Furthermore, respondents provided their recommendations in respect of the individual weightings of causal relationships between nodes contained in the initial and enhanced FCMs.

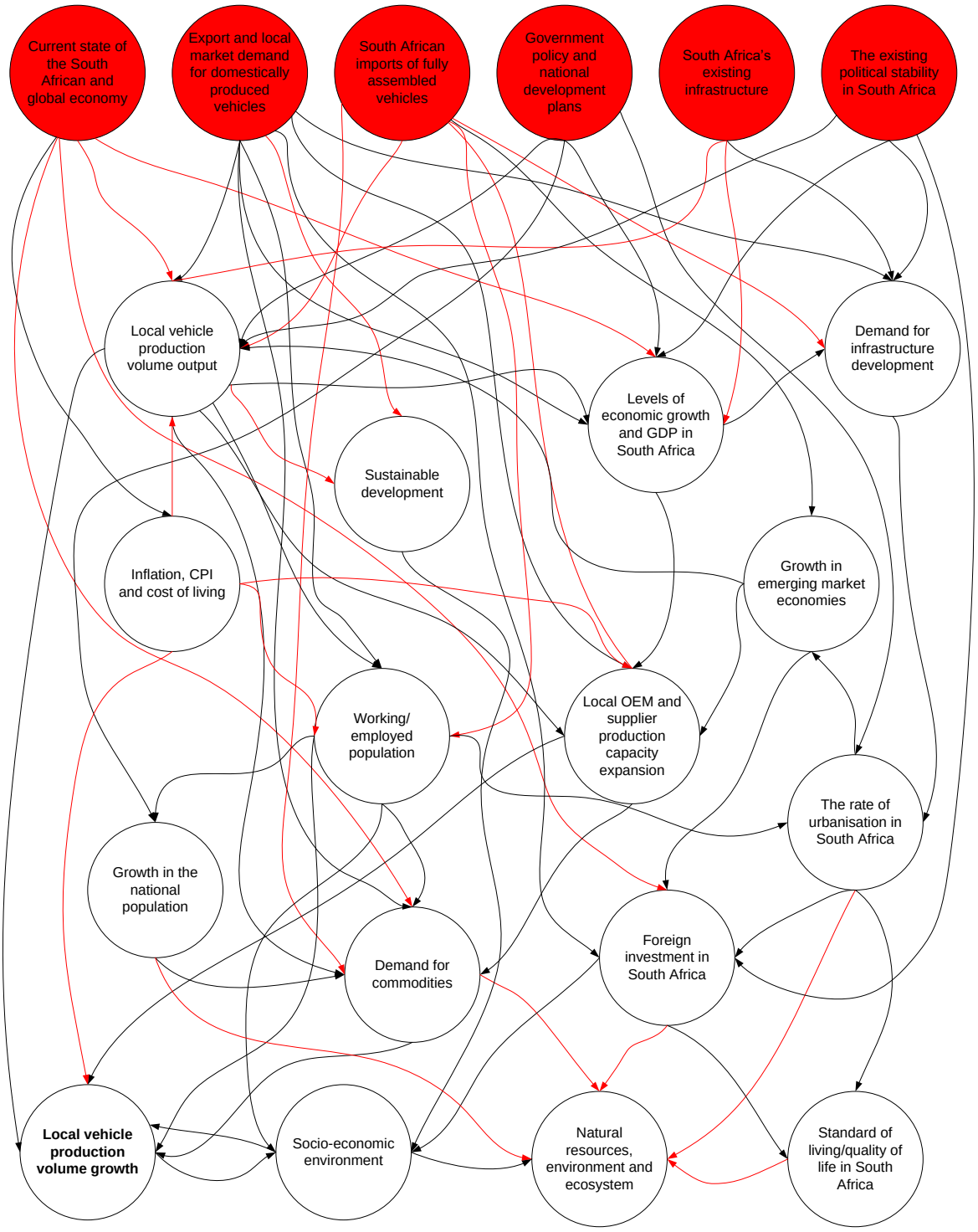


Figure 10: The simplified initial FCM constructed from literature

Key: + denotes an positive causal relationship; - denotes a negative causal relationship	Local vehicle production volume output	Levels of economic growth and GDP in South Africa	Working/Employed population	Inflation, CPI and cost of living	Sustainable development	Demand for commodities (i.e. steel and oil)	Demand for infrastructure development	Local OEM and automotive component supplier production capacity	Growth in the national population	The rate of urbanisation in South Africa	Foreign investment in South Africa	Growth in emerging/foreign market economies	Local vehicle production volume growth	Socio-economic environment	Natural resources, environment and ecosystem	Standard of living/quality of life in South Africa
Current state of the South African and global economy	-	-	-	+	-	-	+	-	-	-	-					
Available skilled labour in South Africa	-	-	-	+	-			+			-					
South African imports of fully assembled vehicles	-	-	-		+	-	-	-			-	+				
Export and local market demand for domestically produced vehicles	+	+	+		-	+	+	+			+					
Current state South Africa's existing infrastructure	-	-	-	+	-	+	+	-	-	-	-					
Government policy and national development plans	+	+	+	-	+	+	+	+	+	+	+	+				
Current state of the South African socio-economic environment	-	-	-	+	-	-	+	-		-	-					
New production methods, automation and technology	+	+	-	-	+	-	+	+								
Demand for hybrid cars (domestic and international)	-				+	-						+				
The existing political stability in South Africa	+	+	+	-	+	+	+	+	+	+	+					
Local vehicle production volume output		+	+			+	+						+	+	-	+
Levels of economic growth and GDP in South Africa	+		+	+	+	+	+	+	+	+	+		+	+	-	+
Working/Employed population							+	+		+	+		+	+	-	+
Inflation, CPI and cost of living	-	-	-		-	-	-	-	-	-			-	-	+	-
Sustainable development		+		-		-	+		+				+	+	+	+
Demand for commodities (i.e. steel and oil)	+	+			-		+			+		+	+	+	-	+
Demand for infrastructure development	+	+	+		+	+		+		+	+	+	+	+	-	+
Local OEM and automotive component supplier production capacity expansion	+	+			+	+	+				+		+	+	-	
Growth in the national population		+	+		-	+	+			+	+				-	
The rate of urbanisation in South Africa	+		+			+	+		+		+	+			-	
Foreign investment in South Africa	+	+	+			+		+	+	+			+	+	-	+
Growth in emerging/foreign market economies	+	+	+			+		+			+		+	+	-	
Local vehicle production volume growth	+	+	+		+	+	+	+		+	+			+	-	+
Socio-economic environment																
Natural resources, environment and ecosystem													+			+
Standard of living/quality of life in South Africa																

Figure 11: The adjacency matrix for the initial FCM

3.4 Population and sample

3.4.1 *Population*

The population for this research comprised of respondents that are subject experts and stakeholders within the South African automotive manufacturing industry. These respondents were from local OEMs, government departments, industry associations, independent consultancies and academic institutions. The respondents possessed government, macroeconomic and industry related experience which facilitated the enhancement of the initial FCM.

3.4.2 *Sample and sampling method*

A purposive sampling methodology was followed whereby respondents were selected based on their relevant experience, subject matter knowledge and understanding of the central theme of this research (Ritchie, Lewis, Nicholls, & Ormston, 2013). Table 2 below outlines the list of potential respondents:

Table 2: Profile of potential respondents

Description of respondent type	Number to be sampled
Government	
Deputy Director: Department of Trade and Industry	1
Director: Department of Trade and Industry	1
Industry	
General Manager: Parts and Operations: Toyota SA Motors	1
Senior Manager: Logistics Planning: Toyota SA Motors	1
Senior Manager: Strategic Planning: Toyota SA Motors	1
Director: NAAMSA	1
External	
Lecturer: Economics: Wits Business School	1
Consultant: Adept Advisory	1

3.5 The research instrument

Data was gathered from unstructured interviews with respondents. The research instrument consisted of an interview outline which included the initial FCM. The initial FCM was further developed to produce an enhanced FCM after input from respondents was taken into consideration.

An unstructured interview together with an initial FCM allowed for more open-ended discussions with respondents while still being guided by key concepts identified in literature. Therefore, a structured interview schedule was not used as an instrument for this research. However, an interview outline has been included in the appendices (Appendix A). A cover letter was also used to encourage respondents to participate in interviews and has been included in the appendices (Appendix B).

3.6 Procedure for data collection

Respondents were first emailed a cover letter which provided brief information regarding purpose of the research; the research methodology (i.e. a brief explanation of FCM); the need for unstructured interviews and the request for assistance from respondents to enhance the initial FCM through unstructured interviews. Respondents were then contacted telephonically and were asked if they had received and read the cover letter which was first emailed. After respondents reverted by asking relevant questions and exhibited an understanding of the central theme of the research, they were verbally requested by the researcher to participate in unstructured interviews. When a respondent agreed to participate in an interview, the researcher confirmed that an appointment would be made at a time and venue which was convenient to the respondent. Furthermore, the respondent was informed that the interview would be conducted after the research proposal has been approved by the business school MBA research panel after mid-July 2015. In some instances, respondents agreed to an unstructured interview directly after being sent the cover letter, without a telephonic confirmation. However, all respondents were

still contacted by the researcher telephonically to confirm their availability for interviews.

Insights and perspectives gained from respondents during unstructured interviews were used to expand the initial FCM by introducing new causal relationships in the form of new nodes (i.e. more inputs, outputs and causal relationship linkages). Furthermore, respondents provided their recommendations in respect of the individual weightings of causal relationships between the nodes in the initial FCM.

3.7 Data analysis and interpretation

Data was analysed through the use of content analysis methodology. According to Bryman (2012), “Content analysis is an approach to the analysis of documents and texts (which may be printed or visual) that seeks to quantify content in terms of predetermined categories and in a systematic and replicable manner” (p. 289). Content analysis requires that the researcher remains objective and systematic in their approach thereby ensuring that the results are not an extension of his or her personal bias (Bryman, 2012).

This approach enabled the researcher to summarise responses from respondents in an objective and systematic manner thereby ensuring a level of consistency with regards to the use of input from each respondent. An enhanced FCM was produced after respondents verified the causal links in the initial FCM and built new nodes and linkages where possible. After testing the enhanced FCM for face validity, the model was ready for analysis and interpretation by the simulation of scenarios on the enhanced FCM adjacency matrix. Results were reviewed against literature to determine if they were plausible, and to understand how the identified factors affected growth in vehicle production within the South African automotive manufacturing industry.

3.8 Limitations of the study

Since this research required in-depth, unstructured interviews to build and enhance the initial FCM, the number of respondents was therefore limited to

those that had a reasonable amount of knowledge and context with regards to the automotive manufacturing industry. However, a smaller or limited number of respondents may have contributed to a potential weakness with regards to randomness of the sample.

Since unstructured interviews were conducted, the consistency of the interviews may have been potentially impacted to some extent. However, the content analysis approach discussed above will limit the impact on interview consistency.

3.9 Validity and reliability

3.9.1 *External validity*

External validity refers to whether the findings yielded in a study may be generalised beyond the specific research context or environment in which it was conducted (Bryman, 2012). Given that the sample of respondents selected for this research is purposive (as per purposive sampling methodology), and not representative of the general consensus on the strategic future of the South African automotive manufacturing industry; the ability to generalise beyond the context of this research may be affected. The development and enhancement of the initial FCM and subsequent results from analyses are dependent on the perspectives and specific insights from the respondents. Although the number of respondents may be limited, the inherent diversity of respondents in the sample may support the replicability and generalisability of this research.

3.9.2 *Internal validity*

Internal validity is related to the subject of causality and is primarily concerned with the question of whether findings and conclusions which incorporates a causal relationship between two or more variables is sound (Bryman, 2012). Internal validity of this research is ensured by establishing causal links in the initial FCM from literature and testing for face validity of the initial FCM in response to specific scenarios. Post interviews with respondents, an enhanced

FCM was produced to incorporate improvements to existing causal links, weightings, new nodes and linkages as recommended by respondents. The enhanced FCM was tested again for face validity prior to performing simulations and analyses of various scenarios.

In order to test for face validity, the initial FCM derived from literature was subjected to three scenarios to determine whether results were valid. The results of these scenarios have been included in the appendices.

The first validation was a scenario to test the performance of the initial FCM by switching-off or deactivating all inhibiting factors and switching-on or activating all enabling factors (as identified in literature), and to review how the initial FCM behaves in response to this scenario. The output of concern was “Growth in vehicle production” since this output is central to the theme of this research. The results of the above scenario were aligned to expectations since switching-off all inhibiting factors and switching-on all enabling factors resulted in a positive value or result for “Growth in vehicle production”. Furthermore, the result yielded for “Natural resources, environment and ecosystem” was a negative value. This was plausible since higher local vehicle production may result in the consumption of more natural resources (e.g. steel) and could potentially result in more carbon emissions during the production process. A steady state chart representing the results of the first validation has been included in the appendices (Appendix F).

With regards to the second validation, all enabling factors were switched-off and all inhibiting factors were switched-on. Again the output of concern was “Growth in vehicle production”. The results of this scenario were aligned to expectations since switching-off all enabling factors and switching-on all inhibiting factors yielded a negative value or result for “Growth in vehicle production”. Furthermore, the result yielded for “Natural resources, environment and ecosystem” was a positive value. This was plausible since no local vehicle production may result in a lower consumption of natural resources (e.g. steel) and potentially result lower carbon emissions. A steady state chart representing the results of the second validation has been included in the appendices (Appendix G).

In terms of the final validation, a combination of inhibiting and enabling factors was switched-on. From the six input nodes, there were three inhibiting factors and three enabling factors. Each causal link was weighted subjectively by the researcher (but on the basis of literature) to ensure the system stability. Switching-on all enabling factors, switching-off only the “Current state of the South African and global economy” and “Available skilled labour in South Africa”, and switching-on the remaining inhibiting factors yielded a positive result for “Growth in vehicle production”. However, this result was a lower positive value in comparison to the first scenario tested above. This was aligned to expectations since no inhibiting factors were switched-on in the first scenario. A steady state chart representing the results of the final validation has been included in the appendices (Appendix H).

All three scenarios used to test for face validity yielded results which were aligned to expectations. Therefore the initial FCM was considered valid and ready for enhancement. In order to maximise validity of the FCM model, weightings of the causal links were adjusted after adopting the recommendations made by respondents during interviews.

3.9.3 *Reliability*

Reliability is primarily concerned with issues of consistency of measures and three significant factors are involved when considering the reliability of a measure (Bryman, 2012). These factors include stability, internal reliability and inter-observer consistency (Bryman, 2012). Each respondent was subjected to the same interview outline to ensure consistency. In addition, the same interviewer (i.e. the researcher) conducted all interviews to enhance the reliability of the research. Finally, the causal links identified in the initial FCM were largely from a contemporary South African macroeconomic context. Therefore another researcher may derive and conclude similar causal linkages.

3.10 Demographic profile of respondents

The demographic profile of the respondents actually interviewed during the data collection process is listed in Table 3 below:

Table 3: Profile of actual respondents interviewed

Description of respondent type	Number to be sampled
Government	
Deputy Director: Department of Trade and Industry	1
Director: Department of Trade and Industry	1
Business Development Manager: AIDC	1
Industry	
General Manager: Parts and Operations: Toyota SA Motors	1
Senior Manager: Logistics Planning: Toyota SA Motors	1
Senior Manager: Strategic Planning: Toyota SA Motors	1
Director: NAAMSA	1
External	
Lecturer: Economics: Wits Business School	1
Consultant: Adept Advisory	1

The respondents were selected based on their knowledge, experience and insight with regards to the automotive industry. Respondents from government, the automotive industry and external respondents provided insights and different perspectives which enhanced the results obtained during the interview process.

In comparison to the planned demographic profile of respondents, one additional respondent was interviewed. The respondent was from the Automotive Industry Development Centre (AIDC); a subsidiary of the Gauteng Growth and Development Agency (GGDA); an entity owned by Gauteng Provincial Government's Department of Economic Development. The additional respondent from government allowed for a more comprehensive view since views obtained from only one government department (i.e. Department of Trade

and Industry) and may have constrained the development of the FCM and overall richness of results. The additional respondent from government provided valuable insight with regards to industry development plans and potential challenges which may directly impact growth within the South African automotive manufacturing industry.

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

This chapter will outline and describe results pertaining to the research propositions defined in the second chapter. The results will be presented and categorised based on the perceived impact of factors which inhibit or enable growth in vehicle production within the South African automotive manufacturing industry. Furthermore, results will be presented with regards to potential measures which may mitigate the impact of dominant factors that inhibit growth in the industry. To address the third research proposition, results will be presented with regards to the unintended consequences that may occur due to the impact of inhibiting and enabling factors on growth in vehicle production.

4.2 Results pertaining to dominant inhibiting and enabling factors for growth in vehicle production

4.2.1 *Classification of factors which inhibit or enable growth in vehicle production*

The research proposition tests dominant factors identified in literature as inhibitors or enablers to growth within the South African automotive manufacturing industry. Table 4 below attempts to classify these dominant factors in accordance with the insights and perceptions articulated by respondents, in terms of the perceived impact of these factors on growth in vehicle production (i.e. high, medium or low).

Respondents from industry, government and external respondents had different insights in terms of the classification of the dominant inhibiting and enabling factors. Therefore, Table 4 below has been divided accordingly to represent the classification of dominant factors by each respondent group.

Table 4: Classification of dominant inhibiting and enabling factors

Dominant Factors		Industry	Government	External
Inhibiting Factors	The current state of the South African and global economy	High	High	High
	South African imports of fully assembled vehicles and automotive components	High	High	Medium
	South Africa's existing infrastructure	Medium	Low	Medium
Enabling Factors	Local and export market demand for domestically produced vehicles	High	High	High
	Government policy and national development plans	High	High	High
	The existing political stability in South Africa	High	High	Medium

Respondents also reviewed other factors identified in literature which were included in the initial FCM and classified these factors in terms of their perceived impact on growth in the industry. Table 5 below attempts to classify the remaining factors identified in literature according to the insights and perceptions articulated by respondents; in terms of the impact of these factors (i.e. non-dominant factors) on growth in vehicle production.

Table 5: Classification of other non-dominant inhibiting and enabling factors identified in literature

Other factors identified in literature		Industry	Government	External
Inhibiting Factors	Availability of skilled labour in South Africa	Medium	Low	High
	Current state of the South African socioeconomic environment	Low	Medium	Medium
	Demand for hybrid cars (local and international)	Low	Low	Medium
Enabling Factor	New production methods, automation and technology	Medium	Low	Medium

There were mixed responses from industry, government and external respondents with regards to the level of impact that skilled labour has on the industry. Government respondents maintained that the availability of skilled labour in South Africa has a low impact on growth within the industry while industry and external respondents perceived available skilled labour as a more significant factor that may affect growth in vehicle production.

The APDP was highlighted by government respondents to be the most dominant enabling factor to growth within the South African automotive manufacturing industry. Respondents from industry concurred that the APDP was indeed a dominant enabling factor but not the most dominant.

The state of the economy, local and export demand and imports of fully assembled vehicles were perceived by industry respondents to be equivalent to

the APDP in terms of its impact on growth in vehicle production. In contrast to findings in literature, all respondents concurred that South Africa's existing infrastructure was not a dominant inhibiting factor but a moderate concern for overall growth in the local automotive industry.

With the aim of rationalising the initial FCM, respondents reviewed the intermediate factors and causal relationships presented in the initial FCM and advised which specific intermediate factors should be omitted due to the perceived weakness of causal relationships that emanates from these factors or nodes. As a result, some of the intermediate factors, nodes and causal relationships depicted in the initial FCM have been omitted in the enhanced FCM.

4.2.2 *Identification of other dominant inhibiting and enabling factors*

The influence of trade unions in South Africa and in particular, the automotive manufacturing industry was highlighted by industry respondents as a potential dominant factor which may either inhibit or enable growth in vehicle production. However the consensus among industry respondents was that the influence of trade unions has been an inhibitor to growth in production volumes. In this regard, external respondents expressed similar views to industry respondents.

An opposing view was held by government respondents who found the existing South African trade union landscape to be structured, well-managed and organised. Government respondents therefore perceived the influence of trade unions as an enabler to growth in the industry. Government respondents asserted that trade unions in South Africa have facilitated effective collective bargaining which is required to determine fair wages and benefits for workers. Furthermore, government respondents argued that the influence exerted by trade unions was necessary to regulate industrial relations. However, there was consensus among all respondents that trade unions facilitate effective collective bargaining and negotiate higher wages on behalf of workers which may contribute towards a higher average cost of labour.

The cost of labour in South Africa, in particular, unskilled and semi-skilled labour was perceived by industry respondents to be a dominant inhibiting factor to production volume growth. Government respondents acknowledged that unskilled and semi-skilled labour costs in South Africa is currently higher than many emerging market economies and could therefore pose a threat to the overall domestic manufacturing sector. External respondents concurred with the views of industry respondents and agreed that the relatively high cost of labour in South Africa may be an inhibitor to growth in vehicle production.

Government, industry and external respondents agreed that OEMs outside South Africa, in particular emerging market OEMs, are a significant threat and perhaps a dominant inhibitor to overall production volume growth. Specific vehicle models produced and exported by OEMs in South Africa are in many cases also produced by emerging market OEMs. Therefore there is strong competition between local and emerging market OEMs with regards to production volume allocations.

The existing local automotive component supplier base was perceived as an enabler to growth in vehicle production by government respondents. Industry and external respondents shared a more conservative view of the existing component supplier base but agreed that automotive component suppliers are critical to the sustainability of the industry and enabled growth in vehicle production. Overall there was consensus among respondents that the existing local automotive component supplier base is capable and has in the past demonstrated the ability to reliably supply components (i.e. either low-tech or specialised components) which are of similar quality to components supplied by foreign component suppliers.

Table 6: Identification and classification of other (new) dominant inhibiting and enabling factors

Dominant Factors	Industry	Government	External
The influence of trade unions in South Africa	Inhibitor	Enabler	Inhibitor
Cost of labour in South Africa	Inhibitor	Inhibitor	Inhibitor
Competing emerging market OEMs	Inhibitor	Inhibitor	Inhibitor
The existing local automotive component supplier base	Enabler	Enabler	Enabler

In conclusion, all inhibiting and enabling factors identified in literature apart from existing infrastructure in South Africa were verified as dominant factors by industry, government and external respondents. Furthermore, other new dominant factors were identified by respondents. These include the influence of trade unions, cost of labour, competing emerging market OEMs and the existing automotive component supplier base in South Africa.

4.3 Results pertaining to measures which mitigate the impact of inhibiting factors on growth in vehicle production

There was consensus by industry, government and external respondents with regards to the review of import duties and investment in technical and social infrastructure being measures which may mitigate the impact of inhibiting factors on growth in vehicle production within the South African automotive manufacturing industry. However, all three groups of respondents also agreed

that investment by local OEMs in hybrid vehicle production infrastructure would not significantly mitigate the impact of the above identified inhibiting factors.

Respondents indentified other (additional) potential mitigating measures which included:

- Increase the local automotive component content in domestically produced vehicles
- Reinforce and accelerate plans to improve the accessibility and level of basic and tertiary education in South Africa in order to improve the availability of skilled labour
- Review options to mitigate the impact of labour costs
- Review the effectiveness of development plans aimed at improving the current state of the socioeconomic environment

In summary, respondents confirmed that mitigating measures identified in literature, in particular; investment in technical and social infrastructure and a review of import duties would to an extent negate the impact of inhibiting factors identified in literature and in the research process. Furthermore, respondents recommended additional measures that may mitigate the impact of the above identified inhibiting factors on growth in vehicle production.

4.4 Results pertaining to unintended consequences that may occur due to the impact of inhibiting and enabling factors on growth in vehicle production

All respondents agreed that the unintended consequences identified in literature were valid and that it was plausible that these consequences may occur due to the impact of the abovementioned inhibiting and enabling factors. Respondents attempted to classify the strength of the causal relationship(s) between inhibiting and enabling factors, and unintended consequences. Respondents also identified three additional unintended consequences which have been listed in Table 7 below.

Table 7: Strength of causal relationship(s) between unintended consequences, inhibiting and enabling factors

Unintended Consequences		Industry	Government	External
Identified in literature	Impact on the socioeconomic environment	High	Medium	Medium
	Impact on the consumption of natural resources, environment and ecosystem	Medium	High	High
	Impact on the standard of living or quality of life in South Africa	High	Medium	Medium
Identified by respondents	Job creation in related and unrelated industries	High	Medium	High
	Influx of foreign skilled labour	High	Medium	High
	Further changes to government policy (i.e. APDP)	High	High	Medium

In conclusion, majority of the unintended consequences identified in both literature and by respondents were perceived to have strong causal relationships with inhibiting and enabling factors. From the above, the unintended consequences which had the weakest causal relationships with

inhibiting and enabling factors were the impact on the socioeconomic environment, and the standard of living or quality of life in South Africa.

4.5 Summary of the results

There was consensus among respondents with regards to the classification of dominant enabling and inhibiting factors identified in literature. Respondents largely agreed with the findings in literature that pertained to the proposed dominant inhibiting and enabling factors. Respondents did however perceive South Africa's existing infrastructure to be a non-dominant inhibiting factor which was in contrast to the literature review. The research process also led to the identification of four additional dominant inhibiting and enabling factors. These included the influence of trade unions, cost of labour, competing emerging market OEMs and the existing local automotive component supplier base.

With regards to mitigating measures, respondents verified measures identified in literature and proposed four additional measures which were perceived to be high priority for government and industry stakeholders to implement in the mid to long-term. The research process also yielded further insight with regards to unintended consequences that may occur due to the impact of inhibiting and enabling factors on growth in vehicle production. Apart from verifying the findings in literature, respondents identified other new unintended consequences which were also classified in terms of the perceived strength of their causal relationships with inhibiting and enabling factors.

An enhanced FCM and adjacency matrix was constructed with the insight and perspective gained during the research process. The enhanced FCM included the newly identified dominant factors, weighted causal relationships between factors, intermediate factors, outputs and unintended consequences. Furthermore, factors which were considered insignificant or weak in terms of the strength of their causal relationships with other factors were omitted from the enhanced FCM.

4.5.1 *The enhanced FCM and adjacency matrix*

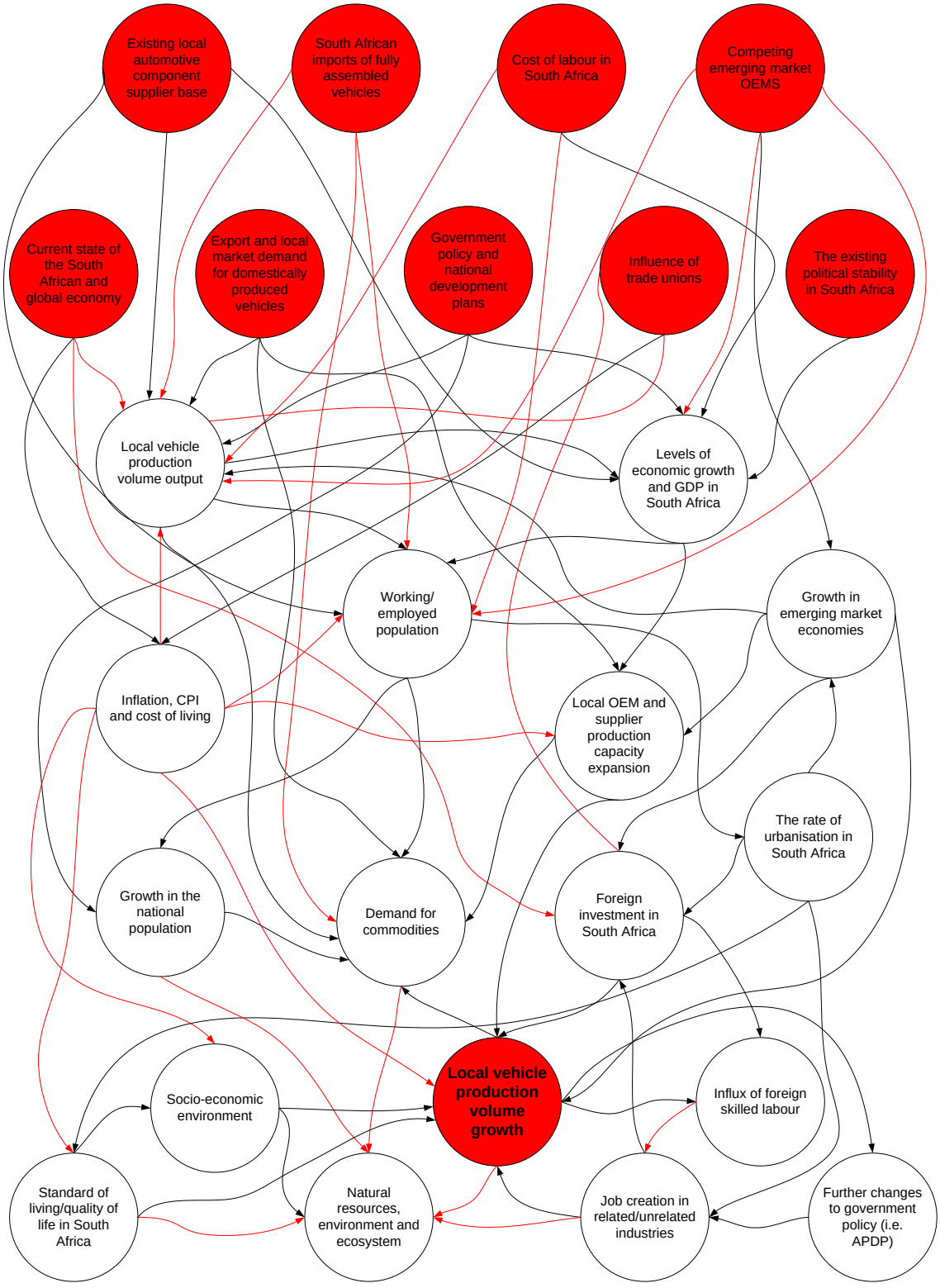


Figure 12: The simplified enhanced FCM

Key: + denotes a positive causal relationship; - denotes a negative causal relationship; high weighting: +++ or - - - medium weighting: ++ or - - low weighting: + or -	Local vehicle production volume output	Levels of economic growth and GDP in South Africa	Working/Employed population	Inflation, CPI and cost of living	Sustainable development	Demand for commodities (i.e. steel and oil)	Demand for infrastructure development	Local OEM and automotive component supplier production capacity expansion	Growth in the national population	The rate of urbanisation in South Africa	Foreign investment in South Africa	Availability of skilled labour in South Africa	South Africa's existing infrastructure	Current state of the South African socio-economic environment	Influx of foreign skilled labour	Job creation in related/unrelated industries	Growth in emerging market economies	New production methods, automation and technology	Local vehicle production volume growth	Socio-economic environment	Natural resources, environment and ecosystem	Standard of living/quality of life in South Africa	Further changes to government policy (i.e. APDP)
Current state of the South African and global economy	- - -	- - -	- - -	+++	-	- - -	+++	- -	-	- - -	- - -	- -	- - -	- - -									
South African imports of fully assembled vehicles	- - -	- -	- -		+	- - -	- - -	- - -			- -		- -				++						
Influence of trade unions in South Africa	- - -	- - -	++	+++		- - -		- - -			- - -							- - -					
Cost of labour in South Africa	- - -	- - -	- - -	+++		- -	- -	- - -		- -	- - -			- -				++					
Competing emerging market OEMs	- - -	- -	- -			++	- -	- - -			- - -	++	++				+++	+++					
Export and local market demand for domestically produced vehicles	+++	+++	+++		-	+++	++	+++			+++	- -	++					++					
Government policy and national development plans	+++	+++	+++	- -	+	+++	+++	+++	+	+++	+++	+++	+++	+++			++						
The existing political stability in South Africa	+++	+++	+++	- - -	+	+++	++	+++	+	+++	+++		+++	+++									
The existing local automotive component supplier base	+++	+	+++			+++	++																
Local vehicle production volume output		+++	+++			+++	++								++	+++			+++	++	- - -	++	- - -
Levels of economic growth and GDP in South Africa	+++		+++	+++	+++	+++	+++	+++	+	+++	++					- - -			++	++	- -	++	+
Working/Employed population							++	++		+++	++				++				+++	+++	- - -	+++	
Inflation, CPI and cost of living	- - -	- - -	- - -			- -	- - -	- - -	- -	- - -									- - -	- - -	+++	- - -	+
Sustainable development		+		-		-	+		+		+					+			+	+	+	+	
Demand for commodities (i.e. steel and oil)	+++	+++			- - -		++			+++							+++		+++	++	- - -	++	
Demand for infrastructure development	++	+++	+++		++	+++		++		+++	+++					+++	++		++	+++	- - -	+++	
Local OEM and automotive component supplier production capacity expansion	+++	++			+	+++	++				+++				- - -				+++	++	- - -		+++
Growth in the national population		+++	+++		- -	+++	+++			+++	+++										- - -		
The rate of urbanisation in South Africa	+++		+++			+++	+++		++		+++				+	+++	+				- - -		
Foreign investment in South Africa	+++	+++	+++			+++		+++	+	++					+++	+++			+++	+++	- - -	+++	- - -
Availability of skilled labour in South Africa	- -	- - -	- - -	+++	-			-			- - -				+++	- - -							
South Africa's existing infrastructure	- -	- - -	- -	+++	- - -	+++	+++	- -	- -	- - -	- - -				+	- - -							
Current state of the South African socio-economic environment	- - -	- -	- - -	+++	- - -	- - -	+++	- - -		- - -	- - -	- - -	++		+++								
Influx of foreign skilled labour																- - -			++				
Job creation in related/unrelated industries															+++					+++	- - -	+++	
Growth in emerging market economies	+++	+++	+++			+++		+++			+++				++	+++			+++	++	- - -		+++
New production methods, automation and technology	++	+	- -	-	+++	- -	+	++								+							
Local vehicle production volume growth	+++	+++	+++		+++	+++	+++	+++		+++	+++				+++	+++				+++	- - -	+++	- - -
Socio-economic environment																							
Natural resources, environment and ecosystem																			+++			+++	
Standard of living/quality of life in South Africa																							
Further changes to government policy (i.e. APDP)																+++			+++				

Figure 13: The enhanced adjacency matrix

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

The enhanced FCM will be used to model the impact of dominant inhibiting and enabling factors on growth in vehicle production within the South African automotive manufacturing industry. The impact of the factors identified in literature and in the research process will be simulated through scenarios using the enhanced FCM.

Several plausible scenarios will be tested to understand the impact of the identified factors on growth in vehicle production and due to the complex nature of the causal relationships between factors and outputs; the unintended consequences will also be modelled in each scenario. This is perhaps one of the main benefits of fuzzy cognitive mapping since the enhanced FCM may provide comprehensive insight to decision makers as each scenario will highlight unintended consequences that may occur as a result of increasing dominant enabling factors, or in real-world terms, promoting various programmes and policies to drive growth in the industry. It is essential that decision makers are aware of the comprehensive impact of their plans and strategies since unintended consequences may be favourable or unfavourable to the South African public and economy.

The scenarios to be tested will involve switching-on or off inhibiting and enabling factors in various combinations which represent plausible scenarios. Furthermore each scenario will be described in detail and justified in terms of its validity. The results from each scenario will then be analysed to understand the effect of various combinations of inhibiting and enabling factors on growth in vehicle production.

The key output in all of the scenarios to be tested will be "Local vehicle production volume growth", or as referred to in this study, "Growth in vehicle production".

5.2 Demographic profile of respondents

The demographic profile of respondents has been detailed in the research methodology chapter. Note that the size of the sample in terms of the number of respondents proved to be sufficient since there was adequate representation from KEY stakeholders within the South African automotive industry (i.e. government, local OEMs, external respondents and industry associations). Moreover, the information gathered from literature guided the construction of the initial FCM and provided significant insight when the research propositions were being addressed.

5.3 Discussion pertaining to dominant inhibiting and enabling factors for growth in vehicle production

During the research process, respondents validated the dominant inhibiting and enabling factors identified in literature and proposed new dominant factors which were subsequently incorporated in the enhanced FCM. Respondents assisted further in weighting the causal relationships between nodes in the enhanced FCM. To study the impact of the dominant inhibiting and enabling factors on growth in vehicle production, the enhanced FCM will be used to simulate plausible scenarios which will see various combinations of the inhibiting and enabling factors being switched-on or off.

Note that the results obtained from each scenario are indicative and not calibrated since a semi-quantitative research methodology has been used to determine the weighted impact of inhibiting and enabling factors in specific plausible scenarios.

Some of the inhibiting and enabling factors or nodes will not be switched-off since the resulting scenario may not be plausible. These factors include:

- South African imports of fully assembled vehicles
- Export and local demand for domestically produced vehicles
- Competing emerging market OEMs

It would not be plausible to assume that imports of fully assembled vehicles be discontinued since South Africa may be in breach of existing international trade agreements with other exporting countries. In addition, government may forfeit significant revenue in terms of excise, duties and taxes payable by OEMs if vehicle imports are discontinued. No imported vehicles would mean that South African consumers may be restricted with regards to variety of vehicle models since only specific locally produced vehicles would be available. This may lead to a decline in overall vehicle sales and loss of revenue to local OEMs. Note that local OEMs and international OEMs generate revenue from service parts and accessories for locally produced and imported vehicles. No imports of vehicles will result in lower demand for imported service parts.

It would be reasonable to assume that there would be a finite demand for vehicles in the near to mid-term. Although there may be alternatives to private transport (i.e. public transport), it is plausible that the passenger vehicles would remain a popular medium of transport for South Africans while public transport infrastructure is upgraded in the long-term. Furthermore, the local and global automotive industry has forecasted a finite demand for vehicles in both export and local markets.

Emerging market OEMs can be expected to operate for the foreseeable future since they have been extremely competitive from a pricing perspective and have become a significant threat to established OEMs in Europe and North America over the past decade. Emerging market OEMs are a significant contributor to country and regional GDP. Therefore, it may not be plausible to assume that emerging market OEMs will cease to operate in the near to mid-term.

5.3.1 *Scenario A: The current state of the local automotive industry*

The following scenario attempts to model the current state of the South African automotive manufacturing industry whereby all inhibiting and enabling factors are switched-on in the enhanced FCM. It may be reasonable to assume that all factors identified in literature and in the research process are currently active and feature prominently in the current economic context. The results obtained from Scenario A are shown in Figure 14 below:

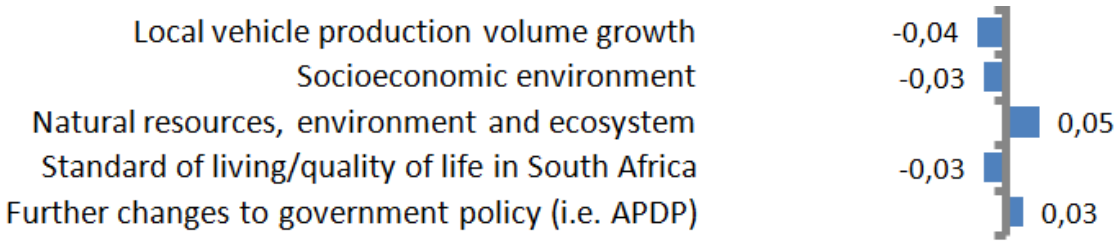


Figure 14: Graphical representation of results: The current state of the local automotive industry

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix I).

The results from the above scenario indicate that the current context in which local OEMs operate is marginally unfavourable towards growth in vehicle production. Although growth in vehicle production is adversely impacted, production volume output, levels of growth and foreign investment may be in a more precarious position in the current context. Furthermore, inflation, CPI and cost of living are also of concern.

The scenario highlights that under current conditions; economic growth, employment and foreign investment are more constrained than growth in vehicle production. In particular, a poor result for foreign investment raises concerns with regards to investor confidence in South Africa. A high level of inflation, CPI and cost of living is consistent with poor growth in vehicle production since under conditions of high inflation, disposable income may be reduced and lead to a decline in demand for non-essential goods and services.

Consumers may opt for more affordable pre-owned vehicles instead of new vehicles if their disposable income is constrained.

With regards to the unintended consequences that may occur due to the impact of the inhibiting and enabling factors; poor results were obtained for the socio-economic environment and standard of living in South Africa. This indicated that in the current context with poor growth in vehicle production, both the socioeconomic environment and standard of living are negatively impacted. Furthermore, job creation in related and unrelated industries may be adversely impacted by a poor outlook for growth in vehicle production.

In contrast, natural resources, the environment and ecosystem had a more positive outlook since there may be lower levels of emissions and consumption of natural resources (e.g. steel and water) if fewer vehicles are produced. Under current conditions there is no significant need to supplement the local automotive manufacturing industry by an influx of foreign skilled labour.

With the overall impact of the dominant enabling and inhibiting factors yielding a poor outlook for growth in vehicle production; the above scenario emphasised the need for further changes to government policy, especially with regards to the APDP. A further change to the APDP may be an unintended consequence as a result of the overall impact of enabling and inhibiting factors on growth in vehicle production.

The findings in this scenario are largely consistent with expectations since it was seen that the dominant inhibiting factors contributed to an overall negative outlook for growth in vehicle production within the South African automotive manufacturing industry.

5.3.2 *Scenario B: Poor domestic and global economic outlook with unfavourable domestic conditions for growth*

The following scenario attempts to model the state of the South African automotive manufacturing industry whereby a poor outlook for the local and global economy is simulated with unfavourable conditions for growth in the

industry. In order to simulate the above scenario, government policy and national development plans, existing political stability in South Africa and the existing local automotive component supplier base were the specific enabling factors that were switched-off. The current state of the South African and global economy, an inhibiting factor, was switched-on to allow for the scenario to simulate a poor domestic and global economic outlook. To simulate poor domestic conditions for growth, inhibiting factors which included the influence of trade unions and cost of labour were switched-on. The results obtained from Scenario B are shown in Figure 15 below:

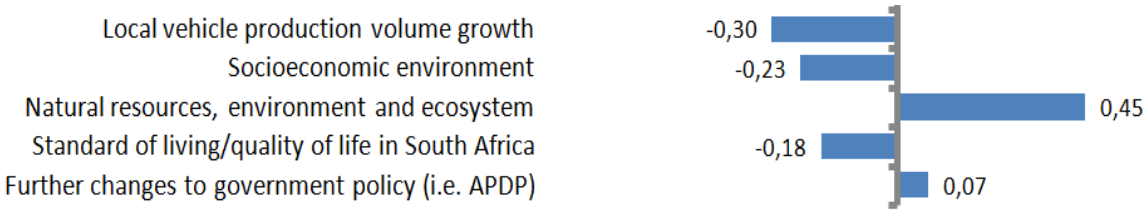


Figure 15: Graphical representation of results: Poor domestic and global economic outlook with unfavourable domestic conditions for growth

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix J).

The above scenario depicts a negative outlook for the South African economy and the local automotive manufacturing industry. High levels of inflation and an even poorer outlook for growth in vehicle production in comparison to the previous scenario highlight the severe impact of a poor domestic and global economic outlook in combination with unfavourable domestic conditions for growth.

Several nodes yielded significantly lower negative results in comparison to results obtained in Scenario A. In particular, local vehicle production volume output, economic growth and GDP, foreign investment, employment, rate of urbanisation, demand for commodities and infrastructure development and production capacity expansion were adversely affected in the above scenario.

The unintended consequences that resulted in the above scenario are a poor socioeconomic environment, low standard of living and reduced levels of natural

resource consumption and emissions. Job creation in related and unrelated industries may be even more adversely impacted by the poor outlook for growth in vehicle production. This scenario calls for more urgency in respect of prompting further changes to government policy, specifically with regards to the APDP in an effort to stimulate growth in vehicle production. It is also plausible that under conditions of low growth in vehicle production that foreign skilled labour may not be required.

The above scenario emphasises the negative impact that inhibiting factors have on growth in vehicle production. The impact of an absence of favourable government policy (i.e. APDP), national development plans and political stability may severely inhibit growth within the automotive industry from a production volume perspective and may adversely impact the economy, foreign investment and the socioeconomic environment.

5.3.3 *Scenario C: Poor domestic and global economic outlook with favourable domestic conditions for growth*

Scenario C attempts to model the state of the South African automotive manufacturing industry whereby a poor outlook for the local and global economy is simulated with favourable conditions for growth in the industry. To simulate a poor domestic and global economic outlook, the current state of the South African and global economy were nodes that were switched-on.

In order to simulate favourable conditions for growth, enabling factors which included government policy and national development plans, existing political stability in South Africa and the local automotive component supplier base were switched-on. Inhibiting factors which included the influence of trade unions and cost of labour in South Africa were switched-off. The results obtained from the above scenario are shown in Figure 16 below:



Figure 16: Graphical representation of results: Poor domestic and global economic outlook with favourable domestic conditions for growth

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix K).

In contrast to the results obtained in Scenarios A and B, Scenario C yielded a positive outlook for growth in vehicle production. Furthermore, local vehicle production volume output, economic growth and GDP, employment, demand for commodities and foreign investment had a significantly improved outlook under conditions simulated in the above scenario.

This scenario also emphasises that the existing local automotive component supplier base is a significant enabler to growth in vehicle production. Cheaper local components and cash rebates from government assist local OEMs to reduce production costs. If vehicle production costs decrease, then the export market may be attracted to vehicles produced in South Africa which are competitively priced. Furthermore, international OEMs under lower production cost conditions, may allocate more global production volume to local OEMs in South Africa instead of OEMs in other markets.

The unintended consequence that results in the above scenario is an improved socioeconomic environment and a higher standard of living. Perhaps a significant finding is that there may be higher levels of natural resource consumption and emissions due to an increase in production volumes. More natural resources may be consumed and higher volumes of waste and emissions are generated when a larger volume of vehicles are produced.

Note that the above scenario does not call for further changes to government policy in terms of changes to the APDP to stimulate growth in vehicle production. A more positive outlook on growth in vehicle production may be

accompanied by an influx of foreign skilled labour. However, as a positive to the South African economy, jobs may be created in related and unrelated industries.

5.3.4 *Scenario D: Maintain the industry status quo with an absence of favourable government policy*

Scenario D attempts to model the current state of the South African automotive manufacturing industry whereby the current context in which the industry operates is maintained, but favourable government policy is non-existent. To simulate the impact on the industry due to an absence of favourable government policy as an enabling factor, government policy and national development plans were switched-off. All other inhibiting and enabling factors were switched-on.

The overall result of Scenario D was similar to the results obtained in Scenarios A and B. The lack of favourable government policy, in particular, the absence of the APDP resulted in a poor outlook for growth in vehicle production. Even with all enabling factors being activated, a negative value was still obtained for growth in vehicle production which suggests that there would be no growth in local vehicle production volume if the APDP was non-existent.

The results from the above scenario highlight the significant weighting and impact of favourable government policy, in particular, the APDP as an enabler to growth in vehicle production. This result is consistent with literature and the majority of views presented by respondents that government policy is one of the most dominant enabling factors for growth in vehicle production. The Vehicle Assembly Allowance (VAA) under the APDP allows local OEMs to receive rebates in the form of duty-free credits which are calculated at 20 percent of the respective local OEM’s ex-factory vehicle prices (NAACAM, 2014).

With regards to unintended consequences, Scenario D yielded results similar to Scenarios A and B. The impact of inhibiting and enabling factors together with the absence of favourable government policy resulted in a poor socioeconomic environment, low standard of living and reduced levels of natural resource

consumption and emissions. However, further changes to government policy, in particular the APDP, may be required to stimulate growth in vehicle production. A negative outlook on growth in vehicle production may inhibit an influx of foreign skilled labour, but to the detriment of the South African economy, job creation in related and unrelated industries may be constrained.

In the absence of favourable government policy; local vehicle production volume output, economic growth, foreign investment, employment, rate of urbanisation, demand for commodities, infrastructure development and production capacity expansion are all adversely impacted. The results shown in Figure 17 below highlights the extent to which the abovementioned nodes are affected by the lack of favourable government policy.

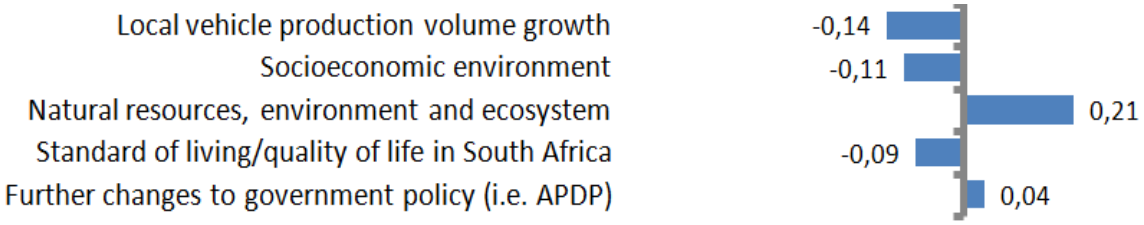


Figure 17: Graphical representation of results: The industry status quo with an absence of favourable government policy

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix L).

Government assistance in the form of policies and programmes are important to ensure the longevity of an automotive industry since the global automotive industry is extremely competitive and OEMs do not all compete on an even playing-field in terms of production costs, economies of scale and supply chain efficiencies (Australian Government, 2014).

To understand the significance of favourable government policy in terms of assistance to OEMs, consider the following example pertaining to the Australian automotive manufacturing industry. The Australian automotive manufacturing industry has been under significant distress and now faces closure since all three OEMs in the industry have decided to cease operations by the end of 2017 and cited the high cost of manufacturing among the main reasons for their

impending exit (Australian Government, 2015). It may be argued whether more could have been done to compensate Australian automotive OEMs in terms of production costs through government subsidies, incentives and assistance programmes.

5.3.5 *Scenario E: Maintain industry status quo but no political stability*

Scenario E attempts to model the current state of the South African automotive manufacturing industry whereby the existing context in which the industry operates is maintained, except for the absence of political stability. To allow for the scenario to simulate the impact due to a lack of political stability, the enabling factor, political stability in South Africa was switched-off. All other inhibiting and enabling factors were switched-on. The results obtained from Scenario E are shown in Figure 18 below:

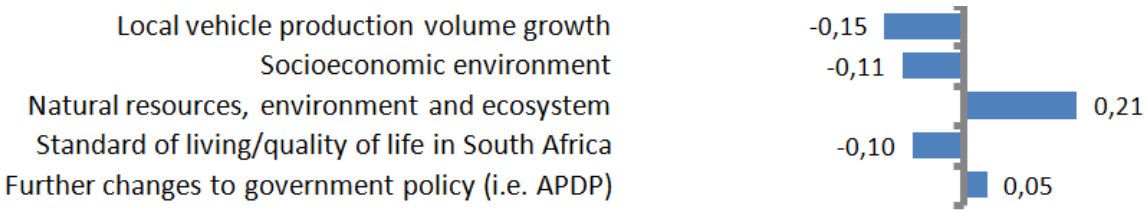


Figure 18: Graphical representation of results: The industry status quo but no political stability

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix M).

The overall result from the above scenario was very similar to the result obtained in Scenario D. The results indicate that in the absence of political stability in South Africa; growth in vehicle production will be adversely affected. Furthermore, it is suggested that even with the impact of the remaining enabling factors, there would be no growth in vehicle production volume if there was an absence of political stability.

A key finding from the results was that the weighted impact of political stability is equivalent to the impact of favourable government policy on growth in vehicle production. This is due to the high similarity in results between Scenario D and

E. In the absence of political stability; local vehicle production volume output, economic growth and GDP, foreign investment, employment, rate of urbanisation, demand for commodities, infrastructure development and production capacity expansion are all adversely affected.

The impact of inhibiting and enabling factors in combination with an absence of political stability resulted in a poor socioeconomic environment, low standard of living and reduced levels of natural resource consumption and emissions. Further changes to government policy, in particular the APDP may be required to stimulate growth in vehicle production. As per the preceding scenario, a negative outlook on growth in vehicle production may inhibit an influx of foreign skilled labour. However, this is to the detriment of the South African economy since job creation in related and unrelated industries may be constrained.

The results highlight the significant weighted impact of political stability as an enabler to growth in vehicle production. This is aligned to findings in literature and views presented by respondents that political stability is crucial and a dominant enabling factor to growth in vehicle production within the South African automotive manufacturing industry.

5.3.6 *Scenario F: Maintain the industry status quo with low cost of labour*

Scenario F attempts to model the current state of the South African automotive manufacturing industry whereby the existing context in which the industry operates is maintained, except for the perceived high cost of labour. To allow for the scenario to simulate the impact of high labour costs, the cost of labour in South Africa was switched-off. All other inhibiting and enabling factors were switched-on. The results obtained from the above scenario are shown in Figure 19 below:

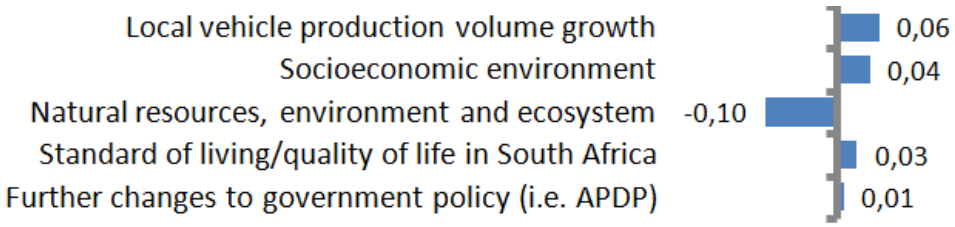


Figure 19: Graphical representation of results: The industry status quo with low cost of labour

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix N).

The results from the above scenario indicate that if the cost of labour is low and competitive internationally, there would be a positive outlook for growth in vehicle production. Furthermore, the results suggest that even with the impact of the remaining inhibiting factors, there would be still be a potential for growth in local vehicle production volume.

In the absence of high labour costs; local vehicle production volume output, economic growth, employment, rate of urbanisation, demand for commodities and infrastructure development are increased. However, the scenario does highlight that the impact of low competitive labour costs alone may not induce favourable conditions to support local OEM and automotive component supplier production capacity expansion and foreign investment in South Africa.

With regards to unintended consequences that occur in the above scenario, the impact of inhibiting and enabling factors in combination with low labour costs resulted in a marginally improved socioeconomic environment and standard of living but at the expense of higher levels of natural resource consumption and emissions. Furthermore, results suggest that no significant changes to government policy are required to stimulate growth in vehicle production. In contrast to the preceding scenario, a positive outlook on growth in vehicle production may induce an influx of foreign skilled labour. However, to the benefit of the South African economy, there may be further job creation in related and unrelated industries.

The positive outlook for growth in vehicle production highlights the significant impact of high labour costs as an inhibiting factor. This outcome is consistent with literature and insights from respondents that the cost of labour is a dominant inhibiting factor to growth in vehicle production.

5.3.7 *Scenario G: Maintain the industry status quo with a lower influence of trade unions*

The following scenario attempts to model the current state of the South African automotive manufacturing industry whereby the existing context in which the industry operates is maintained except for the perceived high level of influence exerted on the industry by trade unions. To simulate the impact of trade union influence on the automotive industry, influence of trade unions in South Africa as an inhibiting factor was switched-off. All other inhibiting and enabling factors were switched-on. The results obtained from the above scenario are shown in Figure 20 below:

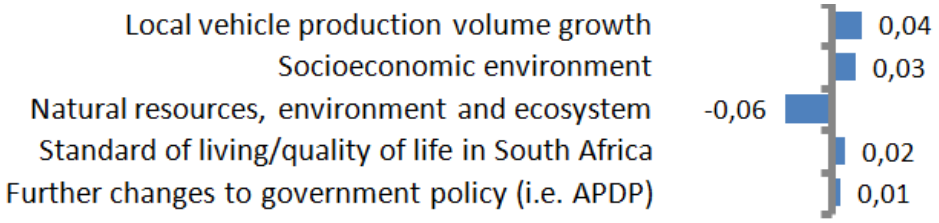


Figure 20: Graphical representation of results: The industry status quo with a lower influence of trade unions

Note that the full graphical representation of results which incorporates the input and intermediate nodes has been included in the appendices (Appendix O).

The overall results were similar to Scenario F. Results from the above scenario indicate that if the level of influence exerted by trade unions is low, there would be a positive outlook for growth in vehicle production. Furthermore, the results suggest that even with the impact of the remaining inhibiting factors, there may still be potential growth in vehicle production.

If one considers the negative impact on production volume output due to the recent mass protests by trade unions; disruptions cannibalised available working hours which led to an increase in cost of labour since OEMs would have had to incur overtime in an attempt to recover lost production volume. This in turn would have increased the total cost per vehicle produced which may be passed onto the consumer by increasing retail prices of new vehicles. Higher vehicle prices may constrain consumer demand for new vehicles which may inhibit growth in vehicle production. Furthermore, attempts to optimise production processes by means of mechanisation to save on headcount and labour costs may be opposed by trade unions since worker rights and employment protection are commonly advocated by trade unions.

A key observation from the results was that the weighted impact of the influence of trade unions was equivalent to the impact of high labour costs on growth in vehicle production. This is due to the high similarity in results obtained for both Scenarios F and G respectively. In essence, results from the above and preceding scenario suggests that the influence of trade unions and cost of labour in South Africa may be considered as dominant inhibiting factors due to their respective levels of impact on growth in vehicle production within the South African automotive manufacturing industry.

5.3.8 *Conclusion with regards to dominant inhibiting and enabling factors for growth in vehicle production*

From findings in literature, insights from respondents and results obtained from the scenarios simulated above, the current state of the South African and global economy and imports of fully assembled vehicles and automotive components have been identified as dominant factors which inhibit growth in vehicle production within the South African automotive manufacturing industry. Furthermore, the influence of trade unions and cost of labour in South Africa, and the existence of competing emerging market OEMs were also identified as dominant inhibiting factors for growth in vehicle production.

With regards to dominant factors which enable growth in vehicle production within the South African automotive manufacturing industry; as per findings in

literature, insights from respondents and results obtained from the scenarios simulated above; local and export market demand for domestically produced vehicles, government policy and national development plans and the existing political stability in South Africa were found to be dominant enabling factors. During the research process, the existing local automotive component supplier base in South Africa was also identified as a dominant enabling factor to growth in vehicle production within the South African automotive manufacturing industry.

5.4 Discussion pertaining to measures which mitigate the impact of inhibiting factors on growth in vehicle production

During the research process, respondents reviewed measures to mitigate the impact of inhibiting factors on growth in vehicle production within the South African automotive manufacturing industry. Respondents reviewed mitigating measures identified in literature and proposed additional measures that may mitigate the impact of the inhibiting factors identified in literature and in the research process.

Mitigating measures identified in literature and in the research process will be discussed in more detail by analysing the mechanics of how each proposed mitigating measure may reduce or offset the impact of a specific inhibiting factor or combinations of inhibiting factors. To follow are the detailed analyses for each mitigating measure identified in literature and by respondents in the research process.

5.4.1 *Review of import duties*

High import duties may mitigate the impact of imported vehicles and components on growth in vehicle production. If duties are high then imported vehicles may become unaffordable to consumers. Consumers may then be compelled to buy comparatively cheaper locally produced vehicles.

A challenge may be the loss of new vehicle revenues which may ultimately be incurred by OEMs and government (i.e. taxes) since consumers may opt for

more affordable pre-owned imported vehicles. Furthermore, consumers may prefer pre-owned imported vehicles in order to gain access to a wider variety of vehicle models which may suit their needs.

If import duties are increased then the volume of imported vehicles may reduce and local vehicle production may increase. However, taking the above into consideration and the overall impact on the industry and local vehicle production, a blanket increase on import duties on all models may not a feasible approach.

In contrast to the above, assuming that consumers will still buy higher priced imported vehicles, *an increase in import duties may compel local OEMs to produce more vehicles in an effort to claim rebates on duties even though there may be no direct demand from consumers*. As mentioned previously, the Vehicle Assembly Allowance (VAA) under the APDP allows local OEMs to receive rebates in the form of duty-free credits which are calculated at 20 percent of the respective local OEM's ex-factory vehicle prices (NAACAM, 2014).

The South African government has decided to freeze import duties at 2012 rates until 2020 and imported light motor vehicles and components will attract an import duty of 25 percent and 20 percent respectively (NAACAM, 2014). Furthermore, a preferential agreement with the EU resulted in an import duty of 18 percent for fully assembled vehicles (NAACAM, 2014). Vehicle import duties in South Africa are comparatively lower and more competitive than many other vehicle producing countries. By freezing duties and not permitting an increase to at least until 2020, the South African government appears to have not adopted a protectionist stance against imports. This may increase the impact of imported vehicles as an inhibitor to growth in vehicle production.

5.4.2 *Investment of technical and social infrastructure*

Although respondents agreed that technical infrastructure may not necessarily be a dominant inhibiting factor to growth in vehicle production; upgrading road, rail, port and energy infrastructure may still reduce production costs incurred by

local OEMs and support an overall improvement in the performance of the economy which may stimulate demand for new vehicles and growth in vehicle production. As per findings in literature, technical infrastructure upgrades may help address the challenges faced by the South African economy which has been identified in this research study as a dominant inhibiting factor to growth in vehicle production.

As highlighted in literature, improving social infrastructure by upgrading public healthcare, education and welfare infrastructure may lead to an improvement in availability of labour. A healthy, educated and employed consumer base would have a greater propensity to stimulate growth in the economy and purchase new vehicles produced by local OEMs.

5.4.3 *Increase the local component content in domestically produced vehicles*

As per literature, increasing the local component content in domestically produced vehicles increases the amount of rebates payable to local OEMs through the Production Incentive (PI) system. These rebates could assist in compensating for a portion of the cost of labour which has been identified as a dominant inhibiting factor to growth in vehicle production. Furthermore, by increasing demand from local automotive component suppliers, higher economies of scale may be achieved thereby reducing cost of local components.

It may then be possible for local and imported components to be on par in terms of costs which therefore incentivises local OEMs to source components locally rather than resorting to imported components which do not derive any benefit from the APDP. Apart from the benefit to local OEMs in terms of the PI system, the multiplier effect of increasing the output of automotive component suppliers may result in growth in other industries of high strategic importance (e.g. mining, petroleum, technology) which may further stimulate growth within the South African economy.

5.4.4 *Reinforce and accelerate plans to improve the accessibility and level of basic and tertiary education in South Africa in order to improve the availability of skilled labour*

Although respondents perceived the availability of skilled labour as a non-dominant inhibitor to growth in vehicle production, improving the accessibility and level of basic and tertiary education in the medium to long term may improve levels of productivity and enable robust growth in the economy since skilled workers may be more employable and able to work in a wider range of industries (e.g. services). Therefore the impact of a poor performing economy may be mitigated by increasing the population of skilled workers.

A higher rate of urbanisation and lower unemployment levels under these conditions may lead to an improvement in the performance of the economy and increase disposable income which may enable consumers to purchase new vehicles. Therefore, this may stimulate growth in vehicle production within the industry.

5.4.5 *Consider options to mitigate the impact of labour costs*

From the perspective of government as an industry stakeholder and decision maker, further incentives may need to be considered in the APDP to subsidise labour costs incurred by local OEMs. Apart from the review of remuneration, benefits and compensation levels which my induce resistance from trade unions, local OEMs may have other available options that could reduce labour costs. Respondents from industry identified the following measures that local OEMs should consider to mitigate the impact of high labour costs:

- Avoid overtime by optimising planning and production processes, and if necessary, increase production capacity
- Recruit the most suitable candidates for the job since OEMs may incur unwanted losses if a worker does not perform to expectations
- Reduce employee turnover since this may reduce indirect costs incurred in the recruitment and training of new employees
- Cross-train employees (i.e. multi-skilling)

- Training and development may inspire and give workers skills to perform more effectively and efficiently, thereby reducing the overall cost per vehicle produced

Process automation by enhanced mechanisation and restructuring to reduce headcount may be highly contested since trade unions may oppose these approaches to address labour costs. Note that due to the perceived high influence of trade unions, there may be a risk of industrial action which could result in severe disruptions to productivity.

5.4.6 *Review the effectiveness of development plans aimed at improving the current socioeconomic environment*

The National Development Plan 2030 and New Growth Path (NGP) may require further review if these programmes have not made a tangible improvement to social infrastructure. It has been highlighted in literature and by respondents that improving social infrastructure by upgrading public healthcare, education and welfare infrastructure may lead to an increase in the availability of labour and improvement in the standard of living.

Respondents asserted that a larger, more healthy and employed population may stimulate further growth in the economy and increase demand for new vehicles produced by local OEMs. National development plans to improve social infrastructure are therefore key to mitigate the impact associated with current state of the South African economy as a dominant inhibiting factor for growth in vehicle production.

5.4.7 *Create certainty with regards to the continuity of the APDP*

Respondents from industry emphasised that the APDP is a dominant enabler for growth in vehicle production and that the programme may be among the most favourable towards OEMs. To highlight the importance of ensuring continuity of the APDP, BMW SA injected R6bn in South Africa to start producing a new model sports utility vehicle shortly after government

announced the continuation of investment support to the industry even after the expiry of the APDP in 2020 (Furlonger, 2015).

Although the abovementioned events may seem unrelated, it may be plausible that local OEMs gain confidence and are more willing to invest in South African operations if the incentives under the APDP are guaranteed to continue for the foreseeable future. By investing in production facilities and supporting infrastructure, production capacity will increase thereby enabling local OEMs to supply more vehicles to the local market and potentially capture a larger portion of the export market. In summary, investment by OEMs in South Africa on the back of assurances that the APDP would continue may allow for an increase in overall growth in vehicle production.

5.4.8 *Conclusion with regards to measures which mitigate the impact of inhibiting factors on growth in vehicle production*

Results from the research process concurred with findings in literature with regards to measures that may mitigate the impact of dominant inhibiting factors on growth in vehicle production. These mitigating measures included investment in technical and social infrastructure and a review of import duties. Several other new mitigating measures were identified by respondents during the research process.

There are two measures that may address the negative impact associated with the current outlook on economic growth. These include a review of the effectiveness of existing development plans aimed at improving the current socioeconomic environment, and the acceleration of plans to improve the accessibility and level of basic and tertiary education in South Africa in order to improve the availability of skilled labour

An increase in local automotive component content in domestically produced vehicles and a review of options to reduce labour costs may assist local OEMs in mitigating the overall impact of labour costs which is a dominant inhibitor to growth in vehicle production. Furthermore, by creating more certainty with regards to the continuity of the APDP, OEMs may invest further in local

production infrastructure. This may improve production processes and increase manufacturing capacity to the extent that labour costs may be optimised.

5.5 Discussion pertaining to unintended consequences that may occur due to the impact of inhibiting and enabling factors on growth in vehicle production

During the research process respondents reviewed unintended consequences identified in literature which may occur due to the impact of inhibiting and enabling factors on growth in vehicle production. Respondents also proposed other potential unintended consequences during the research process.

The scenarios simulated and described in Proposition 1 demonstrate the detailed mechanics of how unintended consequences identified in literature and in the research process may occur due to the impact of various combinations of inhibiting and enabling factors.

5.5.1 *Conclusion with regards to unintended consequences that may occur due to the impact of inhibiting and enabling factors on growth in vehicle production*

In principle, under conditions of declining growth in vehicle production, where the overall impact of inhibiting factors outweigh the impact of enabling factors; the socioeconomic environment; the standard of living and quality of life in South Africa; job creation in related and unrelated industries; and the influx of foreign skilled labour are all adversely impacted. Changes to government policy, in particular the APDP are prompted under conditions of poor growth in vehicle production. Furthermore, when vehicle production volumes decline, natural resource consumption and emission levels reduce. Therefore under these conditions there is a positive impact on the natural environment and resource availability. The converse of the above is apparent when there is a positive outlook on growth in vehicle production and the impact of inhibiting factors do not outweigh the impact of enabling factors.

5.6 Conclusion

The current state of the South African and global economy, imports of fully assembled vehicles and imports of automotive components have been identified as dominant factors which inhibit growth in vehicle production within the South African automotive manufacturing industry. Furthermore, the influence of trade unions; the cost of labour in South Africa; and the existence of competing emerging market OEMs were also identified as dominant inhibiting factors for growth in vehicle production.

South Africa's existing infrastructure was not classified as a dominant inhibiting factor by respondents from industry and government and as a result, did not have a significant impact on growth in vehicle production. From the scenarios that were simulated; political stability, government policy, influence of trade unions and cost of labour were found to have similar levels of impact on growth in vehicle production.

In contrast, local and export market demand for domestically produced vehicles, government policy, national development plans and existing political stability in South Africa were confirmed as dominant enabling factors. Furthermore, the existing local automotive component supplier base in South Africa was also identified as a dominant enabling factor to growth in vehicle. However, the existing local automotive component supplier base was not weighted as high as political stability and favourable government policy in terms of impact on vehicle production volume growth.

Several measures to mitigate the impact of inhibiting factors were identified in literature and in the research process. To some extent the mitigating measures addressed the impact of labour costs and the state of the South African economy. By mitigating the impact of these two particular dominant inhibiting factors, there may be a more positive outlook on growth in vehicle production.

In terms of unintended consequences, the socioeconomic environment and standard of living are adversely affected when there is a negative outlook on growth in vehicle production. In contrast, the consumption of natural resources

and emission levels are reduced when vehicle production volumes are negatively impacted by the above identified inhibiting factors.

Further changes to government policy (i.e. APDP) are prompted when there is a negative outlook with regards to growth in vehicle production. The converse is also true when vehicle production volume growth is improved and no further changes to government policy are recommended. The results from the scenarios that were simulated highlight that an influx of foreign labour may be triggered when there is a negative outlook with regards to growth in vehicle production.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

This chapter will summarise the findings and conclusions derived from this research study in accordance with the research propositions posed in the literature review and within the context and purpose of this study outlined in the first chapter.

From the conclusions derived in this research study, guidance will be provided to government strategy planning departments, national policy making institutions, industry development finance institutions and local OEMs in terms of recommendations to stimulate growth in vehicle production within the South African automotive manufacturing industry.

Finally, suggestions will be made for further research following the conclusion of this research study. Suggestions for further research will be based on recommendations proposed by respondents and reflections on findings from this research study.

6.2 Conclusions of the study

There was consensus among respondents with regards to the outlook for the South African automotive manufacturing industry. Respondents from government and industry were optimistic about the local automotive industry even though several factors were found to inhibit growth in vehicle production. Respondents perceived existing conditions for local OEMs to be largely favourable due to the existence of the APDP programme which crucially incentivises local OEMs to produce vehicles in South Africa. Findings from the research process, literature and results obtained from various scenarios that were simulated accentuated the significance of the APDP programme in terms of its role to sustainably increase growth in vehicle production and ensure the longevity of the South African automotive manufacturing industry.

Several other factors were found to enable growth in vehicle production. These factors included the existing political stability in South Africa, national development plans, forecasted export and local demand for new vehicles and the existing local automotive component supplier base. There were minor differences between findings in literature and insights from respondents with regards to factors that may enable vehicle production volume growth. The only build on literature was the inclusion of the existing local automotive component supplier base as a dominant enabling factor for growth in vehicle production.

There were however differences between findings in literature and insights from respondents with regards to factors that which inhibit growth in vehicle production. In principle, findings from the research process concurred with literature in respect of South African imports of fully assembled vehicles and the current state of the local and global economy being dominant inhibiting factors for growth in vehicle production. However, the cost of labour, presence of emerging market OEMs and the influence of trade unions in South Africa were highlighted as other potential dominant inhibiting factors. Literature did to an extent allude to these factors but respondents from industry and government emphasised the prevalence and adverse effect of these factors on growth in vehicle production.

Measures to mitigate the impact of inhibiting factors on growth will be discussed in greater detail in the recommendations section of this chapter. In summary, there were several differences between findings in literaure and the research process since industry and government respondents were able to draw on industry-specific knowledge and past experience to recommend several additional mitigating measures which were not highlighted in literature. In addition to a review of import duties and further investment in technical and social infrastructure, additional mitigating measures included the improvement in the accessibility and level of basic and tertiary eduction to improve the availability of skilled labour; increase in local component content in domestically produced vehicles; a review of options to optimise labour costs; and efforts to create more certainty with regards to the continuity of the APDP beyond 2020.

The research study revealed several unintended consequences that may occur due to the impact of inhibiting and enabling factors on growth in vehicle production. Further to the unintended consequences identified in literature which included the impact on the socioeconomic environment, standard of living and quality of life in South Africa; findings from the research process yielded three additional unintended consequences. These include the influx of foreign labour, job creation in related and unrelated industries and further changes to government policy (i.e. APDP).

When the cumulative impact of the inhibiting and enabling factors resulted in a negative outlook with regards to growth in vehicle production; the socioeconomic environment, job creation in related and unrelated industries and standard of living were all adversely affected, and further changes to government policy (i.e. APDP) was prompted. Conversely, when the outlook for growth in vehicle production is positive, there was an improvement in the socioeconomic environment, standard of living and an increase in job creation in related and unrelated industries. Moreover, under these favourable conditions, no further changes to government policy were recommended.

Similar to the inverse relationship between the outlook on growth in vehicle production and further changes to government policy; the consumption of natural resources and emission levels are reduced when the overall cumulative impact of the inhibiting and enabling factors results in a negative outlook on growth in vehicle production. These outcomes are particularly relevant to policy makers and those involved in the development of environmental regulations since higher vehicle production volumes do have an adverse effect on natural resource availability and level of emissions.

6.3 Recommendations

The general theme in respect of recommendations to stakeholders is to adopt the mitigating measures identified in this research study in order to limit and perhaps reduce the adverse impact of inhibiting factors on growth in vehicle production within the South African automotive manufacturing industry. Furthermore, recommendations will be provided in respect of enhancements to the identified enabling factors to facilitate a higher output for vehicle production and growth within the industry.

Government may need to review duties on vehicles that are imported into South Africa by OEMs. A protectionist stance adopted by government may result in an increase in import duties which may raise retail prices of imported vehicles. This may compel consumers to purchase locally produced vehicles and increase local vehicle production. As alluded to in the preceding chapter, implementing higher import duties may not have the desired effect since consumers may alternatively purchase more affordable, pre-owned vehicles which may either be locally produced or imported.

Moreover, South Africa is obliged to honour international trade agreements which involve imports of vehicles from various countries. Government would need to consider the abovementioned unintended consequences of adopting a protectionist stance but may have several options available by selectively increasing import duties on specific vehicle segments and models.

With regards to infrastructure, government has a lead role to play in ensuring that technical and social infrastructure is upgraded to support economic growth in South Africa. The existing New Growth Path and National Development Plan 2030 does to an extent address infrastructure concerns, however, more specific development plans, especially with regards to power generation, fuel and water supply requires more structure and clarity in terms of timing with regards to implementation and completion. This may give the public and investors (e.g. OEMs) more confidence that infrastructure will not constrain growth in the economy and that businesses will have the necessary infrastructure available to operate in the long term.

As discussed in the preceding chapter, to improve a social infrastructure government needs to reinforce and accelerate plans to improve the accessibility and level of basic and tertiary education in order to improve the availability of skilled labour. Furthermore, government needs to periodically review the effectiveness of development plans to ensure that sufficient progress has been made and that existing plans are still relevant to the current and forecasted economic outlook.

Government has made efforts to increase confidence in local OEMs and automotive component suppliers by committing to the APDP until 2020. It may further benefit the industry if the continuity of the programme can be confirmed beyond 2020 in order to give local OEMs more confidence to invest in capacity expansion projects which may require payback over a period of five to ten years.

Local OEMs and automotive component suppliers have a significant role in increasing growth in vehicle production and addressing the impact of some of the inhibiting factors identified in this research study. In partnership with automotive component suppliers, local OEMs should take the lead and actively look to increase the local component content in domestically produced vehicles and consider options to mitigate the impact of labour costs.

Local OEMs may be able to leverage-off their knowledge and expertise in best practices, resources and economies of scale to assist and support the development local automotive component suppliers. This may enable local suppliers to be more competitive in comparison to foreign suppliers in terms of reliability, cost and quality and therefore become more feasible as primary suppliers of components to local OEMs. The recommendation to increase local content in domestically produced vehicles may enhance the existing local automotive component supplier base which has been identified in the research study as a dominant enabling factor for growth in vehicle production.

The continuation of a democratic and politically stable South Africa will not only benefit the local automotive industry, but the greater public and business community. It is therefore in the interest of government to maintain the status

quo with regards to political and judicial structures and ensure that existing democratic processes are maintained for the foreseeable future.

Government, policy makers and local OEMs need to continually strive for a balance between imported and locally produced vehicles. Efforts to increase export and local market demand for domestically produced vehicles needs to be carefully managed since South Africa may not be able to completely cease imports since foreign trade agreements need to be honoured and reciprocated.

To stimulate more demand, policy makers and local OEMs may need to consider more aggressive incentive programmes (i.e. trade-in assistance, car scrapping subsidies etc.) to stimulate growth in new vehicle purchases. These programmes may include higher cash subsidies for consumers who wish to purchase new vehicles, or competitive retail pricing and more promotional campaigns.

In addition to the above recommendations, there may be an opportunity for government to improve relations between trade unions and local OEMs in order to reduce the potential risk and subsequent impact of disruptions to production. Local OEMs and government may be able to leverage-off the influence of trade unions on the workforce to improve productivity and efficiencies.

Since it may be plausible that the level of influence exerted by trade unions on the local automotive industry may essentially remain unchanged in the near to mid-term, an option for government may be to facilitate more structured consultations between trade unions, local OEMs, automotive component suppliers and industry associations (e.g. NAAMSA). This may improve relationships between key stakeholders in the industry by improving trust and transparency. Furthermore, enhanced relationships between trade unions and industry stakeholders may encourage more inclusive strategic decision-making with regards to the future of the South African automotive industry.

6.4 Suggestions for further research

6.4.1 *Consider the historical statistical impact of the identified factors to be considered*

This research study focused on the identification of factors which may inhibit or enable growth in vehicle production within the South African automotive manufacturing industry. Industry stakeholders and government decision makers who served as respondents during the research process provided valuable insight to inform the classification and weighting of the abovementioned inhibiting and enabling factors.

Since this research was semi-quantitative, the priority was to gain an understanding and appreciation of the underlying logic supporting the perceptions and insights of the selected respondents. It is therefore suggested for future research that the historical statistical impact of the identified factors on the industry be considered in order to further enhance the results and findings in this research study.

6.4.2 *Strategies implemented by OEMs to limit the impact of inhibiting factors on growth in vehicle production*

Another suggestion for further research would be to consider different strategies implemented by OEMS in developed and emerging markets which are aimed at limiting the impact of inhibitors to growth in vehicle production. It would add good value to understand how OEMs tailor their strategies to suit the dynamics in both developed and emerging markets to ensure the longevity of the industry. Furthermore, a study of strategies which have failed in emerging markets may provide additional guidance to local OEMs when developing plans to stimulate growth in the industry. A potential research question may be: “What are common strategies implemented by OEMs to limit the impact of inhibiting factors on growth in vehicle production?”

6.4.3 *The effectiveness and need for automotive incentive development programmes*

Government policy, in particular the APDP, has been highlighted in this research as a dominant enabling factor for growth in vehicle production. Literature and findings from the research process emphasise the significance of the APDP in ensuring the longevity of the South African automotive manufacturing industry.

Therefore, as a suggestion for further research, a study of other existing automotive incentive development programmes in high volume, vehicle-producing countries should be considered to provide decision makers further context with regards to policies and programmes that may facilitate growth in the industry.

Past and present automotive industry incentive and development programmes which have not been successful should also be considered for further research. A potential research question may be: “Are government-led automotive incentive development programmes effective and necessary for the sustainable growth of a local automotive manufacturing industry?”

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APPENDIX A

Actual Research Instrument: Interview Guideline

1. Request the respondent to explain their involvement with the South African automotive industry and/or a related sector

2. Provide an explanation of the initial FCM including a demonstration of the adjacency matrix and steady state graph which illustrate the results of the simulation

3. Review existing nodes in the initial FCM

4. Identify if possible, additional input factors, nodes and causal links

5. Identify if possible, additional unanticipated consequences

6. Review the weighting of the causal links

7. Identify if possible any further measures to mitigate the impact of inhibiting factors on growth in vehicle production.

8. Request from the respondent their personal view on the future of vehicle production in South Africa. Will production volumes increase or decrease?

APPENDIX B

Sample email for requesting participation in interviews

Dear Sir/Madam,

I am currently preparing my research proposal for my studies and one of the requirements for my research is to interview key stakeholders relevant to my topic and research problem. Below is a brief summary of my request.

My research topic is "Growth within the South African automotive manufacturing industry". For my research proposal, I would only need to get confirmation on the availability of interviewees who may be subject matter experts or stakeholders within the industry of concern. The interviews would be unstructured and would essentially be a critical discussion for the duration of an hour (maximum). Upon approval of my research proposal by the research panel, I will start with the interviews from the start of August 2015. I have compiled a Fuzzy Cognitive Map (FCM) which takes into consideration various factors (inhibiting/enabling) that may impact growth within the South African automotive manufacturing industry. These factors thus far include socio-economic, political, infrastructure, finance and investment, labour, government and trade policy, global economy or any other factors which may potentially impact growth within the industry.

The purpose of the interviews would be to review my initial map and make enhancements with further information, insight and detail from interviewees. Each interviewee would bring their own relevant industry perspective with regards to the enhancement of the map which aims to determine the effect various factors have on growth within the automotive manufacturing industry. I will provide prior to the interview, the initial FCM and analysis which will be used as the basis of the discussion.

Would you be prepared to participate in an interview with me to further enhance my model?

Kind Regards
Amit Rupee (Student: Wits Business School)

APPENDIX C

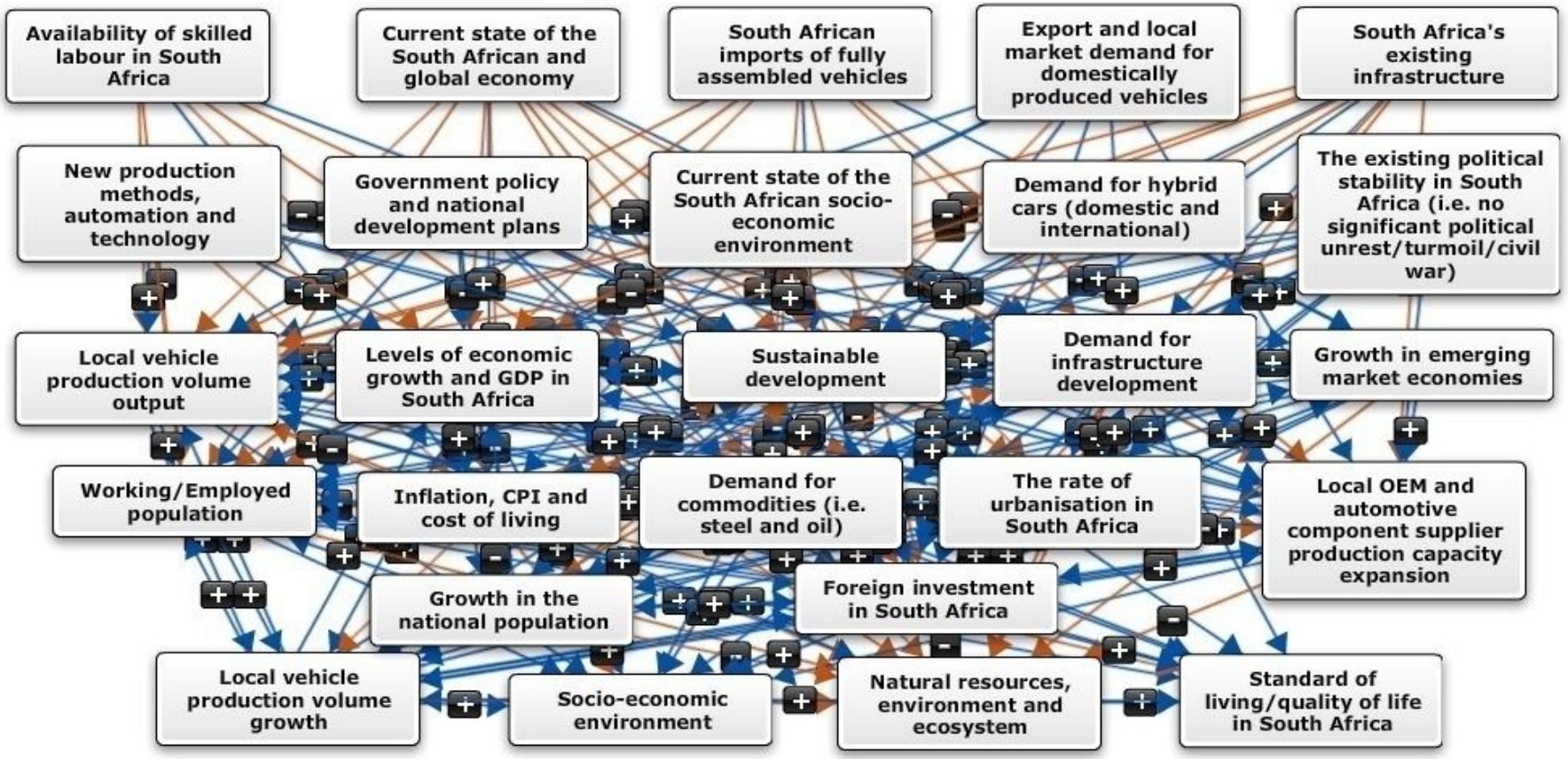
Consistency Matrix

Research problem stated here					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
The first sub-problem is to model the effect of inhibiting and enabling factors on growth in vehicle production within the South African automotive manufacturing industry	• (NAAMSA, 2015) • (Lamprecht, 2015) • (StatsSA, 2015) • (Logan Rangasamy, 2009) • (L. Rangasamy & Blignaut, 2005) • (Raphael & Gabriel, 2015) • (Mwenda & Mutoti, 2011) • (Ahmed et al., 2011; Bloom et al., 2011; Chan-Yuan et al., 2013)	The following factors inhibit growth in vehicle production within the South African automotive manufacturing industry: • The current state of the South African and global economy • South African imports of fully assembled vehicles and automotive components • South Africa's existing infrastructure The following factors enable growth in vehicle production within the South African automotive manufacturing industry: • Local and export demand for domestically produced vehicles • Government policy and national development plans • The existing political stability in South Africa	Unstructured interviews with subject experts from industry including literature will be the primary source of data	Binary data and Ordinal data collected from subject experts will be used to enhance	Analysis of results from the enhanced FCM

Research problem stated here					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
The second sub-problem is to identify measures to mitigate the impact of the identified inhibiting factors	• (NAACAM, 2014) • (Fedderke & Simkins, 2012) • (IHS, 2015b) • (National Planning Commission, 2011)	The following measures may mitigate the impact of inhibiting factors on growth in vehicle production within the South African automotive manufacturing industry: • Investment in technical and social infrastructure • Review of import duties	Unstructured interviews with subject experts from industry including literature will be the primary source of data	Binary data and Ordinal data collected from subject experts will be used to enhance	Analysis of results from the enhanced FCM
The third sub-problem is to determine if the effect of the identified inhibiting and enabling factors have unanticipated consequences	• (Porritt, 2007) • (Stacey & Stacey, 2012)	The following are unanticipated consequences as a result of the above identified inhibiting and enabling factors affecting local growth in vehicle production: The impact on the: • Socioeconomic environment • Natural resources, environment and ecosystem • Standard of living/quality of life in South Africa	Unstructured interviews with subject experts from industry including literature will be the primary source of data	Binary data and Ordinal data collected from subject experts will be used to enhance	Analysis of results from the enhanced FCM

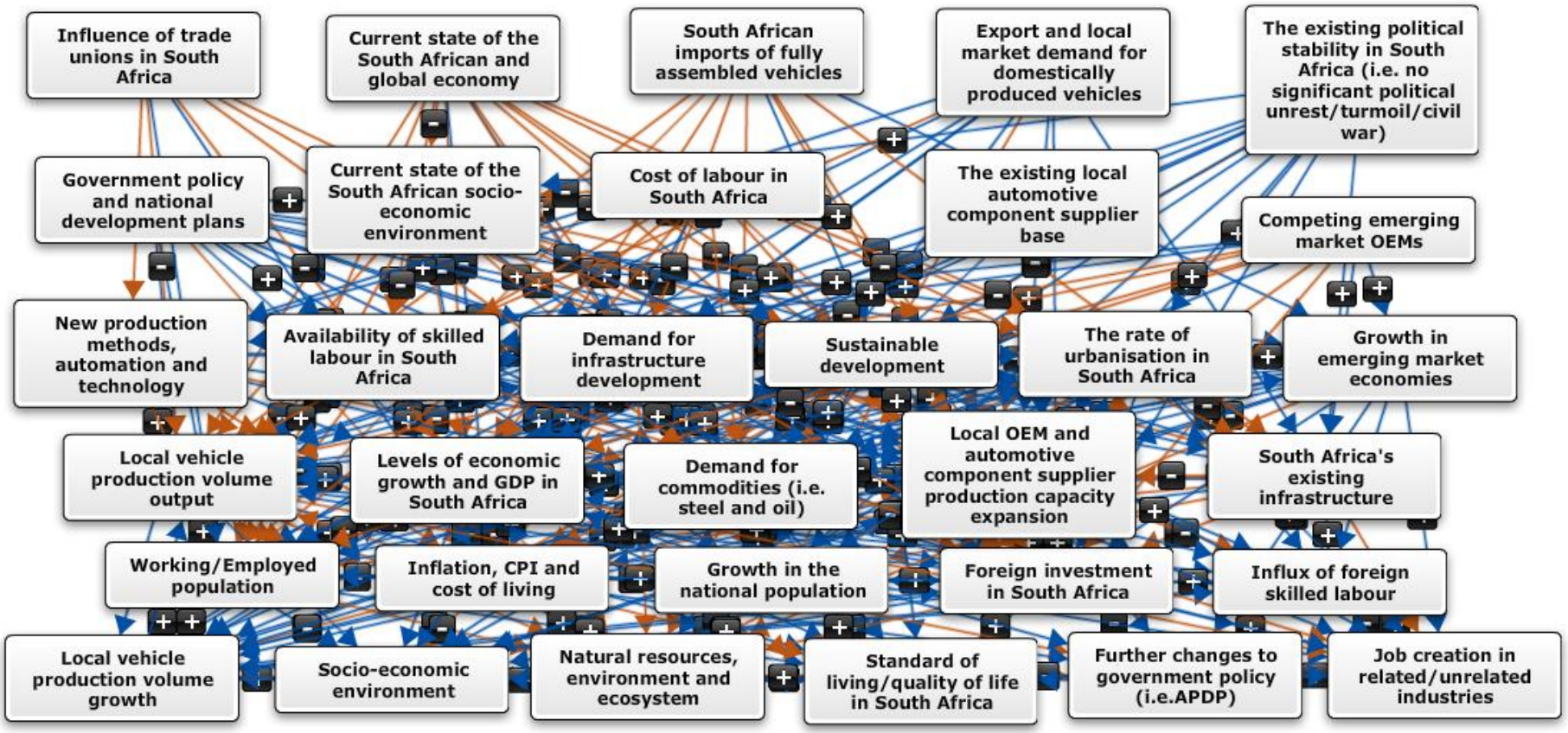
APPENDIX D

The initial FCM constructed from literature



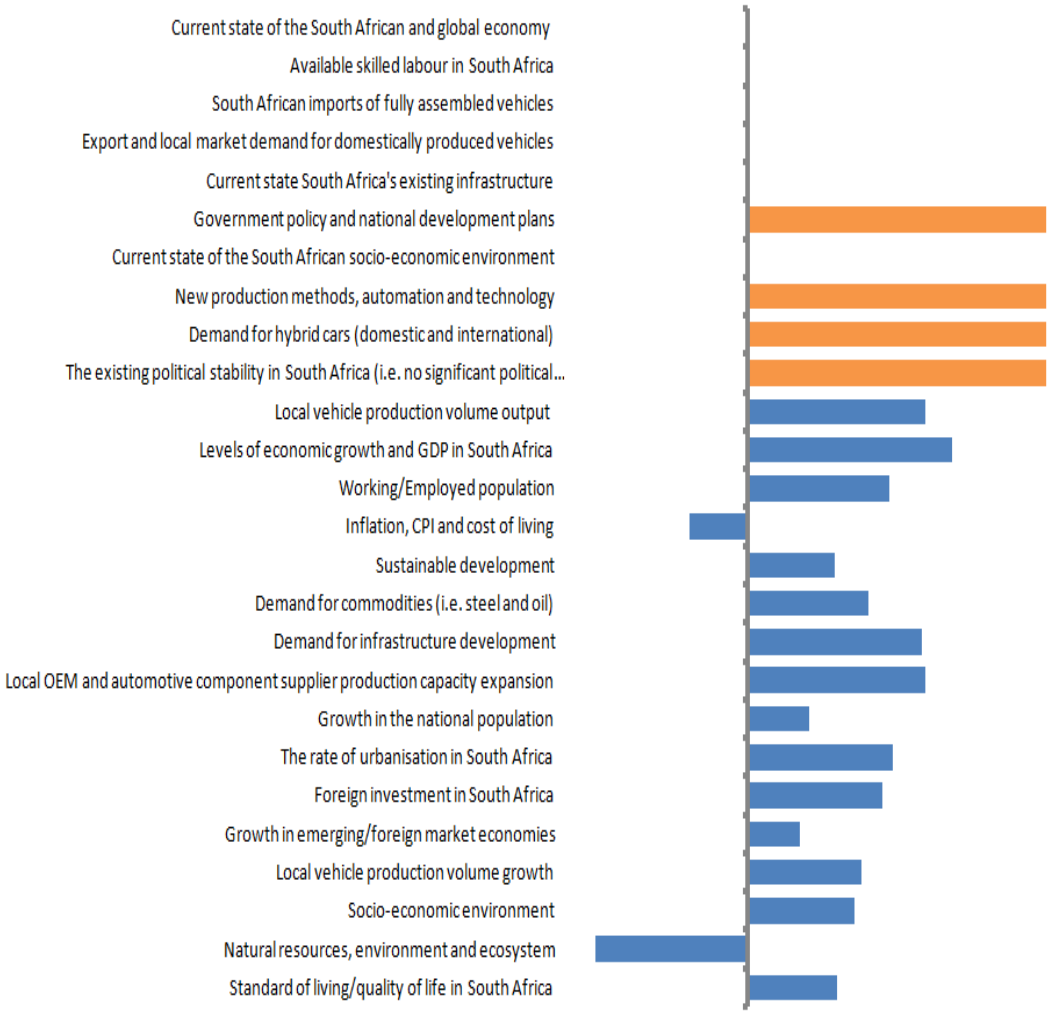
APPENDIX E

The enhanced FCM



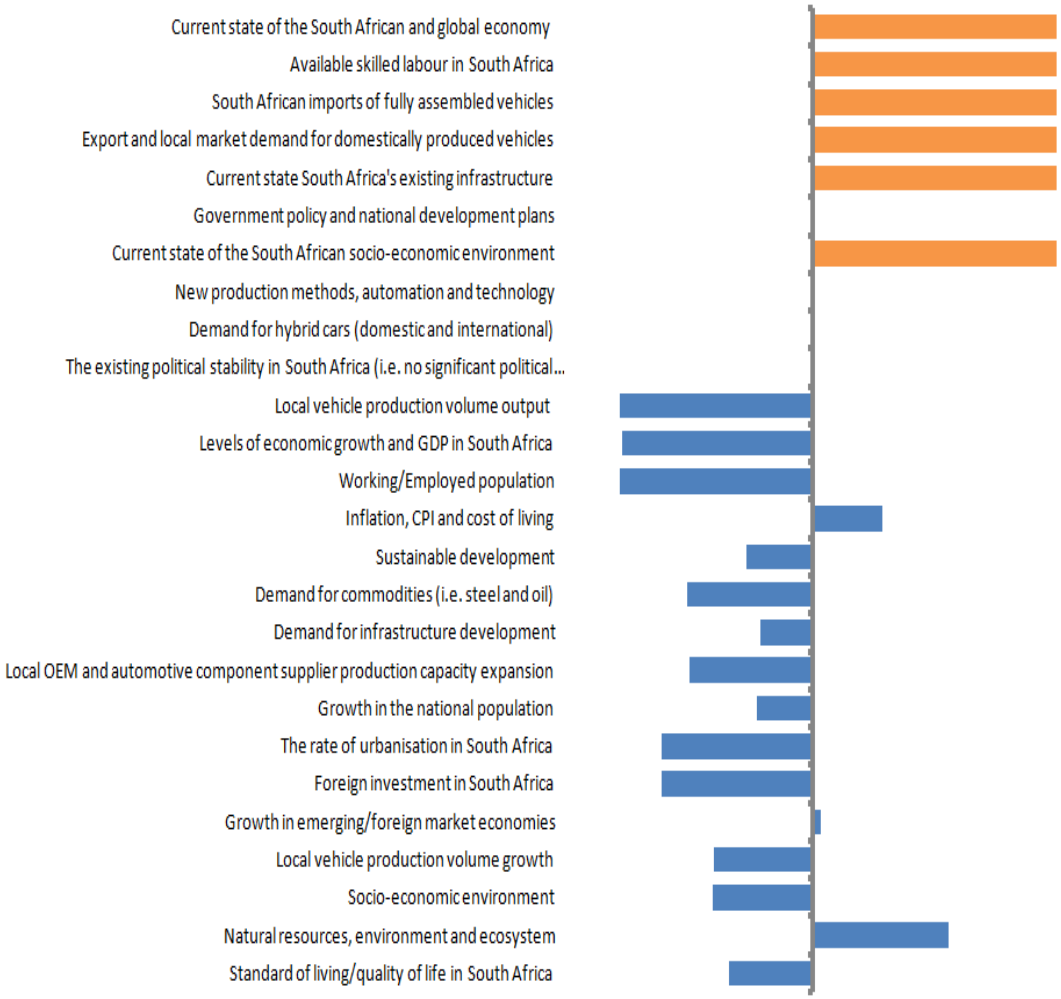
APPENDIX F

First validation of the initial FCM



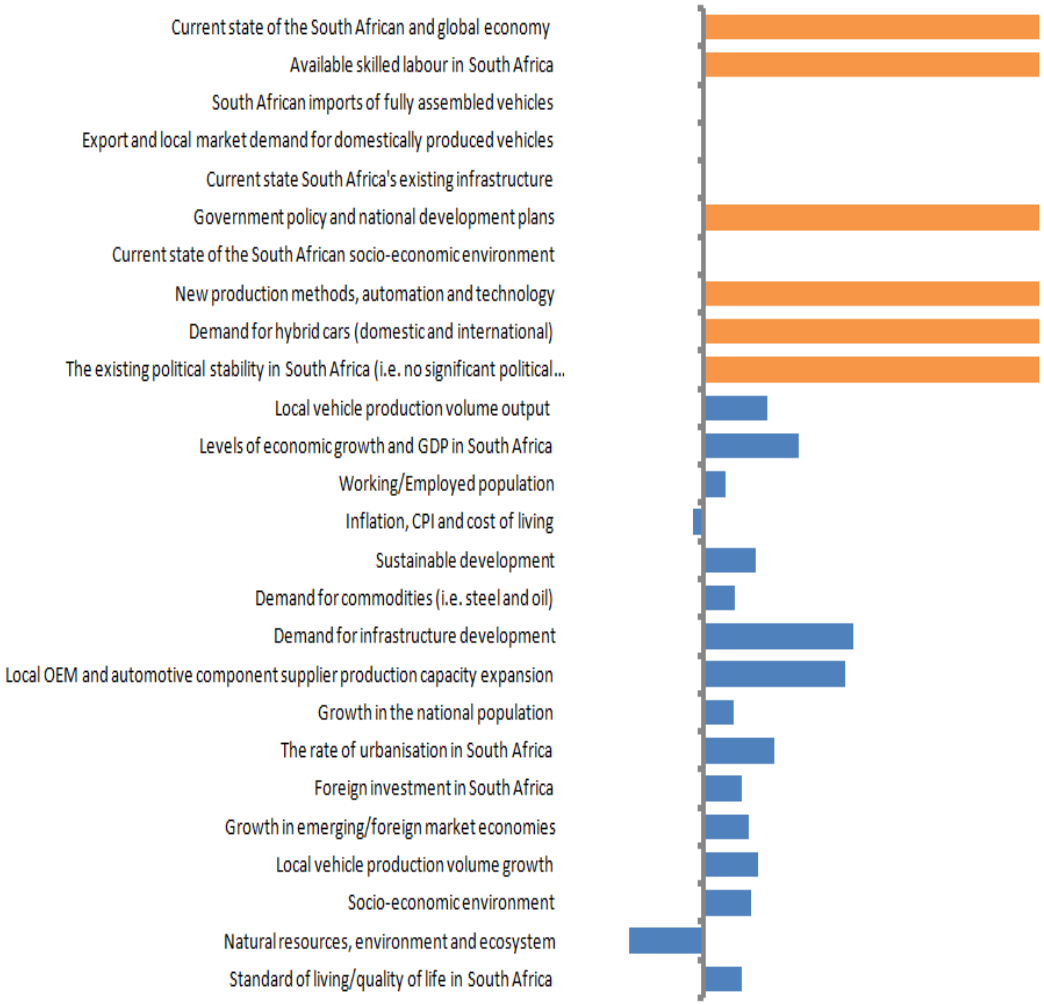
APPENDIX G

Second validation of the initial FCM



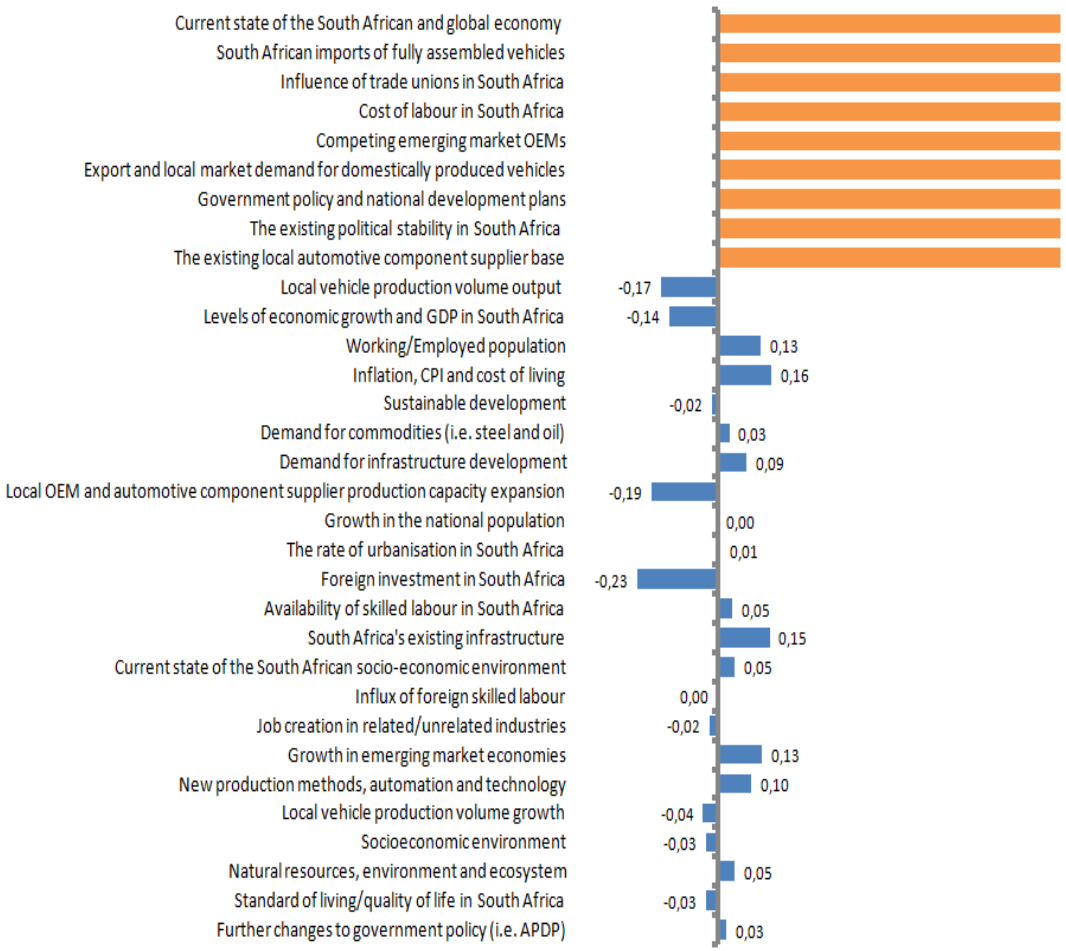
APPENDIX H

Final validation of the initial FCM



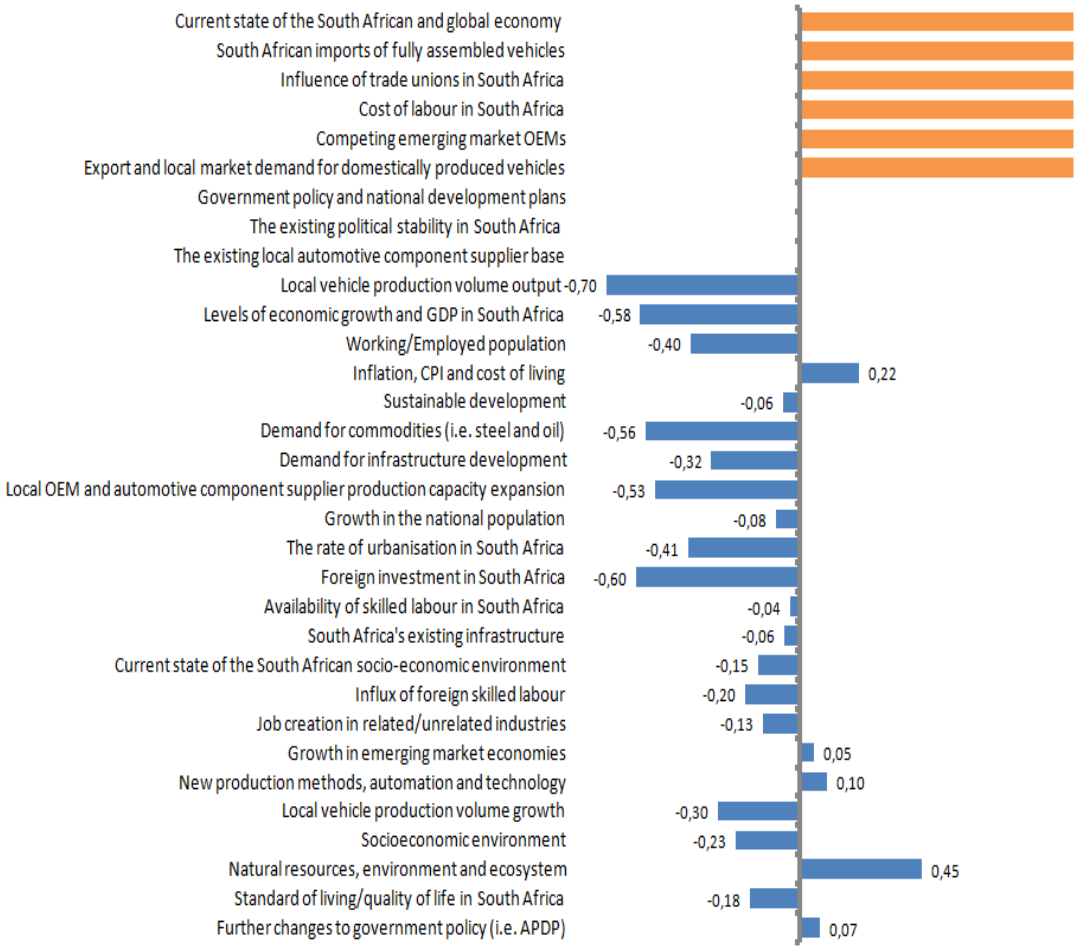
APPENDIX I

Scenario A: The current state of the local automotive industry



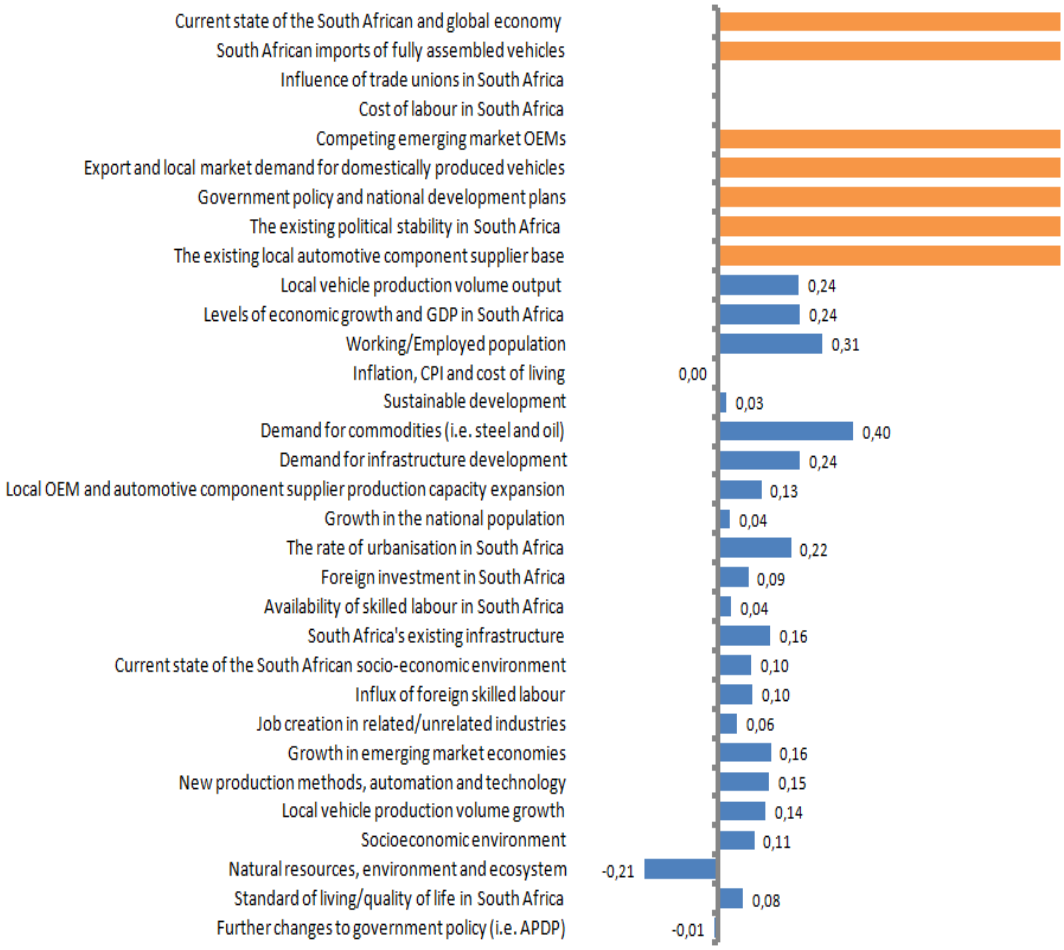
APPENDIX J

Scenario B: Poor domestic and global economic outlook with unfavourable domestic conditions for growth



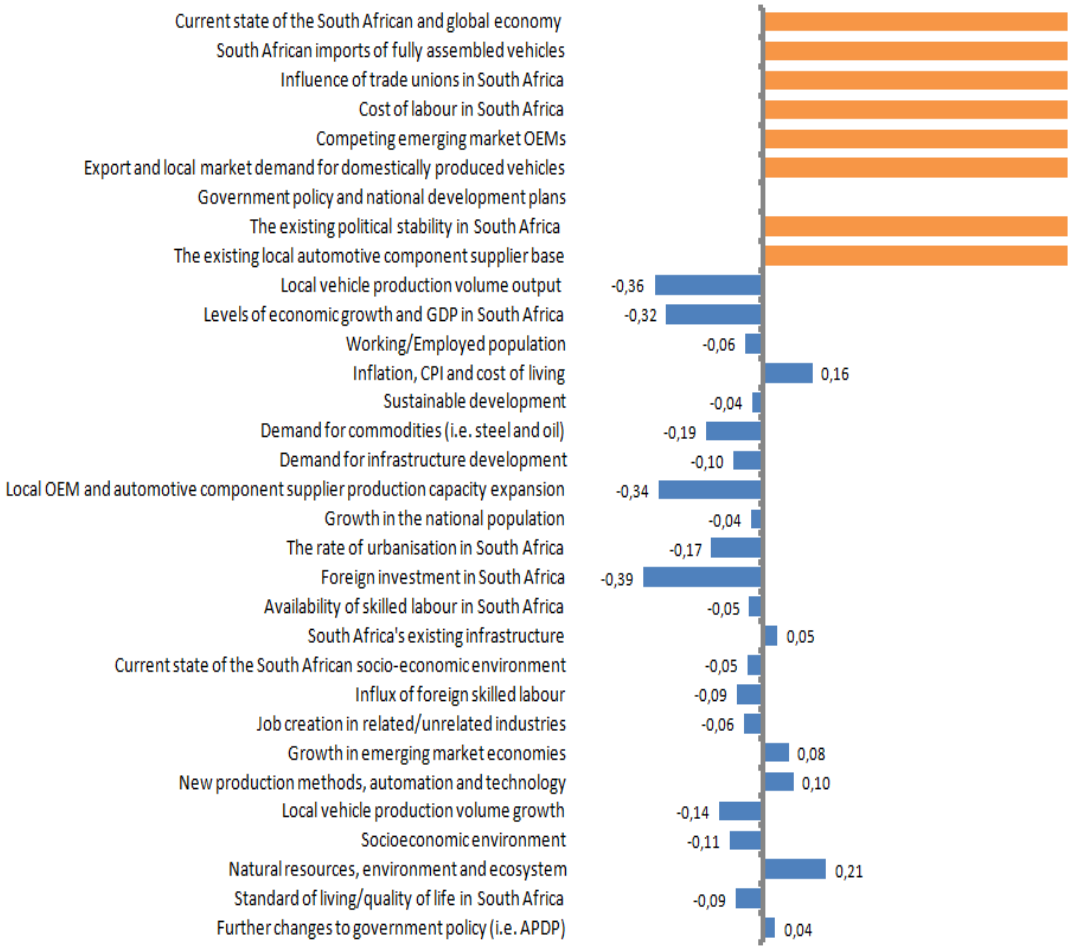
APPENDIX K

Scenario C: Poor domestic and global economic outlook with favourable domestic conditions for growth



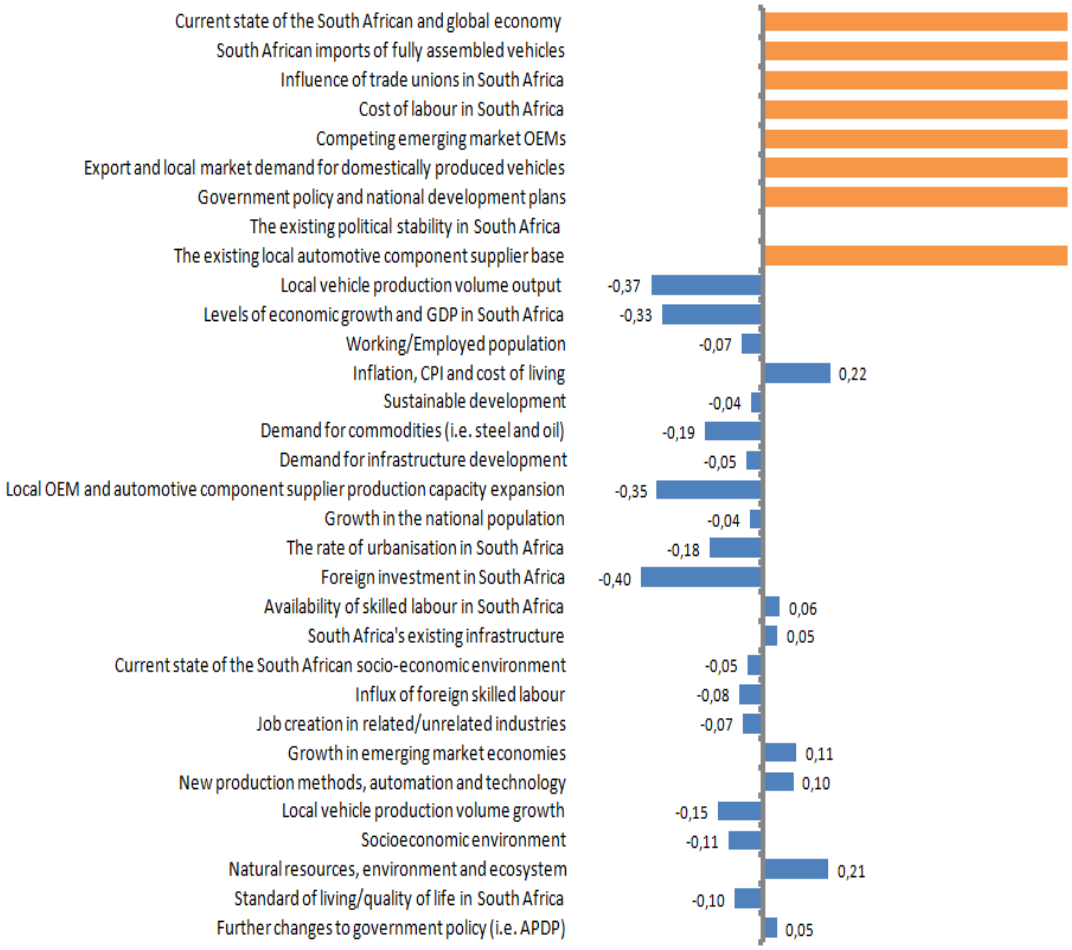
APPENDIX L

Scenario D: Maintain the industry status quo with an absence of favourable government policy



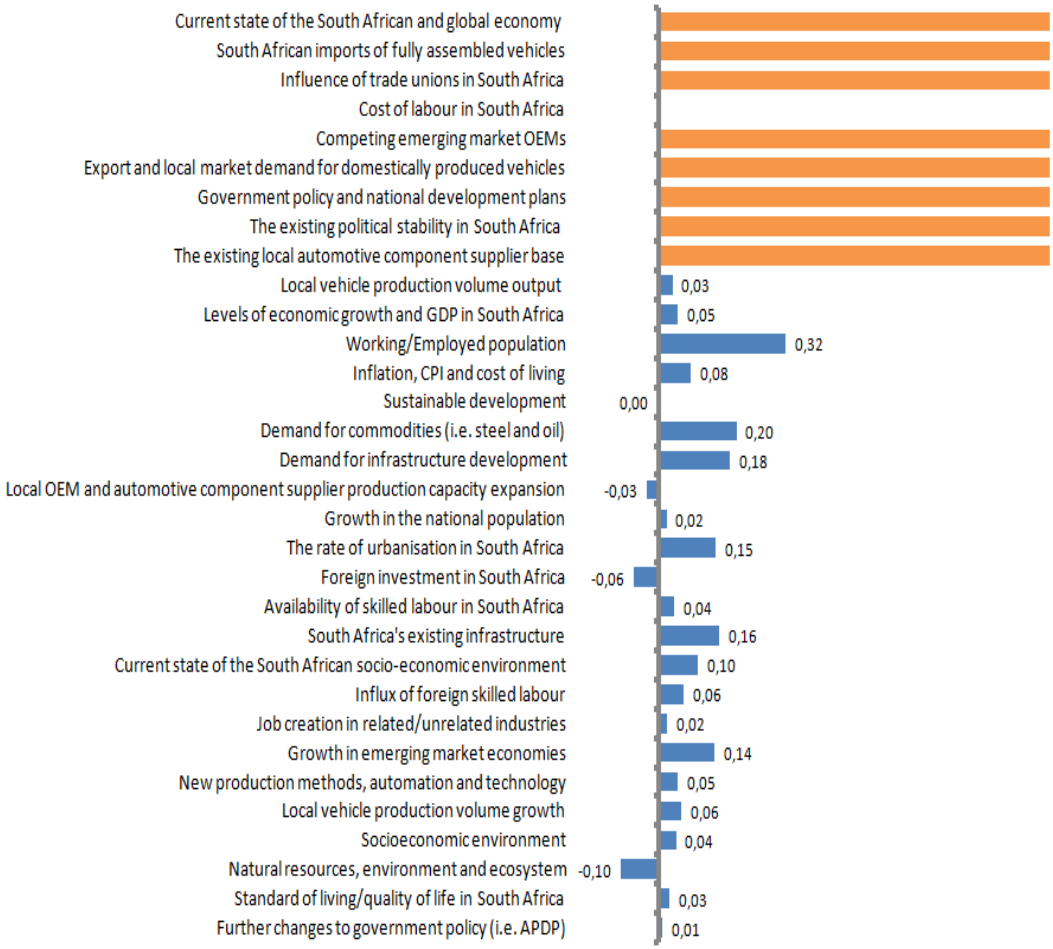
APPENDIX M

Scenario E: Maintain industry status quo but no political stability



APPENDIX N

Scenario F: Maintain the industry status quo with low cost of labour



APPENDIX O

Scenario G: Maintain the industry status quo with a lower influence of trade unions

