LEARNING AND KNOWLEDGE PRODUCTION: A CASE STUDY OF THE AUTO INDUSTRY IN THE PRETORIA REGION

BY

JOHN WESLEY

STUDENT NO: 1107946

PROTOCOL NUMBER 2015ECE034M

A THESIS SUBMITTED TO THE SCHOOL OF EDUCATION, IN THE FACULTY OF HUMANITIES

AT THE UNIVERSITY OF THE WITWATERSRAND

IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN EDUCATION

SUPERVISOR: DR ANDRE KRAAK

CO-SUPERVISOR: DR PRESHA RAMSARUP

MARCH, 2020

DECLARATION

I hereby declare that the thesis/dissertation/minor dissertation submitted for the Degree of Masters in Education to the University of the Witwatersrand, apart from the help recognised, is my own work and has not previously been submitted to another university or institution of higher education for a degree.

..... John Wesley

March 2020

DEDICATION

To my parents Eraste and Rose and my siblings, Ezra, Josiah, Fidel, Benjamin, Beni and Nadia, thank you so much for your support and prayers!

ACKNOWLEDGEMENTS

I would like to express my profound gratitude to my supervisor Dr Andre Kraak for his guidance, support and patience during this journey.

I would like also to thank Dr Ronel Blom who was my initial co-supervisor and Dr Presha Ramsarup for agreeing to step in as a co-supervisor upon the departure of Dr Blom from WITS University.

It was particularly difficult to gain access into companies to conduct interviews and without the consistent intervention of my supervisor Dr Kraak, the completion of the project would not have been possible. Many thanks also to Helen Brown and Harry Geldenhuys from merSETA for their efforts in facilitating access to a number of automotive companies for my research. In the same light, I would like to acknowledge and thank the companies that agreed to take part in my study by granting me access into their plants and by patiently answering my questions.

I received financial assistance from merSETA and CHIETA as well as WITS, without which, my enrolment for this programme would not have been possible, and for this I am very grateful.

To my parents, siblings and friends, I cannot thank you enough for your support and encouragement. This project would not have succeeded without your prayers.

To the Lord God Almighty, I thank you for seeing me through this journey.

ACRONYMS AND ABBREVIATIONS

AAAM	African Association of Automobile Manufacturers
AECDP	Automotive Experiential Career Development Programme
ACTS	Automotive Component Technology Station
AIDC	Automotive Industry Development Centre
AMIC	Automotive Manufacturing Industry Certificate
AMTC	Advanced Mechatronics Technology Centre
AMTS	Advanced Manufacturing Technology Strategy
ASEAN	Association of South Asian Nations
APDP	Automotive Production and Development Programme
ASP	Automotive Supplier Park
BAW	Beijing Automotive Works
BEE	Black Economic Empowerment
CBU	Completely Built Units
CKD	Completely Knocked Down
CLO	Client Liaison Officers
COMESA	Common Market for East and Southern Africa
DAC	Durban Automotive Clusters
DTI	Department of Trade and Industry
EAC	East African Community
ECOWAS	Economic Community of West African States
EU	European Union
FAW	First Automobile Works
GEAR	Employment and Redistribution
HSRC	Human Sciences Research Council
IAMER	Institute of Advanced Manufacturing and Engineering Research
IMF	International Monetary Fund
ITA	International Trade Administration
merSETA	Metals Engineering and Related Services Education and Training Authority
MIDP	Motor Industry Development Programme
NAACAM	National Association of Automotive Component and Allied Manufacturers
NAMA	Nigerian Automotive Manufacturers Association
NAMB	National Artisan Moderating Body
NATED	National Accredited Technical Education Diploma,
NBI	National Business Initiative
NBS	National Bureau of Statistics
NCV	National Certificate Vocational
NMU	Nelson Mandela University
NTI	National Tooling Initiative
OE	Original Equipment
OECD	Organisation for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
OFDI	Outward Foreign Direct Investment
PAA	Productive Asset Allowance
PLC	Programmable Logic Controller
PLS	Programme Limit Switch
RJTO	Required Jobs to Operate
RPL	Recognition of Prior Knowledge
SAABC	South African Automotive Benchmarking Club
SAAM	South African Automotive Masterplan
SACU	South African Customs Union
SAIVCET	South African Institute for Vocational and Continuing Education and Training
SAQI	South African Quality Institute
SETA	Sector Education and Training Authority
SSACI	Swiss-South African Cooperation Initiative
SUV	Sports Utility Vehicles

TVET	Technical and Vocational Education and Training
UKZN	University and University of KwaZulu Natal
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VET	Vocational Education and Training
VWSA	Volkswagen Group South Africa
QCTO	Quality Council for Trades and Occupations

ABSTRACT

The automotive industry is undoubtedly one of the most important economic sectors in the world. It is also a sector that commands highly advanced levels of technology, which requires an equally highly technical workforce, capable of meeting its increasingly sophisticated nature of production. The primary focus of this study was to examine how the auto industry in South Africa can mitigate the difficulties involved in meeting these needs as it seeks to improve its competitiveness on the global auto value chain.

Using the global value chain framework, the study has looked at the automotive industry within the Pretoria region in Gauteng to examine what it takes for automotive companies in South Africa to succeed in such a highly competitive industry, especially as regards obstacles involved in operating from a developing country, while striving to meet stringent international quality standards. There are understandably numerous challenges involved to participate successfully in this industry, but the study focuses on those difficulties that are related to developing the necessary technical expertise in auto manufacturing and production.

Of particular interest to the study is the provision for highly technically skilled workers such as artisans, especially considering the perceived inefficiency in the vocational education system in South Africa, which is seen by the industry as inadequate with regards to meeting their skilling needs. The study examines factors that hinder the college system from playing its intended supportive role to the industry and then looks at alternative learning strategies used by automotive companies to develop the expertise that is needed for their operations. To this end, the study highlights the importance of incorporating both codified knowledge, which is acquired through traditional formal classroom instruction and tacit knowledge, which is developed through informal and situated learning in the workplace, to contribute to provision for the required technical expertise in the industry.

CHAPTER STRUCTURE

PART III: DATA OBTAINED FROM THE FIELDWORK

List of tables

List of appendix

PART I: CONTEXT

CHAPTER I: INTRODUCTION

1.1. A brief overview of the automotive industry in South Africa

The automotive industry is one of the world's largest manufacturing sectors, accounting for 15% of the world's gross domestic product and employing the highest number of workers (Kraak, 2010). In South Africa this industry is a major contributor to the manufacturing sector, contributing up to 6.9% to the GDP in 2012, directly employing 100 000 workers, providing employment opportunities to another 200 000 in related services and with 50% of its products aimed at the export market (B & M analysts, 2013). Its political significance has also been underscored by the important roles played in government by the leadership of the unions affiliated to this industry over the years, such as through the tripartite alliance which included the National Union of Metalworkers.

In the Gauteng province, one of the nine provinces of South Africa and where the study was conducted, the economy has been dominated by the mining and financial sectors for many years. This trend led to the neglect of other sectors that also have the potential to contribute to the provincial economy. In addressing this, the Gauteng government has set out to transform its economy by ensuring a more inclusive and diversified regional economy. To this end, some sectors, such as the manufacturing industry, which have been previously neglected, were identified in the 2010 Provincial Industrial Policy to receive support. For this study, the focus will be on the automotive manufacturing industry.

The local automotive manufacturing industry was identified as one of the sectors that must be supported by the Gauteng province, and consequently, several initiatives were established to support it. The Gauteng Employment Growth and Development Strategy, released in 2010, selected the automotive industry for future infrastructure development, policy interventions and growth incentives from the provincial government. The Blue IQ, the agency in charge of infrastructural development in the province, has systematically set out to invest in the auto sector in training and logistics through its subsidiaries the Automotive Industry Development Centre (AIDC) and the Automotive Supplier Park (ASP), both located in Rosslyn, Pretoria. The AIDC focuses mainly on supply chain, supplier and skills development. It also facilitates

both local and foreign investment in the sector. The ASP is a Gauteng infrastructure initiative aimed at improving the logistics and competitiveness of the local automotive sector.

Seven of the major Original Equipment Manufacturers (OEMs) worldwide have established assembly plants in South Africa; these include BMW South Africa, Nissan South Africa and Ford Motor South Africa which are located in Gauteng. Then there is VW South Africa in Port Elizabeth, Mercedes South Africa in East London and Toyota South Africa in Durban. There is also a new Chinese company, Beijing Automotive Works (BAW) which owns a taxi assembly plant in Springs, Gauteng as well as a truck assembly plant built by First Automobile Works (FAW), another Chinese automobile company, in Coega, outside Port Elizabeth in the Eastern Cape (merSETA Sector Skills Plan Update, 2013).

In Gauteng (Rosslyn Silverton and Erkhuleni) the biggest presence of OEMs, which include BMW, Ford and Nissan, account for about 40% of the South African automotive manufacturing industry. Based in Port Elizabeth and Uitenhage in the Eastern Cape, General Motors and Volkswagen account for about 30% of the South African Automotive manufacturing industry and Daimler in East London represents 6% of the industry. In the Western Cape, there is also about 4% of the component industry, including catalytic converters, stitched leather components and seat covers, engines and engine parts, tyres, road wheels, automotive wiring harnesses, silencers and exhausts as well as automotive safety glass. These are some of the auto parts exported, with more than 12 million converters exported every year at a value of 9.9 billion Rand (Barnes & Meadows, 2008).

The 2010 Industrial Policy for Gauteng states that the automotive industry in Gauteng produces 41% of all the light motor vehicles assembled in South Africa. As Gauteng is home to three of the seven local vehicle assemblers, as well as some of the 164 automotive component manufacturers in the country, the sector is considered important to the Gauteng province as it is a major contributor to the provincial and national GDP (The Development of an Industrial Policy for Gauteng Province, 2010).

1.2. Purpose of the study

Globally, the automotive sector is one of the most developed industries in terms of the number of workers employed, output and level of technologies used, but participation in its production

chain is challenging, especially for developing countries, due to the sophisticated and highly technological requirements of production (Barnes & Morris, 2008). The value chain of this industry is highly hierarchical with lead firms being largely involved in research, design and branding as well as final assembly, while first-tier suppliers come second, producing complete subsystems in conjunction with wide networks of lower-tier suppliers and subcontractors (De Backer and Miroudot, 2014).

Given the high technological demand for production in this industry, automotive firms are highly dependent on skilled workers who should be able to meet the stringent technological requirements. It is thus understandable that automotive companies need to update the skills of their workforce constantly to match the dynamic nature of the skill requirements as well as other regular operational changes that occur in the industry.

This study, therefore, examines learning and knowledge production in the industry, focusing on those based in Pretoria, to look at problems involved and how they can be overcome. To narrow down the scope of the research, the present study has elected to focus on learning and knowledge for artisans as well as other strategies used in the industry for learning and knowledge production. These strategies would include formal processes of learning which would comprise collaboration and partnerships with formal education and training institutions, as well as other informal processes used within the industry, such as endogenous and intra-firm learning. The focus of the study is related to the following:

- The strategies used by the industry towards learning and knowledge production
- The role of organisations, firms, educational institutions and other role-players that are in partnerships with the automotive industry
- How firms work together (if at all) to tackle challenges in the sector and the learning that ensues
- Looking at possible solutions for improvement in the provision for learning and skills development in select professions in the auto industry.

It is anticipated that the findings from this study will not only be beneficial for the auto manufacturing industry as a whole, but also to other sectors of the economy.

1.3. Research questions

The main research question of the study is, "*what are some of the main obstacles that hinder learning and knowledge production in the auto industry in South Africa, and how do these affect the local auto industry's upgrading capabilities on the auto global value chain?"*

The main research question is underscored by the following guiding questions

1. What is the position for the local auto sector within the global auto industry?
2. What are the strategies used in the auto industry to stimulate learning and knowledge production within the industry?
3. How does the local auto industry promote learning and skills development for supplier and lead firms?
4. What types of collaboration exist between the local auto industry and education and training institutions concerning learning and knowledge production for artisanal development?
5. How does the skilling and training of artisans impact on upgrading capabilities for auto manufacturers/suppliers in the local auto industry?

1.4. Research methodology

The study has employed the interpretive paradigm, which requires a qualitative approach to carry out an in-depth analysis of the situation in question. This process has been conducted through the asking of 'why' and 'how' questions to study the dynamics involved in the relationships among the stakeholders involved in learning and knowledge production for the auto manufacturing industry and how these efforts assist firms in upgrading in the global auto value chain.

The use of the qualitative approach for this study is supported by several scholars. Creswell (2003) states that qualitative research uses multiple methods for collection of data. In this study the process has included interviews and observations to explore the phenomenon. Creswell (2007) lists the following characteristics of qualitative research, which align with the present study:

- Data is collected directly by the researcher using multiple sources of information,

- The experience of the participants is important to understand the issues under investigation,
- The research process is emergent in that it may change during the study, and
- The qualitative research endeavours to use multiple perspectives in identifying various factors and complex interactions involved in a given situation (Creswell 2007; 37-39).

The interpretive paradigm is usually concerned with gaining an understanding into the people that are being studied and the issues that face them. It aims to look at the situation from their perspective by making sense of their world and how they have come to understand it. Henning and colleagues (2004) agree that, in the interpretive framework, characteristics of a phenomenon are analysed in great detail to explain the phenomenon in depth. The authors add that knowledge is not only obtained by observable phenomena but also by descriptions of people's intentions, beliefs, values, reasons, meaning and self-understanding.

Creswell (2014) goes on to say that the use of social constructivism is a framework in which the aim is for people to make sense of their world through their individual life experiences. Creswell argues that it is up to the researcher to ensure they uncover as many perspectives and viewpoints as possible on the issues under study. Thus, this paradigm was deemed most appropriate in addressing the research questions listed above. The focus of the study has been on the learning strategies at the firm level, by looking at the methods that firms are using to improve skills of their workers and stimulate learning and knowledge development in their companies.

Several informants from Original Equipment Manufacturers (OEMs) and component manufacturing firms that supply them participated in the study, and the information gathered helped to develop an appreciation of the difficulties that they are faced with in terms of skills needs and the strategies that they use in meeting these problems. This finally helps to draw a picture of the situation to come up with suggestions on moving the industry forward to improve the positioning of the domestic auto industry in the global auto value chain.

The involvement of a private and public training institution in the study provided more insight into the role played by educational and training institutions and the nature of the relationship

between auto firms and the education sector. Interviews from other agencies that support the automotive industry provided more information on the role that they play in the industry, especially about skills provision and learning development. This method, which seeks input from multiple sources, was informed by Creswell's argument that the researcher relies to a large extent on the perspectives of the participants as well as their knowledge and experiences regarding the situation under study (Creswell, 2014).

1.5. Data collection

The collection of data was in the form of semi-structured interviews of training managers and trainers at the two auto OEMs and representatives from the component manufacturers. Other participants included a private training institution, a public TVET college, a government agency and an automotive association as well as trainees and interns from OEMs. Concerning qualitative research, Bernard (2012) argues that there is no set number of participants required as a researcher can only use individuals who are willing to participate. Bernard also advises that to gather sufficient data, questions for the interviews should be designed in such a way that different participants can answer the same set of questions.

Table A below outlines the companies and organisations that were visited during the fieldwork, as well as the people who were interviewed:

Company/ institution visited	Person(s) interviewed
OEM A	A training manager An assistant training manager Two senior artisans/trainers Two learners/apprentices
OEM B	A training manager A technical manager Two interns
Component manufacturer 1	A Training manager An Instrumentation technician A Toolmaker A Fitter A Shop floor supervisor
Component manufacturer 2	A training manager Two technical managers Two interns
Component manufacturer 3	A training manager A human resource/procurement manager
(Small) supplier company 1	The CEO of the company
(Small) supplier company 2	A Training manager
TVET college	The Rosslyn campus manager
Private training academy	A training manager
Automotive Association	The Director

The interviews were arranged to suit the participants, depending on their availability. As the interviews were the primary instruments for data collection, they were recorded and supplemented by observation notes. The data gathered was then studied carefully to identify emerging themes; a process guided by Creswell's six steps in data analysis and interpretation:

1. Organisation and preparation of the data for analysis,
2. Reading through all the data collected to make sense of the general impressions, tone, credibility and use of the information gathered,
3. Detailed analysis with a coding process: organising the material into chunks before interpretation,
4. Using the coding process to generate a description of the setting or people and categories or themes for analysis,
5. Advance how the description and themes will be represented through a narrative passage to convey findings of the analysis,
6. Finally, the interpretation of the data (Creswell, 2003, 190-195).

Sampling used for this study was purposeful as participants were selected based on their expertise and experience either in the industry or in terms of duties and responsibilities in the automotive industry. The interviews were guided by the prepared interview schedules and took place at the workplaces of the participants.

1.6. Validity and reliability of data

Creswell (2014) advocates the use of a variety of approaches in checking and ensuring the credibility and validity of data. For this purpose this study used multiple sources during the process of data gathering to ensure the accuracy and reliability of the research findings.

Denzin (2009) observes that triangulation, which is the utilisation of multiple sources for data gathering, contributes to the reliability of the information gathered. Mays and Pope (1995) agree, adding that it is a method which is used to gain different perspectives on the same research problem, thereby enhancing the validity of data. Validity and reliability of data in any research are vital, and for this to be achieved, the final findings of the research have to both represent what they claim to represent and should also be replicable in other studies (Grossoehme 2014). In this regard, the study endeavoured to secure the participation of multiple sources to obtain different perspectives from as many of the key role-players as were willing to participate in the study.

1.7. Ethical issues

Participation in the study was completely voluntary and explanations about the study and its relevance were offered to all participants. Permission for the study was obtained from the University of the Witwatersrand Ethics Committee for Research on Human Subjects (non-medical), Protocol Number 2015ECE034M. Consent forms and information sheets, explaining the reasons for selection and the voluntary nature of participation, were also presented and participant's privacy and anonymity were respected at all times.

1.8. The narrative structure of the study

- The thesis is structured in three parts. Part one comprises the first chapter which contains the contextualisation of the study covering a brief introduction into the auto industry, both globally and in South Africa. This chapter also outlines the purpose of the study as well as the research methodology.
- Part two comprises Chapters 2, 3 and 4. Chapter 2 constitutes the literature review focusing on the global value chain framework and the global auto industry, as well as theories on firm learning. Chapter 3 looks at situated learning and ways of seeing learning in South African education and training, focusing on the literature that addresses the study's research questions on learning and knowledge production for and within the industry. Chapter 4 looks at auto industries in three developing countries, namely India, Brazil and Nigeria, to identify applicable lessons for the South African auto industry. This chapter also described the development of the South African auto industry, the policies that have impacted on the industry over the years and factors that contributed to successful participation in global value chains.
- Part three contains Chapter 5 and 6 and the conclusion of the study. Chapter 5 defines the role of OEMs and the status of South Africa's auto industry in the global auto value chain. Chapter 6 details relational dynamics between lead firms, component firms and colleges meeting the high demands of the OEMs. The conclusion of the study contains the key findings of the study as well as recommendations for future research.

PART II: LITERATURE REVIEW

CHAPTER II: THEORIES ON THE GLOBAL VALUE CHAIN FRAMEWORK

2.1. Introduction

Competition in the automotive global value chain is quite fierce because different countries worldwide strive to attract investment from OEMs to benefit from spill-over benefits associated with vehicle production. Countries in various parts of the world have, over the years, stepped up strategies to attract vehicle production to their shores. For instance, the Association of South Asian Nations (ASEAN), as well as the European Union (EU) with countries such as the Czech Republic, Hungary, Poland and Slovakia, have, in recent years, endeavoured to attract foreign direct investment as they vie for business in auto manufacturing (Black, 2009).

In Asia, successful automakers such as South Korea, have been able to achieve success by specialising in a narrow range of vehicles and producing them *en masse*, while Thailand's strategy has been to adopt policies favourable to foreign direct investment (Black 2009). Conducting business in a highly integrated environment such the global automotive industry means that lead firms can source parts in any part of the world, which implies that automotive component manufacturers should offer the best products at the most competitive prices to attract business from OEMs.

Design activities are mostly carried out in high-income countries with only minimal activity in low-income countries (Kaplinsky, 2000). The subsequent offshoring of production has brought about major changes in the industrial organisation of developed countries. Low-wage and low-value-added services are shipped to poor countries, while the developed countries focus on higher value-added services which allow them to cut production costs. This trend has been described as a global division of labour by Arndt and Kierzkowsi (2001), due to the way the production chain is distributed globally among different players, sourcing for the best and most cost-effective suppliers. Giulio and colleagues (2013) argue that to benefit from this type of international division of labour in the auto industry, countries should have an efficient plan in place that carefully considers pertinent issues such as economic gains made from offshoring production to lower-income countries, efficiency and length of the supply chain as well as how offshoring impacts on innovative processes.

From this standpoint, for developing countries to participate in the global automotive chain, their options are to either manufacture to the design of global first- and second-tier component suppliers or focus on after-market services. Morris and Barnes (2003) categorise the global automotive industry into the following three groups:

- The Original Equipment Manufacturers (OEMs);
- Original Equipment Suppliers (OESs); and
- Independent Aftermarket (these are the independent retailers of parts and repair shops).

OEMs are known to use their dominance in the value chain to influence the market within the value and production chains. They do this because they hold key roles in research and development as they are in a position to direct where different productions would take place. Direct suppliers of components to OEMs are the ones referred to as Tier 1 component suppliers, while firms that supply to Tier 1 companies are referred to as Tier 2 suppliers. The after-market service sector is also controlled by big brands, while the unbranded market is highly saturated. Concerning these obstructions to the productive participation of developing countries in the automotive sector, it has been argued that perhaps developing countries should not focus their limited resources on such a demanding and highly competitive sector (Humphrey, 2000).

2.2. The global value chain conceptual framework

The conceptual framework that was deemed most appropriate for this study is the global value chain framework as it enables the study to look at the issue of skills and how learning takes place in firms, from the perspective of the automotive industry. This is accomplished by looking at the different strategies and methods that local automotive firms use to develop and facilitate learning in the workplace to meet the increasingly changing requirements in manufacturing. The study also examines the impact that skills-related obstacles have on automotive firms about upgrading on the value chain.

The global value chain analysis encompasses four different stages which a firm can undertake in the process of moving up the value chain. Depending on the type of business that a particular company is involved in, the GVC theory can be adapted to fit the type of business. There are many problems pertinent to the South African context, including an unreliable power supply

and labour unrest as well as skills related hindrances, among others, which cannot all be studied at once. Thus, this study has limited its focus to firm-based learning to explore how learning takes place at firm level and the difficulties experienced by the firms and other relevant roles players in this process. Also, to limit the scope of the study, the empirical research is limited to automotive firms as well as a number of their partners and stakeholders in the industry, all located within the Pretoria region.

Before attempting to look at the role of learning and knowledge production in the upgrading process for the automotive industry, it is important to look at the previous four stages explored in the global value chain theory. These include process- , product-, functional- and intersectional-upgrading. The first two categories involve improvement in production which may result from improved technologies and the adoption of innovative methods for production. The other two categories involve changing positions in the GVC to move away from less competitive slots, for instance, abandoning manufacturing in favour of design as well as moving from one value chain to another, possibly where there is less competition (Psilos & Gereffi, 2011).

The stages have also been categorised into six phases, including entry into the value chain, upgrading of products, processes, functions, chain and end-market (which may involve entry into new higher-end value market sectors, Fernandez-Stark and colleagues (2012). Moreover, according to the Psilos and Gereffi (2011), the GVC approach encompasses various stakeholders, including private and public entities, and endeavours to touch on different geographic areas extending from local to sub-national, national and global. They add that this framework helps to clarify the role of training standards, as well as product and process certifications in assisting workforces in developing countries, achieve better skill manageability, improved working conditions and better production and integration within the global economy.

Giulio and colleagues (2013) support the use of the GVC theory because it helps to explore the intricacy of the globalising industry by studying the extent of the complexity of the distribution of roles, commitments and gains along the global production networks. It is understood that the automotive manufacturing industry involves complex functions of value-added services along the chain. The GVC theory helps to analyse the possibility for improvement of a firm's profitability through its standing in the value chain. This being based on the premise that the

higher up the value chain a firm manages to reach, the more access to higher-added functions it would attract and consequently the more the profit it would anticipate making.

The GVC approach clarifies the process of governance and upgrading for global industries, describing the governance concept which illustrates the role played by lead firms in distributing and organising economic activities along the GVC (Lee & Gereffi, 2015). These authors point out that the GVC analysis also looks at other types of relationships and synchronisations that exist between autonomous firms scattered in different countries. The GVC analysis also looks at public and social governance and the institutional elements that impact on them (Lee & Gereffi, 2015).

As an approach that centres on the analysis of the sequences of value-added during different stages of production, the GVC framework studies various players in the value chain and how individual businesses can add value or remain competitive at whatever stage they operate, as well as how they can move up the chain. For the current study, the focus is on how GVC theory can help to study how learning and skills acquisition in the auto industry is achieved in specific occupations at firm level.

However, Morrison et al (2008) caution that the GVC framework does not offer a clear process of how upgrading takes place in terms of all the processes involved for moving on to different levels in a value chain. The analytical framework based on a technological approach is then used to show how some GVC studies look at the concepts of learning innovation, basing the argument on the assumption that participation in a GVC leads to positive results on all local producers, without considering other necessary inputs such as sufficient investment in technology or learning capabilities.

The research carried out by Morris and colleagues (2008), set out to approach the study from a different perspective by suggesting firstly that the focus should be on the endogenous process of technological capability development for the efforts of a specific firm, as well as the contextual factors that hinder or enhance these efforts. They also suggest that it may be necessary to study the mechanism that allows for knowledge to flow among different GVCs. In addition, innovation theories, as well as the study of knowledge in the mechanism described above, can help in understanding such a complex concept (Morris et al, 2008).

2.3. Governance in value chains

In his earlier work, Kaplinsky (2000) argued that the concept of governance, as well as the various chains, is essential to understanding how value chains work because, according to him, it is not just a matter of being a participant in a global value chain production but also how efficient that participation is that determines the rewards. He observed that the rents were becoming increasingly concentrated within a few global locations, making it difficult for developing countries to make significant returns from their investments.

Gereffi (1999) differentiated between two types of value chains, describing the first one as buyer-driven, where the key governance role is played by buyers, and the second as producer-driven, where the main producers in the chain play a key role because they possess core technological resources and are in charge of coordinating the relevant links along the chains. The automotive global value chain fits more within the producer-governed category. Most of the automotive companies are owned by multinational companies, which also set the rules and standards of operations and production, to which suppliers must adhere. As links along the value chain become more and more integrated, so does the need for more collaboration among these links, which is where the role of governors becomes vital, especially in developing countries where the firms have to find ways to upgrade on the value chain.

Governance is a concept that is essential to understanding the nature and dynamics involved in the relationship among firms participating in the value chain. This is because governors in any chain are the key decision-makers regarding specific requirements such as delivery times, quantities and qualities as well as prices of the products (Morrison et al, 2008). This concept of governance along the value chain has been emphasised in global value chain literature as it determines how the organisations are interconnected. Lead firms play powerful roles as they can set rules and standards that must be adhered to. Large manufacturing firms, big multinational producer firms or Tier 1 suppliers can wield influence and demands on firms at the lower end of the chain, such as insisting on higher operational standards or other specific requirements (Morris & Barnes 2006). Three types of governance are obtainable in value chains. First are networks, in which many firms share relatively equal abilities and competencies. Second, quasi-hierarchy, in which relationships between independent firms are not equal, and one firm is subordinate to the other. Thirdly, hierarchy governance where a firm is owned by an external firm (Morris & Barnes 2006).

The GVC analysis emphasises the essential role that lead firms play, especially in transferring knowledge and competencies across various stages of the value chain. For firms in developing countries, guidance provided by lead firms particularly assists in gaining insight on processes required to access global markets through upgrading. The present study is particularly interested in looking at the role that lead firms play in assisting firms on the lower end of the hierarchy, such as their supplier firms, especially in areas of learning and knowledge production for these firms to meet the standards expected by the lead firms.

Ponte and Sturgeon (2014) posit that opportunities and obstacles that have risen alongside global value chains for both developed and developing countries imply that there are no firms, however small or large, that can now be shielded from global competition. They argue that there is no single theory that can help to understand how economic systems work in various countries or regions because there are always different factors involved which cannot be explained simplistically. On the part of the concept of governance on GVC theory, the authors highlight the role played by influential multinationals in various ways such as through the huge orders placed to their suppliers in their value chains but focusing on the business networks that make up these value chains. They argue that the governance concept in GVC looks at actual practices, underlying forces and other organisational areas that make up the arrangements of cross-border trade linkages. On this concept of governance in global value chains, Ponte and Sturgeon (2014; 201) discuss three aspects namely governance as driving, governance as linking and governance as normalising:

Governance as driving: this is explained about how lead firms exert influence on member firms that make up the value chain by stipulating who, what and where value is added. Global buyers, described as the large multinational retail companies, are particularly more directly involved in the affairs of their value chains either through regional offices or from their headquarters or through intermediaries. Although most of these companies do not have their own factories, their purchasing powers allow them to dictate to the firms in their value chains the exact terms of production for the goods that they buy. For supplier firms to match the demands of the lead firms, they have to come up with strategies to meet the needs of their chain governors, such as moving their operations to low-cost areas as well as other means of reducing their own production costs.

Governance as linking: here, the focus is on how linkages are formed in different global industries and how information and knowledge are passed from one point to another and where these points are located. Gereffi and colleagues (2005) list five ways through which linkages are established and governed in firms. These include simple market linkages which are governed by price, modular linkages where transactional data governed by high standards is transferred to suppliers, relational standards where tacit information governed by trust and reputation is transmitted between buyers and suppliers, captive linkages governed by buyer power, where specific instructions are passed to less capable suppliers by buyers and, lastly, linkages within the same firm which are governed by hierarchy. These five linkages can then be related to the complexity of information exchanged in value chain tasks, the codifiability of that information as well as the capabilities available within the supply (Gereffi et al, 2005). Although the concept of linkages that exist at different points in value chains may affect how a value chain is governed, most value chains have various linkages which may include different businesses partners. Consequently, Ponte and Sturgeon (2014) argue that this complexity in linkages renders it difficult to characterise the governance concept in a GVC, and therefore adopt an approach that divides the concept into three different levels from the micro to macro.

Governance as normalising: this relates to the idea of re-aligning a practice to a standard or a norm and looks at the dimensions that exist between buyers and suppliers as price remains the best measure of quality. This concept is derived from convention theory which has been used to explore internal firm organisation and coordination in terms of how quality conventions are set up, in cases where the price is established as the main measure of quality (Ponte & Sturgeon, 2014; 201-207).

Other factors that can influence governance in GVCs can be external to the value chains and can come in the form of regulations, lobbying, civil-society campaigns and standards. While consumers exert influence on GVCs through their purchase choices, through boycotts, class-actions, or using purchased products for uses other than that intended by producers. Workers can also impact on GVCs governance through actions such as strikes and through unions (Ponte & Sturgeon, 2014)). All these factors show that governance in GVCs cannot be broadly defined as it depends on specific contexts.

Two additional concepts ‘diversification’ and ‘upgrading’ are differentiated where upgrading is described as representing a shift towards specialisation in higher value-added goods within

the same sector and diversification involves specialising in new areas of comparative advantage in different sectors (Morrison et al, 2008).

In the process of upgrading, innovation is considered to be most important because it is the level and depth of technological advancement and abilities that determine local firms' industrial capabilities. Therefore, technological capabilities and the corresponding determinants in a firm should be the basis of analysis. The Technological Capabilities model which is derived from Nelson and Winter's work (1982) suggests that a study of technical capabilities in developing countries should be carried out to understand the process of industrial development and innovation (Morrison et al, 2008). The technological capabilities referred to in this case include the technical, managerial or organisational skills which firms need to apply to the hardware (equipment) and software (information) of technology to accomplish any process of technological change. These capabilities are specific to each company as institutional knowledge consisting of individual skills and experiences are acquired over time. Therefore, for technology to be properly adopted by firms, an overhaul of technical skills as well as the required equipment is necessary (Morrison et al, 2008).

2.4. Globalisation and the GVC theory

Globalisation has brought with it many opportunities as well as challenges. GVCs are increasingly extending and creating new opportunities for firms globally to participate at various stages of the value chain. Since the playing field is now global, firms have to compete internationally and this presents a challenge for developing countries as they can no longer compete based only on cheap labour. Auto firms in South Africa, like other developing countries, have to invest more in knowledge production to compete effectively for business with the rest of the world and to attract more value-added functions in their productions.

According to Gereffi and colleagues (2011), the GVC approach helps to clarify the role of training standards as well as product and process certifications in assisting the workforce in developing countries to achieve better skills, improved working conditions and better production and integration within the global economy. This approach enables us to look at how the industry is organised in terms of the functions that firms in South Africa are mainly involved in, the skills- related concerns and how learning and knowledge are developed for the

purposes of upgrading on the value chain. It also adds new insights to our understanding of innovation.

The GVC framework has, however, been criticised for being too focused on global industries; in response, Fernandez-Stark and colleagues (2012) have argued that the opening of regional markets to global value chains leads to improvements in operational standards in developing countries because their firms are compelled to meet international standards to compete effectively. In producer-led value chains such as the automotive industry, lead firms play a principal role because they prescribe standards and use their positions to influence quality from their suppliers.

Developing countries may struggle to meet some of the high standards in some markets as they lack the necessary resources such as human and financial capital and are, therefore, sometimes unable to sustain participation in global value chains (Fernandez-Stark et al, 2012). As the South African auto industry supplies to domestic, regional and international markets, it is involved in a complex production system that needs to meet the various standards and demands from different markets which presents a real challenge for local auto manufacturers.

Fernandez-Stark and colleagues (2012) observe that, even though the GVC framework has been used in studying the participation of developing countries, this framework has not been used in looking at firm learning and knowledge production for upgrading. Consequently, they came up with an outline by which GVCs can be connected to human capital and labour markets:

- First, they state that, using the GVC methodology, all aspects of the value chain and their corresponding activities can be highlighted. This would then inform a country's position in the value chain through the activities that the country performs on the value chain;
- Second, a study of the human capital involved in specific activities in the value chain can help understand the skills required for each stage;
- Thirdly, a linking of skills needs with the projected upgrading trajectories would assist in providing guidance for countries to estimate future workforce and skills requirements and therefore prepare ahead accordingly (Fernandez-Stark et al, 2012; 8-9).

Even though the points discussed above do not link directly to firm learning, they can help in exploring how learning and knowledge production strategies suitable for value chains can be developed. This can be achieved by looking at the activities that the firms are involved in on the value chain with a view to designing and executing learning programmes that best suit those activities.

Kaplinsiky and Morris (2016) add that the GVC framework addresses a trust-intensive trade relationship, particularly among parties with thin equity links as well as intra-firm trade within multinational corporations. These two types of transactional interactions require governance and coordination among these pyramids of power along the value chain. The authors further distinguish between 'vertically specialised value chains' and 'additive specialised value chains'. Vertically specialised value chains are described as those that emanate from offshoring as more firms outsource or offshore non-core functions of their productions. These offshored functions are then carried out elsewhere around the globe, at the same time as the core functions remain with the original firms. Vertically specialised value chains usually exist in cases of products that require several components or input to manufacture such as cellular phones, cars or aeroplanes. Additive specialised value chains, on the other hand, involve sequentially adding value to each stage of the production chain. These tend to be the case in resource-intensive sectors where the primary input contributes a large proportion of the value of the final product and where the losses incurred during processing form an important component of the value of the final product value, for example, cocoa value chains (Kaplinsiky & Morris, 2016).

What would be the relationship between horizontal and vertical cooperation in a globalised world with increasing hierarchical economic relations? Several researchers point out that the concept of the value chain should be seen as a circle that starts with the procurement of raw materials and culminating in a finished product (Womack Jones, 1996, Kaplinsky and Morris, 2001). Knowing that production itself only leads to minimal benefits in terms of value-added and only an efficient incorporation of other value-added elements such as branding, design and marketing, yield significant returns on the value chain.

2.5. Thinning out and thickening in vertically specialised GVCs

Thinning out involves the outsourcing in production of most of the value-added products while the lead firms focus on their core competences. It is the exact opposite of what firms used to

do historically, which was to carry out most, or all, the value-added production in one factory. Thinning out has seen firms import most of the required components from other countries. Thickening in additive GVCs takes place when linkages are formed to add value, especially in cases of the resource sector. In this instance, firms endeavour to carry out most of the value-added domestically or internally as opposed to offshoring or involving external players (Kaplinsky & Morris, 2016).

Kaplinsky and Morris also discuss some mechanisms on global value chains which are important when making use of the GVC framework. They refer to chain governors that set the division of labour in the chain, consequently defining each firm's capacity to generate suitable rents, for instance by limiting the supplier's ability to develop the capacity to brand their own products. Lead firms also constantly scout the globe in search of other suppliers to bring the cost down by creating competition among their suppliers. This is one of the strategies that affect firms' ability to upgrade from one function to another on the value chain.

Global value chains differ from multinational companies because lead firms in global value chains have vested interests in assisting firms in their chains to upgrade and improve their quality of production. Lead firms in GVCs are more willing to share and transfer technical knowledge to independent firms under them. This, however, does not apply to all lead firms as some are reluctant to assist participating firms upgrade to higher functions such design and research and development, preferring to keep those higher-value functions for themselves (Rainbird & Ramirez, 2012).

Various final markets and different value chains impose different standards on producers. Governments, lead firms and civil societies are some of the agents that set these standards which impact on a firm's ability to upgrade. Smaller firms tend to find it particularly difficult to meet the high standards and are sometimes unable to sustain their participation in GVCs. It is thus important for firms on the value chain to develop capabilities that enable them to move into operations that generate higher rent. Some of the determinants for the distribution of higher rent functions on the value chain are highlighted by Kaplinsky and Morris (2016) as follows:

- Chain governance: chain governors determine the division of labour in the chain, influencing the capacity of individual firms to generate and appropriate rents. The main

aim here is to assist firms to enter into chains which provide the scope for upgrading their operations and to move out of links which have very low barriers to entry.

- Market insertion: different requirements are set, providing scope for different margins. These requirements are increasingly segmented and volatile, especially in high-income markets where command over brand names is an important determinant of rent distribution, and helps to explain the pattern of functional integration where formerly lead manufacturing firms have vacated production and subcontracted this to low- and middle-income economies.
- The importance of standards: different final markets and different GVCs impose different standards on producers, some of which are set by governments or lead firms.
- The power inequality: some GVCs have many buyers involving either final retail chains or intermediary firms in different sectors. The power inequality affects the division of labour in GVCs and the capacity of different producers to upgrade their offerings.
- Ownership embeddedness: different patterns of ownership affect the pattern of supply chain upgrading and hence upgrading trajectories in the GVC. Western firms are more likely to assist their suppliers to upgrade. However, MNCs from developing nations, such as China, have not been as good at assisting their suppliers to upgrade (Kaplinksy & Morris, 2016; 13).

The points above show obstacles to chain-upgrading at various stages of the value chain and in different value chains.

The value chain framework also helps to understand the process of market-led linkages through the analysis of the dynamics that drive supply chain development in lead-resource firms. Kaplinsky and Morris (2016) observe that performance in these firms is influenced by demands of both governments and civil societies; governments seek to diversify and maximise economic development from spill-overs from resource exploitation, by extending linkages to other sectors of the economy. The demands of civil societies on the other hand, can compel firms to adhere to certain standards, such as environmental or labour laws. Lead firms are consequently forced to adopt a Corporate Social Responsibility Supplier Development Scheme, which assists the development of firms, leading to efficiency for suppliers and also appeasing the demands of civil society for stronger localisation of production. This obliges lead firms to encourage certain improvements in production along the value chain (Kaplinksy & Morris, 2016).

There is concern about the opportunities that come with participation in global value chains, especially for developing countries, but the GVC approach is focused on examining how this participation affords opportunities to developing countries to learn, upgrade and innovate in skills and technology. This is because participation in GVC enables participating firms to move into more sophisticated higher-value-added activities on the value chain. International producer and buyer companies provide assistance and training to their suppliers and the rigorous requirements and high-quality demands which supplier firms have to meet assist these firms in moving up the value chain (Rainbird & Ramirez 2012).

2.6. The GVC framework and knowledge production in firms

Gereffi and colleagues (2011) state that upgrading is normal for firms participating in a value chain and that it plays an important role in competitiveness. Consequently, learning and knowledge production are important to a firm's ability to move up the chain and to be able to produce more value-added. The GVC approach is particularly focused on relationships among small and medium enterprises and big lead firms through which their access to global final markets are processed.

Gereffi and colleagues (2011), however, argue that lead firms and their value chain strategies which influence and impact on the upgrading capabilities of developing nations have not been adequately discussed within the GVC framework. They state that a key feature of the GVC approach is that it operates at a meso-level by looking at macro-factors that affect national economies and the micro-level focus on firms, workplaces and communities. The GVC framework, however, does offer a useful perspective which helps to analyse the demand for skilled workers as related to trajectories and paces of economic upgrading. This is made possible because upgrading trajectories follow clear patterns that can be recognised through GVC case studies and research on experiences of countries at different levels of development. These would indicate that there are multiple pathways, sequences and entry points for developing countries in any industry (Ibid).

The approach used by Gereffi and colleagues (2011), (operating within a GVC framework) for firm learning and knowledge development aims to link specific industries in terms of economic upgrading and to essential firm learning strategies that are required at each upgrading

stage. The argument here is that a good understanding of specific cases of value chain upgrading can help in planning learning programmes within reasonable and achievable upgrading trajectories which can be done by studying how other successful developing countries were able to achieve this. This is because a good knowledge of the relevant upgrading trajectories in different industries and contexts would point to skills needs, policies or business proficiencies that would be required to upgrade on the value chain.

Technical education has as crucial for upgrading to increase the number of artisans and technicians. It is even more so for developing countries as most firms are involved in the lower functions of the value chains. To this end, the authors advise increased investment in universal basic education and also in training of workers for current and future work. Therefore, it is advised that developing countries identify GVCs in which they currently compete, as well as those they can project to participate in and then prepare accordingly (Gereffi et al, 2011). Most of the firms in that study indicated a mismatch between the demand and supply and between the education and training institutions and the employers. Here, the authors argue for a more aggressive approach to training to enable firms in developing countries to compete effectively in GVCs and attract more investment. Proper coordination of this process among key stakeholders, including governments, businesses, education and training institutions as well as labour organisations, can lead the way out of poverty to formal employment and career development, especially in developing countries (ibid).

The lack of efficient information exchange among stakeholders in the value chain is also seen as a hindrance to efficient firm learning. The information that can be shared would include emerging trends or practices which could assist firms in keeping up with the latest development in the industry, thus enabling them to share new knowledge. However, both the educational and training institutions and the employers are implicated for poor communication; the training and education sector for being unable to produce workers with the necessary qualifications and the employers for being unable to communicate about their skill needs effectively. Gereffi and colleagues (2011) go on to argue that it has proven difficult to incorporate feedback from the industry when designing curricula in developing countries. These are the sort of problems that make it all the more important for firms to develop the capacity to sustain firm based learning because they cannot rely solely on formal education and training providers to meet their skill needs.

Inter- and intra-firm learning can play an important role in ensuring efficient information and knowledge exchange to benefit both workers and employers, and there is also room for formal education and training providers if they partner with firms to facilitate this form of learning. Fernandez-Stark and colleagues (2012) argue that developing countries must address the problems besetting the workforce structure urgently if they are to move along with the rapidly integrating global value chains.

Morris and colleagues (2006) divide organisational learning in GVCs into three major processes. Firstly, scanning, interpretation and learning, hypothesising, exposure and encoding; secondly, integration, generating, integrating, interpreting, acting and observing, assessing and designing; thirdly, implementing. These processes are further summed up into three learning stages, namely, acquisition, interpretation and application of information (Morris et al, 2006).

2.7. Successful participation in GVCs

In terms of efficient participation in the global value chain, Nigam (2016) identified the following as key determinants for beneficial participation in GVCs, market size, level of development, industrial structure, location, policy incentives, logistics and location in GVC. The size of a domestic market translates into potentially big sales while countries with a higher income as well as established manufacturing sectors have higher chances of succeeding in GVCs. Countries in closer proximity to established manufacturing centres like the USA, Germany or China also have higher chances of benefitting from participating in GVCs (Nigam, 2016). Nigam adds that countries which introduce policies that encourage foreign direct investment, export incentives as well as trade agreements also tend to succeed in GVCs.

The general benefits associated with participation in GVCs include improvement in trade, increased investment and a skilled workforce. These benefits increase even more as those countries with emerging economies can improve their specialisations in their respective level of value chain participation. Nigam (2016) warns, however, that developing countries should exercise caution before joining GVCs, especially if they do not have the necessary competitiveness domestically, arguing that caution is needed before opening up their local markets through trade agreements and market liberalisation policies.

CHAPTER III: SITUATED LEARNING AND WAYS OF SEEING LEARNING IN SOUTH AFRICAN EDUCATION AND TRAINING

3.1. Dual-path to education and learning

Conventionally, learning is described as:

> *A process by which a learner internalizes knowledge, either through discovering transmitted knowledge from others or experienced in action with others* (Lave & Wenger, 1991; 47).

There are dual lenses through which issues of learning are studied; these are the traditional educational perspective and the situated and relational approach. The traditional education perspective looks at learning as acquisition. This perspective approaches learning from the angle of formal education, including provision for education and training through institutions such as colleges, SETAs and universities. This approach also focuses on other factors affecting education and training, including shortages in some professions and trades, scarce skills and so on.

Situated and relational learning looks at learning as participation, by which tacit knowledge is produced, arising from processes such as cooperation between firms and training institutions as well as Research and Development institutes. The institutional mechanism through which situated learning occurs and develops is a result of relationships within and between firms, in GVCs between lead firms and supplier firms, and communities of practice within a clustered neighbourhood of similar producers. This study is interested in the practical, situated and relational learning that takes place in GVCs and in firm workplaces.

Although education and training encompasses both the act of acquisition in the classroom and participation in collective social practices, especially at the workplace, Guile (2010) observes that most educational stakeholders, such as state policy planners and government education departments, tend to see education and learning as acquisition, as classroom outcomes and shortages of critical professionalism and human capital and not as relational or experiential learning. Guile further criticises the tendency of policymakers and transnational agencies such as the World Bank, the Organisation for Economic Cooperation and Development (OECD), the International Monetary Fund (IMF) and the United Nations Educational, Scientific and

Cultural Organisation (UNESCO) to focus on one aspect of the role of knowledge in the economy, which treats knowledge as an abstract entity that is separate from any social practices, neglecting the role that tacit knowledge plays in the economy. This perception of education as individualistic, which stems from codified knowledge, and which is acquired from an expert teacher or professor and imparted to a passive student, overlooks knowledge that develops from situated learning which takes place through participation in social routines at work, through communities of practice, with knowledge creation that has a capacity to lead to incremental innovation (Guile, 2010).

Table B below provides a clearer picture of the two routes to education and learning, which are discussed above:

ROUTE 1: **Focus on individual**	**ROUTE 2** **Focus on collective processes**
Learning as an individual	Learning within a firm, region, cluster, government agency
The individual acquires a qualification	Society gains certain important 'collective production goods' embedded in institutional localities
Outcomes: Diploma Bachelor's degree Honour's or Master's degree, PhD Individuals are matched to jobs requiring these levels of education	**Outcomes:** Learning acquired through 'social practice' in a wide variety of settings Firm learning, dynamic capabilities, tacit knowledge, the absorptive capacity of firms Agglomeration of dynamic capabilities in a region or industry cluster
Education creates another member of a highly mobile global professional labour force Sometimes with few benefits to society but rewarding to the individual.	These dynamic capabilities are the foundation of local economies to enter the global knowledge economy where increasingly competitive advantage is based on the above collective and locational assets.

Source: Kraak, lecture notes on Wits M Ed programme, 2018

Although the dualism depicted in the table above may create a disjuncture in attaining a distinct overview of learning in the firm, it is necessary to incorporate both of them to paint an accurate picture of the learning and education process. One factor that both of these perspectives have in common relates to inadequate practical work experience. In terms of relational learning and

classroom teaching in the South African VET system, a major challenge is the absence of solid practical work experience and the build-up of relational capabilities.

3.1.2. Situated learning

In an expanded view of Lave and Wenger (1991)'s concept of situated learning, Evans and Rainbird (2006) put forth a new set of ideas that deviate from the former's original concept about workplace learning, especially in apprenticeships. These ideas suggest that the concept of 'novice' and 'expert' are not as important in the contemporary setting because even new workers join the workplace with some prior capabilities which they share with existing and more experienced workers. Evans and Rainbird (2006)'s expanded views on situated learning perceive learning in three ways, firstly, in practical activity, secondly in the culture and context of the workplace and or learning environment and, lastly, in sociobiographical features of the learners' life (Evans & Rainbird, 2006).

The situated learning concept contends that learning does not only take place in schools, colleges or training centres but also through informal channels which also serve as learning environments. Just as Vocational Education and Training (VET) theories take into account the vital role of work experience and practical activities, the situated learning concept focuses more on social aspects of learning as opposed to individualistic emphasis, as well as capabilities acquired from participation instead of specialised training that focuses on a single set of skills (Evans & Rainbird, 2006).

To elaborate further on these three dimensions, the authors explain that:

- To be practically situated requires engagement in actual work practices and workgroups, access to programmes of activity, as well as time and space provided for learning.
- Learning that is culturally situated is described as involving the history and culture of vocational education and training in the firm organisation or the working environment.
- Learning that is socially or biographically situated requires shared responsibility for learning and personal development, adjustment of the learning context to learners' interests and experiences and links between activities and chains of support, as well as the acknowledgement of social and emotional dimensions of learning (Evans & Rainbird, 2006).

- Some of the criticism levelled against situated learning includes the fact that it is centred on legitimate peripheral participation, and it does not lead to growth beyond the communities of practice. Other limitations of the concept are that the working relationship between novices and experts does not automatically result in learning because acceptance of apprentices as members of the community of practice is not always guaranteed. The social theory of situated learning is also criticised for its presumption that novices are accepted willingly by the community to share in learning and knowledge development which might not be the case for social discriminatory reasons (Evans & Rainbird, 2006).

3.1.3. Communities of practice

Wenger et al (2002:4) defined communities of practice as groups of people who share a concern, a set of problems or a passion about a topic and who deepen their knowledge and expertise in this area by interacting regularly. These kinds of interactions do not have to take place every day but, when they do, there is an exchange of ideas, insight and information-sharing as well as problem-solving among members. Benefits of participating in communities of practice include immediate help with problems which reduces the amount of time spent looking for solutions. Members are also able to develop professionally and to keep updated with whatever innovations and practices may arise in their respective fields while also being able to benchmark their capabilities against those of their peers (Wenger et al, 2002).

It is this shared method of learning that many see as a process of participation in a community of practice, which Lave and Wenger (1991) described as novices becoming experts to work together to achieve a common objective. In this sense, learning is defined as a social process of belonging to a community of practice, of developing an identity as a member of this community, of experiencing the meaning of common work tasks and of carrying out practical actions that contribute to the common work tasks (Wenger, 1998). The community of practice was described by Lave and Wenger (1998:98):

> *As a system of relationships between people, activities and the world, developing with time and in relation to other divergent and overlapping communities of practice.*

A community of practice, therefore, goes deeper than the technicalities or proficiency that may be required to carry out a specific task and also includes the relationships that develop from interactions with associations of people who share some area of knowledge or activity (Lave

& Wenger, 1991). In describing the situated cognition concept, Wenger (1999) added that this social process of learning could be perceived as a gradual process in which participation in communities of practice is developed through three main dimensions of becoming, experiencing and doing.

3.1.4. Learning through apprenticeships

The theory of novice and experts as described by Lave and Wenger (1991) is challenged in light of current complexities in the world of work where skills and capabilities of younger and older workers are not so simply distinguished. The notion that the novice is expected to learn and absorb knowledge from the older, more experienced worker in the execution of tasks does not necessarily ring true of the modern workplace. In particular, Fuller and Unwin (2003) argue that, in the contemporary world, young people enter the workplace with pre-developed sets of skills, knowledge and attitudes, implying that they cannot be called complete novices. This is because the prior knowledge and skills which they bring to the workplace can also be shared with their more experienced counterparts meaning that they may be perceived as novices only in the sense that they have to learn specific practices and procedures which they are yet to encounter (Fuller & Unwin, 2003). It is, however, highly questionable whether this view is applicable in the South African context, given the educational backlog resulting from the apartheid era and other concerns that are peculiar to this country. Employers in South Africa complain about the frustratingly poor capabilities of novices who enter the workplace for the first time and who come with very few capabilities to work. As findings from the automotive companies that took part in the study will indicate, artisans are more skilled than novices and, in the auto industry, the novice-expert transition is still a crucial journey which tradespeople have to make.

Billett (2016) argues that most human occupations emanated from apprenticeships and not necessarily through learning at educational institutions. He maintains that learning would rather have come from learners' active and independent engagement in occupational tasks, as opposed to direct teaching and guidance. With this view, Billett describes apprenticeship as a learning process that is facilitated by students themselves and not only what the 'experts' or 'masters' endeavour to impart to them. Apprenticeships, therefore, should be viewed as a form of learning which may be used to develop professional abilities and sustain them during the duration of their working lives.

3.2. Workplace-based learning

Workplace learning differs from training in that training infers a formally structured process of knowledge transfer, whereas workplace learning relates to both formal and informal training but more importantly to informal, through social relations in the workplace (Evans et al, 2004). This could mean, for instance, learning from employers or professional organisations associated with the profession. This type of learning differs from training as it focuses on learning within the work environment, aiming to address the learning needs of various stakeholders in the workplace (Evans & Rainbird, 2006). Workplace learning also refers to learning which develops from the context of employment going deeper than training, involving learning through and for the workplace (Sutherland, 1998: 5). The process of learning in the workplace is not necessarily formally structured and includes social interactions in the workplace. This process of learning at work relates to opportunities that are accessed through the employment relationship which might occur through professional organisations which employees may gain access to as part of professional networks. There may also be other opportunities to learn through on-the-job training which is provided to improve employees' understanding of their work within the organisation (Evans & Rainbird, 2006).

To understand processes of workplace learning, it is helpful to look at it as taking place in three layers in which two relate to the context of learning and the third to how workers themselves relate to the opportunities arising from this context. The first layer relates to wider social structures and social institutions, which impact on learning at the workplace, based on the level of support or recognition afforded workers, such as the provision of resources. The second layer is where various local factors can influence the learning environment of the organisation. This level of workplace learning is vital because it is where the acquisition of the actual learning culture should be cultivated. However, for firms, the primary objectives are often profit-driven which means learning comes second or third in terms of priorities. Even in firms where the importance of learning has been established, the development of learning policies usually lies with senior management, and may not be implemented easily at the workplace. The third layer relates to experiences of the workers and their personalities, with regards to how each individual takes advantage of the available learning opportunities; the more educated workers tend to gain more access to professional development opportunities compared to their less qualified counterparts (Hodkinson & Rainbird, 2006).

According to Hodkinson and Rainbird (2006), an approach that can be used to ensure that all workers have equal access to opportunities for learning, would be to establish, through the law, entitlement to learning educating managers, trade unions and workers. This, the authors argue- can be reinforced by instilling workers' confidence through the recognition of their tacit skills.

3.2.1. Restrictive and expansive workplace environments

A workplace environment is considered restrictive or expansive depending on the availability or lack of opportunities that facilitate further development of workers' skills. These can include personal and professional development which contributes to the experiences of the workers, with regards to how stimulating or dull the job may be, as well as the availability or lack of thereof of prospects for career development and advancement (Evans et al, 2006).

Rainbird and colleagues (2004) observe that the workplace can exhibit both restrictive and expansive characteristics in various ways. Restrictive features can be manifested through a lack of opportunities for off-the-job learning which would otherwise afford workers the exposure to new concepts as well as opportunities to reflect analytically on their jobs. Expansive features are exhibited by workplaces that allow access and facilitate experience to a variety of work methods as well as types of management that support the construction and dissemination of knowledge (Rainbird et al (2004). The authors argue that expansive and restrictive learning environments should be examined in terms of breadth and depth to determine their structuring as learning environments, which can then inform the design of skills policy and development for the workers and progress in their professions (Rainbird et al, 2004).

Additionally, Hodkinson and Rainbird (2006) explore, in the following steps, how expansive learning environments can be created with the help of various stakeholders, including managers, trainers and trade unions:

1. Identifying the scope of the existing learning environment. The authors observe that within the same organisation, opportunities for learning may differ, depending on the nature of the jobs of the workers within organisations. Some may have limited opportunities for mobility, while others may have opportunities to train or improve their qualifications and move on to more highly paid positions.

2. Assessing the current workplace against those scopes: upon identifying the dimensions of restrictions and expansions, the opportunities and restrictions on learning can be identified against those dimensions.
3. Identifying the potential for improvement. After assessing the existing learning environment, possibilities for improvement can be identified by examining how to loosen the more restrictive dimensions.
4. Identifying the balance of advantage. In this case, the best possible improvements suitable for the firm or organisation are identified for implementation.
5. Implementation and monitoring. It is important to keep examining and monitoring that these stages are properly implemented in the organisation to assess the impact on learning. What is advised here is also a dual approach which recognises the needs of workers individually as well as what pertains to the context of learning. This involves looking at ways to motivate workers to learn at the workplace individually and then to enhance the learning environment. Since most of the workplace learning takes place through day-to-day working activities, this informal learning environment should be enriched to promote a more beneficial learning environment (Hodkinson & Rainbird, 2006, 169:172).

Approaches aimed at performance management and short training initiatives are viewed as learning through the acquisition of skills and knowledge rather than through participation. These approaches are criticised for their failure to recognise informal learning which is not measurable. These approaches also do not accommodate working practices and conditions of employment as factors that impact on workplace learning (Evans et al, 2004).

The understanding that workplace learning takes place within the context of employment means that learning which is in, through and for, the workplace should take into account the needs of the different role-players involved, including employees, employers and the government. Those who support the learning of others at the workplace also have to be assisted in broadening their learning frameworks beyond those offered by their job descriptions. Evans and Rainbird (2006) highlighted constructivist and sociocultural theories as being best suited to study workplace learning because they acknowledge the importance of the context and environment in which learning takes place. These theories underline the importance of skills and knowledge as well as power relations in workplace learning, while also recognising that tacit and explicit aspects of skills and knowledge can be incorporated in creating knowledge.

The authors also suggest that these views show that learning takes place through determined social interactions which can be enhanced by appropriately structured teaching and learning environments (Evans & Rainbird, 2006).

3.2.2. Limitations in recognition of the role of tacit knowledge in firm learning

Kraak (2017) observes that, despite a general agreement in the various schools of thought including economic geography, evolutionary economics and innovation studies, about the importance of firm learning to global and national competitiveness, there has not been extensive research on the role of post-school institutions such as the polytechnics and technical colleges. Kraak (2017) notes that there has not been any study on the crucial interface between education and the world of work aimed at understanding how education and training institutions support the production of tacit knowledge both internally and externally. He argues that these schools ignore the societal and institutional foundations which shape the formation and social distribution of tacit knowledge generated in the workplace.

In the same way, some of the practice-based theories are criticised for overemphasising the situatedness while underestimating the institutional node where these practices take place. Kraak (2017) identifies two main flaws in the main literature on work-based research as follow: (1) the evolutionary school's neglect of the role of differing post-school institutions, such as the polytechnic, in supporting firm-based learning and (2) the 'practice-based' school's problematic incorporation of key institutions within their concept of 'social practices,' which reduces various mezzo and macro institutional processes to the level of the micro relational dynamics occurring within firms. Citing Guile (2010), Kraak argues that, even though practice-based accounts have become recognised in the academic world, the traditional cognitive view remains prominent in conventional accounts of education (Kraak, 2017).

3.2.3. Inter- and intra-firm learning

According to Bessant et al (2003), companies can only survive by learning to change and evolve to not only remain competitive but also to take advantage of available opportunities. The authors highlight the crucial role that learning plays, especially in the continuously integrated nature of the firm network, for all participating firms not only the prominent ones. This implies that firms have to constantly maintain an ability to learn and adapt amid the

integration, together with peer companies with whom they compete and with whom they are engaged in production and business.

Two main aspects involved in this kind of learning are identified. Firstly, one that relates to the accumulation and development of a central knowledge base, which serves as the main competitive advantage from other firms. Second is the ability to maintain a long-term capacity for learning across the entire organisation (Bessant et al, 2003). This model of learning is, however, not without difficulties and to overcome them, the concept of inter-firm shared learning proposed by Bessant and Tsekouras (2000) is advised. Advantages of this concept include mutual support, risk reduction and exposure to various other insights (Dent, 2001).

When looking at firm learning, it is particularly important to focus on tacit knowledge and the role it plays in firm learning. Unlike codified knowledge which is presented in formal curricula manuals, software programmes or other forms, tacit knowledge may be held by a person or experientially produced in action. Tacit knowledge can also be technical and cognitive, that is, encompassing techniques, processes and methods as well as values, beliefs and ideas (Mirvis et al, 2016). Schoenherr and colleagues (2014) add that tacit knowledge develops interactively over time through shared experiences and 'learning-by-doing'. It cannot be formally explained rationally but can be transferred through methods such as observation, imitation or other training-related techniques such as internships, work-study programmes, mentoring or job rotations (Lejeune, 2011). The study of the development of tacit knowledge in auto firms is one of the aims of this dissertation, especially as to how this type of knowledge is developed and how it contributes to knowledge production within auto firms.

3.2.4 Social capital as a contributory factor to inter-firm learning

Social capital is described as a "complex collective of social relations and institutions reached in organic collective market-driven processes" (Lorenzen 2007: 811). In defining the concept of social capital, Lorenzen (2007) referred to Woolcock (1998) who discussed various aspects attributed to social capital. These included altruism, trust and participation in various social activities such as voluntary social work and social inclusion, among others. Lorenzen, however, elected to look at some of these as outcomes of social capital rather than parts of it. The value of social capital is related to the argument that the competitiveness of firms, regions or nations is based on continuous, flexible and affordable production of knowledge. As competitiveness

shifts from efficiencies in production to efficiencies in learning, where firms start to adopt new production methods and innovative ways of conducting their business activities, this is where the value of social capital is best explained (Lorenzen, 2007).

It has been established that collaboration among firms leads to innovation and technological learning. Firms can innovate from their associations with other firms as they study each other's innovative practices and also from labour movements which lead to knowledge transfers. Associations between universities and firms as well as other knowledge centres are particularly highlighted as important sources of knowledge and information-sharing. The social exchange that exists among people belonging to the same clubs, associations and professions also contribute to informal learning and trading information. This also contributes to a reciprocal evaluation for firms in the same level of a value chain (Lorenzen, 2007).

Most countries show significant civic and business interactions nationally, and globalisation has created new businesses and a global civic community. Lorenzen (2007) however argued that none of these surpasses local alliances, informal exchanges and knowledge flow that take place through channels such as interaction among employers' associations, labour unions, social places such as local pubs, and other types of local connections and interactions. In terms of utilising social capital as a booster for economic development, it is important to acknowledge that not all localities have the same stock of social capital. Lorenzen argued that one of the reasons for the lack of social capital for some regions could be as a result of poor social relations, and for businesses this would mean a poorly coordinated supplier network which would lead to a situation where interactive learning is restricted.

It is also possible for regions to be abundant in social relations yet lacking in institutions that contribute to social capital. What happens, in this case, is that the institutional learning acquired through social relations leads to misunderstandings and failed collaboration instead of socially beneficially institutions. These kinds of contexts are filled with mistrust and lack of communication. Lorenzen (2007) suggests that the role of the state in accumulating social capital should be to establish a foundation for the promotion of social capital strategically and geographically across the nation. The state also has an obligation to ease regional policy-making processes to encourage investment in social capital, especially in the regions where it is lacking (ibid).

3.3. Some theories on work-place learning

Kraak (2017) identifies two dominant theories in work-based learning. These are the practice-based theory of situated learning and evolutionary economics. Discussing practice-based theories of work-place learning, he explains that there is a shift from a number of dualisms such as theory/practice, codified/tacit, individual/collective, acquisition/participation, product/process, mind/body, material/non-material to a collective process of learning, encompassing both formal and work-based contexts, which are supported by participation in social practice. These theories emanate from the school of thought associated with Lave and Wenger's work (1991), from whom the theory of communities of practice originated and from which several sub-schools on practice-based learning have since emerged (Kraak, 2017).

The other school, labelled the evolutionary school, focuses on the study of the firm as a social and economic establishment - specifically the role that learning plays within the firm in the new global economy as most of the value-added in production has become more and more dependent on the capabilities of firms and their ability to adopt new technologies. Thus, competitiveness is developed by channelling the tacit knowledge within the firm as well as through cooperation with neighbouring firms where tacit knowledge is shared.

3.3.1. Critique of cognitive-psychological accounts of learning

According to the Knowledge-Based Education logic (Guile, 2010), which is dominant in all the policy work of multi-lateral agencies (World Bank, UN and OECD) and policy discourses of most nation-states, learning for the KBE can be characterised as the individualised acquisition of existing knowledge or skills, with clearly defined disciplinary boundaries in the form of qualifications. Learning is distinguishable from 'work', and the knowledge that is learned in one context, such as college, is assumed to be readily transferable to other contexts such as the workplace. Thus, the KBE logic translates precisely into the credentials notion which presumes that an increase in skill levels of a country's workforce results in increased economic development (Masters Course lecture notes, Wits M E).

Lave (2009) disagrees with the traditional view of learning, which sees it as being mainly about the individual acquisition of formal knowledge and is perceived to be something that can be acquired and transferred while disregarding the influence that social and cultural roles may

have on the process. Lave points out that this view dissociates learning from other kinds of human activities, which are assumed to have no impact on the learning processes, as it does not account for how new knowledge may develop outside a formal teaching environment. James et al (2013) are also cited by Kraak as disagreeing with this logic, where they argue that it wrongly compares the attainment of formal qualifications to learning. Conversely, they point out that acquiring more qualifications does not necessarily translate into learning.

To establish a balance between individual and collective learning, Hodkinson et al (2007) acknowledge the importance of developing a theoretical framework that incorporates the individual learner in a sociocultural theory of learning. The authors observe that, although many cognitive thinkers recognise the wider significance of the situation and that many situated learning thinkers acknowledge that individuals are significant, there have not been many scholars who have recognised the importance of both (Hodkinson et al, 2007). Hager (2009) contends that the main issue centres on constructing a joint and balanced perspective on learning which supports the process of learning as both individual and social, while acknowledging that, in some cases, learning is more individual and in others, more communal, social and situated.

3.3.2. The practice turn

The practice turn, a terminology that emerged from Schatzki, Knorr, Cetina and von Savigny's book (2001), describes a shift in theoretical thinking about the understanding of how learning takes place. This theory sees learning as socially constructed and as occurring collectively in education and training institutions, in social life and the workplace (Guile, 2012). This approach moves away from the traditional individualistic view of learning associated with the global educational policy of the KBE, which focuses on increasing the acquisition of formal qualifications in formal educational institutions.

Lave and Wenger (1991) concur that learning is more about participation than it is about the acquisition. Wenger (2009) goes on to suggest that participation occurs in different ways.
For individuals, learning is about engaging in, and contributing to, the practices of their communities. For communities, learning is about refining their practice and ensuring new generations of members. For organisations, learning is about sustaining the interconnected communities of practice by which an organisation knows what it knows and thus becomes

effective and valuable as an organisation. Learning, in this sense, is not a separate activity; it is an integral part of our everyday lives (Wenger, 2009: 213).

The main idea presented by Lave and Wenger here is that participation in social practices is an epistemological principle of learning because it is only by varying or changing our mode of participation that we come to embody the knowledge and skills of the community of practice and learn to use it in more encompassing ways (Guile, 2010).

3.4. Artisan and apprentice training

Wildschut and Meyer (2016) describe an artisan as a person who is skilled at practising a particular trade or handcraft. Training for artisans usually comprises vocational education and extensive practical training experience. Historically, artisan work used to be associated with traditional crafts, but it is now also characterised by skilled manual labour, especially in manufacturing and even in the provision of services in the services and financial sectors (ibid).

In looking at the training trajectory for artisans and apprentices in South Africa, Gamble (2016) incorporated some of the findings of a study carried out earlier (Kruss et al, 2012), which found disparities between the type of skills needed at the workplace and those with which apprentices and learners were equipped during their training. For artisans, Gamble's findings indicated that technical proficiency was important to the nature of their work, whether it was acquired formally or through a more technologically knowledgeable colleague or peer.

Essentially, on-job training at the point of job entry remains the main means of guaranteeing workplace capabilities for both workers who join the world of work without the appropriate qualifications and those with some formal qualifications (Gamble, 2016). The findings of her study also indicated that there would be an increase in training and development, possibly necessitated by increased participation in global markets, which would require alignment of quality of production and services with international standards. A highly knowledgeable and informed clientele in future will also result in the need to maintain an equally highly competent workforce to match the increasingly sophisticated demand. Gamble also observed that investment in education and training would, to a large extent, be dependent on the trust that employers have on the supply side of formal education and training with regards to the quality of education and training produced.

3.4.1 Trends in apprenticeship training in developed countries

In a study of apprenticeship programmes in several countries including Germany, Denmark, England, USA and Ireland, it was found that they all had measures in place to support apprenticeships, but Ireland was found to have the most effective system (Buchanan et al, 2009). Like many other countries, the apprenticeship system in Ireland suffered a setback as a result of the 2008 economic recessions. What made the Irish apprenticeship system stand out from other countries, however, were the measures introduced by the Irish government to rectify the situation (ibid).

These measures included firstly, an Employer-Based Redundant Apprentice Rotation Scheme aimed at assisting unemployed apprentices to afford them the experience and skills to enable them to complete their apprenticeships. The employer would take on the non-placed apprentice while their existing apprentice was on off-job training and train them, paying them an agreed rate which would be matched by the Irish Training Authority. This specific initiative was aimed at construction apprentices, having been the worst affected by the slowdown in the local economy. The second strategy involved a coordinated work placement programme in partnership with the Irish Electricity Supply Board, aimed at apprentice electricians to assist them in completing their training. Thirdly, an initiative by the Irish Training Authority aimed to find jobs for apprentices in the European Union, supported by the European Commission. The Irish Training Authority also established training programmes for apprentices who could still not find work, aimed at re-training in scarce skills as well as specialised green skills. There were also other programmes developed by the state aimed at higher-level education through universities and technology institutes (Buchanan et al, 2009). The successful approach of the Irish has features that could be adopted by other countries, including South Africa, in promoting artisan and apprentice development, especially to facilitate opportunities for trainees to complete their on-the-job training.

3.5. The absence of a dual perspective in South African vocational training policy and research

The emphasis on transforming and modernising vocational training within the South African Technical and Vocational Education and Training (TVET) college system has resulted in the establishment of training policy that is inclined towards the traditional acquisition of skills which takes place through formal classroom education. This is evident through the promotion

of the (National Certificate Vocational) NCV curriculum which places little emphasis on practical training and has side-lined the old apprenticeship training system. It is also evidenced through the limited research available on South African policy on training that highlights the importance of tacit and situated knowledge which develops through learning in the workplace.

This discounting of situated learning and tacit knowledge that is developed within the workplace can be traced to the decline in the apprenticeship training system which occurred in the aftermath of the global economic crisis of the 1970s; a period which saw profit and investment slump globally, leading to some major labour market changes (Osterman, 2014). The subsequent changes in the system of employment had a negative effect on apprenticeship training. These changes included factors such as deregulation in various sectors of the economy, which has transformed the competitive landscape; the spread of new technologies that allow companies to organise work in new ways, such as just-in-time inventory, work-teams and outsourcing – all of which led to increased productivity but with leaner staffing. The changing nature of skill and the weakening incentives for employers to maintain long-term links with employees have also negatively impacted on apprenticeship training as the most structured form of internal labour market training and employment (Kochan, Finegold & Osterman 2012; Osterman, 2014).

In the South African context, apprenticeship training was even more affected by government strategies such as the Growth, Employment and Redistribution (GEAR) strategy in 1996, which sought to curtail the financial deficit in the new democratic state. This led to a radical reduction of the government's investment in public infrastructural projects, which in turn resulted in reduced numbers of apprentices contracted to public companies such as ESKOM, SASOL and TELKOM (DoF, 1996). The austerity measures instituted by the government also meant that there were fewer bursaries and work placement opportunities available for the training of technicians and artisans.

3.5.1. The impact of the introduction of the NCV curriculum on the college system

The introduction of the NCV curriculum in 2007 presented a drastic change in the college system in South Africa. Through this new curriculum, the government sought to create vocational training programmes that would simultaneously support vocational skills and build a strong general education base (DoE, 2008). It, however, failed to deliver on both the desired efficiency in vocational training and quality in qualifications and instead, further alienated the

industry because it was perceived by employers to be even more lacking in the crucial practical component than the National Accredited Technical Education Diploma (NATED) programmes (Archer, 2010; Kraak, 2011; Scott, 2018).

The NCV curriculum was also seen as an attempt to move away from a vocational training system that was directly aimed at the needs of the economy and labour market. The government's promotion of the NCV through bursary and sponsorship schemes led to a major decline of the 'N' programmes as these received no funding and enrolment to programmes other than the NCV were limited to 20% (DoE, 2008). The de-emphasising of N1-N3 enrolments and a change in funding for learnerships away from colleges to SETA funding resulted in significant reductions in enrolment of N1-3 courses by 2010, a reduction of key components in artisanal training (Kraak, 2011).

The period of policy change in the college system has seen an emergent shift in the employer preference from public to private training providers or by developing their own in-house-training facilities, which shows the extent to which employers have lost confidence in the public colleges and the new NCV curriculum, which they deemed to be inadequate for artisan qualifications (Mzabalazo, 2014).

Due to several factors, among which was the required evidence of workplace experience for Trade Tests, the success rate of the NCV has remained very poor because employers are still not eager to take on NCV students for the practical aspect of their training, having preferred the NATED programmes over the NCV. An Organisation for Economic Co-operation and Development OECD study on the South African Vocational Education and Training (VET) system also found that lack of access to workplace training for both the NCV and N programme students has been a major limitation, especially for the NCV programmes, which did not require work-based training in the curriculum (Simon et al, 2014).

Research from the Swiss-South African Cooperation Initiative (SSACI) has shown that the apparent snub of the public college system by the industry in South Africa has persisted. The figures below shows the SSACI research findings demonstrating that employers have a strong preference for in-house or private provision of the theoretical and simulated practice components of the apprentice training rather than that offered at public TVET colleges:

Percentage distribution of training providers of apprentices

INSTITUTIONS	PERCENTAGE
Public TVET Colleges	25.3%
Private Colleges	12.3%
Company in-house training centres	62.3%

Source: SSACI, 2017.

3.5.2. The need to align industrial and training policies

As seen above, the reforms that were instituted for vocational training in post-democratic South Africa, have resulted in some (negative) unintended consequences. There are various factors that can be attributed to this, some of which would include policies that over-emphasise the traditional classroom-based method of knowledge acquisition, at the expense of other types of knowledge, especially the situated and tacit which is acquired informally in the workplace.
There has also been a tendency to enact policies that are too general, which do not accommodate the specific needs of different economic sectors. As Pavitt (2003) observes, firms operate in different sectors, adopting different features of innovation processes, which require different kinds of support from the government. Policy alignment should use a differentiated process, which should take into consideration such differences (Pavitt (2003). This implies that instituting a one-size-fits-all approach to skilling across all sectors, ignoring the specifics of sectoral location and how sectoral technologies shape the skills needed in those industries, would only lead to an inefficient vocational education system that is not in step with the industry's skills requirements. Sectors such as the auto industry, which is becoming more and more automated, requiring sophisticated robotic technologies, need a vocational education that can produce an equally highly technically qualified workforce that can meet these skills needs.

In light of this, Kraak (2009) argues that certain important conditions must be put in place to have an efficient alignment of skills development and industrial policy:

- The policies should be embedded in appropriate structures that are institutionally intimate with employers and their specific sectoral needs and which provide the state

with conduits to privately held knowledge and information, 'situated knowledge', not usually volunteered in competitive market relations.

- These institutional agencies will be required to achieve forms of deliberate association with the state and other firms, which succeed in moving private actors beyond points they would not normally pass on their own (Kraak, 2009; 19).

Kraak also agrees with Pavitt (2003) that each sector deserves skills development strategies that are tailor-made to match each sector's conditions. Kraak points out that this would not only require that government changes the approach used to design policies, but also how intermediary agencies such as SETAs and their officials can develop the capacity and expertise to implement policies that are relevant to the sectors they represent (Kraak, 2009).

3.6. Challenges in firm learning in the auto industry in South Africa

As a highly dynamic sector, the automotive manufacturing industry is constantly expanding, and new technologies are being introduced which leads to increased demand for highly skilled and well-trained artisans, especially those with sound exposure to practical knowledge and understanding. In particular, the quality of qualifications of newly recruited technicians from education and training institutions is constantly brought into question, due to inadequate spaces for work placement to gain practical experience.

Although South Africa does have many reputable higher educational institutions that should be producing highly trained workers for the automotive sector, there are problems in terms of meeting specific skills required by the industry and those supplied by the educational and training institutions, this mismatch having been underscored many times by the industry. The auto industry in South Africa itself has, however, also been at fault for not committing adequate resources to training because, when compared to the international average of 3.2%, expenditure on training remained below 2% 2006 (HSRC Report on the auto industry, 2008).

3.7. Support for skills provision in the auto industry in South Africa

There are a number of higher education institutions that have established various partnerships with the automotive industry to promote learning and knowledge production. Nelson Mandela University (NMU) in the Eastern Cape has several training programmes which focus

specifically on the automotive sector. NMU also has several research centres aimed at supporting the automotive industry. These include the Institute of Advanced Manufacturing and Engineering Research (IAMER), the Automotive Component Technology Station (ACTS) and the Advanced Mechatronics Technology Centre (AMTC) (NMU website). Additionally, in 2005, NMU introduced a programme called the Automotive Experiential Career Development Programme (AECDP), a collaboration involving NMU, the AIDC, local businesses and the Nelson Mandela Bay Municipality, aimed at sponsoring young students interested in the automotive industry. This programme sponsors regular workshops, an annual two-week winter school for Grade 12 students and aims to eventually promote and increase the number of black engineers and technologists in the automotive industry. The programme also targets workers already in the industry, encouraging them to improve their qualifications.

According to the 2008 HRSC report on the auto sector, the most reputable institutions in terms of meeting the skills needs of the automotive industry include NMU, the Volkswagen Education and Training Institute, the University of Pretoria, the University of Cape Town and the University of the Witwatersrand. These institutions provide middle management and professional staff training for artisans, top management and professional staff, among others (Barnes & Meadow, 2008:52).

The National Tooling Initiative (NTI) and the graduate placement programme initiated by the Department of Science and Technology, called the Advanced Manufacturing Technology Strategy (AMTS) are some of the other initiatives that have been put in place to mitigate skills related shortcomings in the manufacturing sector. The NTI started in 2000 to improve tooling skills within the automotive sector and the general engineering industry. The AMTS is coordinated through the AIDC and South African Automotive Benchmarking Club (SAABC), and it is through this programme that fresh graduates are placed at automotive and components manufacturers to gain practical experience and for firms to have access to skilled workers whenever they are urgently needed. The AIDC also runs various human resources development programmes which develop technical schools in conjunction with tertiary institutions in Gauteng and the Eastern Cape. Similarly, the Durban Automotive Clusters (DAC) run benchmarking programmes aimed at improving skills of senior and middle management within the automotive component industry in the Kwa Zulu Natal region.

3.7.1. Sector Education and Training Authority (SETAs) as facilitators of learning within the industry

The establishment of SETAs in 2001 after the promulgation of the Skills Development Act (Act No. 97 of 1997) was done to address and improve provision for skills development at the workplace. There have since been several restructurings of SETAs; in April 2005, the 25 SETAs were reduced to 23 and, in April 2011, another restructuring resulted in mergers and formations of new ones, as well as a further reduction to 21 SETAs operating under the DHET.

Since their inception, SETAs have been plagued with many shortcomings which have hindered efficient execution of their mandate in the various industries with which they are affiliated. Kraak, in a 2013 report to the Human Resources Development Council, highlighted some of the hindrances that prevent SETAs from carrying out their supportive role to the industry effectively. These include inadequately qualified staff and a lack of proficiency in the dynamics of the complex economic sectors in which they work, among others. As facilitating agents between training institutions and employers, SETAS are supposed to provide sector-specific business support.

3.7.2. Some criticisms of the SETA system

Archer (2010), in his assessment of the SETA's performance in South Africa's national skills development strategy, found some major problem areas. Outlining functions of SETAs by categorising them into two namely administrative and regulatory as well as compensatory (for market failure in the skills acquisition process), he described SETAs as intermediary institutions which play a vital role in addressing market failure. He suggested that these types of intermediary institutions are needed to arbitrate different interests of various parties, including employers, workers, training providers and the government.

Archer pointed out that, in terms of information, the most challenging problems facing intermediary institutions such as SETAs are obstacles in obtaining information about the intentions, investment decisions and willing collaboration of decision-makers in the sector. This relates to a lack of information on, for instance, the likelihood of poaching skilled workers from the firms that do train by those that do not (Archer, 2010).

Some other criticisms of the SETA system include that done by Singizi in 2007 and Marock et al in 2008. On the issue of poor planning on skill projections by SETAs, the observation from the Singizi report was that an intermediary body such as the SETA, could not be said to be in a position to identify the exact needs in production and that neither would there be a satisfactory process of identifying or aggregating the actual training that is carried out at the workplace, which is what is presumably expected of SETAs. The Singizi report highlighted the complexity of the national training system, suggesting that it lacked prioritisation or ranking of the separate items as all objectives in the National Skills Development Strategy are given equal priority. The report also observed that, over the years, the range of functions carried out by SETAs had been increased to include functions that could have been undertaken by other institutions. Some of these added responsibilities include training career guidance counsellors, recruiting learners directly into learnerships and ensuring their placements into workplaces, promoting SMME creation, among others.

Marock and colleagues (2008) pointed to the general negative perceptions associated with SETAs which emanate from failures and inefficiencies of some SETAs but which ultimately taint the reputation of all of them.

The National Business Initiative (NBI) also offered some criticism of the system mostly based on the perspectives of the employers. Companies that were consulted in the compilation of the report expressed dissatisfaction with the level of support offered by SETAs. The companies wanted SETAs to be more transparent and focused regarding their approach to funding, especially in areas of technical skills, such as apprentices and engineers. A need to increase funding to develop mathematics, science and accounting was also highlighted by the participating companies (NBI Report, 2007).

It would, however, not be fair to group the performance of all the SETAs in the same category as some have been able to carry out their mandates effectively. The Metals Engineering and Related Services Education and Training Authority (merSETA) has been commended by some of the participants in the current study as having made a positive impact on its sector.

3.8.Government's (planned) intervention in training and skills provision for the industry

In addressing the many weaknesses that have been identified within the education and training sector, the government has introduced various measures, especially aimed at improving

provision for skills as well as facilitating learning and knowledge development within the industry. The 2013 White Paper on post-school education and training and the 2017 draft National plan for post-school education and training below highlight some of the government's plans for the sector.

3.8.1. The 2013 White Paper on post-school education and training

The main objective of the government in the White Paper is to streamline the coordination of the post-school education system within the Department of Higher Education and Training. The White Paper emphasises the crucial role of technical and vocational education and highlights strategies for transforming it, defining its place in the post-school system.

Listed below are some of the government's plans to build stronger cooperation between firms and TVET colleges, facilitating learning and knowledge development in the industry for the post-school sector as outlined in the White Paper. As the main purpose of the TVET colleges is to prepare students for the workplace and self-employment, the importance of developing and sustaining close working relationships with employers in their areas of study has been highlighted in the White Paper:

- The White Paper emphasises partnerships between colleges and employers in supporting colleges to find opportunities for work-integrated learning and to help them place students upon completion of their studies.
- It also strongly suggest special arrangements for college staff to obtain regular workplace exposure to keep themselves updated on developments in their industries.
- Employers and experts from industry are also encouraged to contribute in the form of advice around issues of curriculum and by teaching at colleges on a part-time or occasional basis.
- It states that colleges would also benefit from donations of equipment from particular employers; this would be mutually beneficial to employers and students because young people would get to assist the business while they learn and also allow employers to assess them during their workplace training for possible later recruitment.
- The White Paper encourages SETAs, individual employers, education institutions, South African Institute for Vocational and Continuing Education and Training

(SAIVCET) and the DHET to cooperate in facing important difficulties which include increasing access to workplaces for students in vocational and higher education in the form of various of types of work-integrated learning. Educator knowledge and experience through the provision of appropriate work-exposure opportunities for TVET lecturers are emphasised.

- As part of the strategy of expanding the delivery of skills development through TVET colleges, SETAs were urged to work with colleges and SAIVCET on sector-relevant curricula and materials with a specific focus on integrating theoretical and workplace learning.
- To facilitate the close working relationship that is necessary, it was advised that SETAs maintain a presence in the form of offices shared by some SETAs in the institutions, starting with the TVET colleges. Depending on the curriculum focus of the particular college, SETAs would be able to assist them in developing collaborative partnerships with employers in many sectors.
- Given the expected needs of the economy, a particularly important form of work-integrated learning is artisan training through apprenticeships or learnerships, which are presently used mainly to produce artisans in the engineering and construction industries. The National Artisan Moderating Body (NAMB) has been established to monitor the quality of artisan training and testing, to assure the quality of trade tests and the trade testing system, and to make recommendations to the Quality Council for Trades and Occupations (QCTO) on the certification of artisans.
- An important development in the management of the Strategic Infrastructure Projects is the establishment of occupational teams which bring together representatives of employers, education and training providers, professional bodies and others, such as trade testers and licence issuers. Their purpose is to address problems of curriculum relevance and alignment between institutional (theoretical) and workplace (practical) learning as well as work placement problems at a systemic and national level.

Having acknowledged that TVET colleges are currently not sufficiently equipped to take on these new responsibilities, the DHET has outlined a plan to address shortcomings which would involve setting up a ‘benchmark of optimal functionality’ to determine the intervention needed in each institution (the Minister of Higher Education and Training).

3.8.2. Draft National Plan for post-school education and training (2017)

The plan has been described as a roadmap for the development and reinvigoration of the post-school system in South Africa in the period of 2018-2030, providing an implementation framework for the 2013 White Paper on post-school education and training. The plan outlines various steps that have been introduced to ensure that these goals are achieved.

One of the key ideas of the plan is the acknowledgement that more opportunities for post-school outside the higher education sector are needed. This is because universities alone are not enough to accommodate all school leavers, which highlights the need for a more diverse spectrum of opportunities. The plan also clarifies the envisaged roles that TVET colleges should play in mid-level programmes aimed at the development of formal employment, self-employment and other forms of employment.

On the problematic and complex relationship between education and the labour market, the plan advocates the establishment of a central skills planning mechanism shifting focus from scarce and critical skills to qualifications and programmes for occupations in high demand, including programmes that will provide employment opportunities for a large number of people and support social development priorities. To achieve these goals, efficient integration of institutions that are part of the skills system including private providers, workplace training, labour market intermediaries, SETAS, the National Skills Fund and the National Skills Authority is advised.

3.8.3. TVET Colleges

According to the plan, some of the problems identified within the TVET college system include qualifications which are not fit for purpose, inadequate funding, lack of systemic planning for public TVET colleges, limited access to workplace-based learning for TVET students in public colleges, complications relating to staffing and governance capacities in the system. Capacity building of lecturers, administrative, management and student support staff have also been identified as needing improved efficiency. Workplace-based learning as a key link between TVET colleges and the world of work and strategies to improve employer participation in workplace learning has also been highlighted as crucial. A new set of qualifications for the

TVET colleges would be introduced. The role of SETAs will also be amended to support skills planning through engagement with the industry. They will focus on building their relationships with workplaces to facilitate practical experience for graduates and will, with the support of the DHET, provide funding to support workplaces to increase enrolment and throughput in occupational qualifications.

3.8.4. Workplace-based learning

Problems identified by the plan regarding workplace learning include:

- The fact that work-based learning is not currently a requirement for the two main qualification types being offered at public colleges, the NCV and NATED.
- Most TVET colleges lack staff or divisions that support work placement.
- Lack of funding as the DHET does not fund workplace-based learning.
- Weak links between the industry and the TVET colleges.
- Policy incoherence which discourages employers from taking on students for workplace-based learning, where the Labour Relations Act allocates apprentices and students on short workplace-based learning the same rights as permanent workers, thereby placing undue risk on employers that take in trainees.
- Similarly, the Compensation for Occupational Diseases Act does not provide for short term learners in the workplace through the National Insurance Scheme, making employers fully liable for the full cost of injuries to students while on training.

To strengthen workplace-based learning, the plan proposes the following:

- That the workplace-based learning for students is designed and planned carefully to suit both students and employers.
- That institutions should have adequate and qualified staff to support workplace-based learning, including staff for workplace-based facilitation, integration of continued professional development who would pursue partnerships with employers, with the assistance of SETAs.
- Implementation of work-based learning programmes by employers must be supported by the DHET, recognising that training is not the primary focus or responsibility of

workplaces. Technical expertise which offers high-quality training for workplace supervision and mentors must, therefore, be provided.

Additionally, there should be incentives for workplace-based learning. The DHET has already started processes that will streamline workplace-based learning within the BBBEEE codes. There already is a tax incentive that enables workplaces to take on new people for workplace experience.

The impact of the White Paper and post-school plan recommendations, as described above, would go a long way to resolving many of the problems facing TVET colleges and apprenticeship training, particularly improved provision of access to work-based practical experience. In the absence of effective implementation of these reforms, and alongside the absence of a dual approach to teaching both technical theory and providing vocational practical exposure (with the latter consistently underdeveloped over the past 25 years), artisan training in South Africa will continue to be burdened by an overly strong education and formal classroom approach to learning, with neglect of the practical competencies that are needed in auto production.

CHAPTER IV: AUTOMOTIVE INDUSTRIES IN THREE COMPARATIVE COUNTRIES; LESSONS FOR SOUTH AFRICA

4.1 Introduction

This chapter firstly looks at the development of the automotive industry in South Africa in terms of how it has evolved over the years as well as the policies that have shaped and impacted its growth. Second, it looks at a number of automotive industries in other industrialising and developing countries including Nigeria, Brazil and India, not as a comparison to the auto industry in South Africa but with the aim of studying how they have been able to develop and sustain their auto industries and whether there are lessons that can be applied to the South African context.

4.2. A brief history of the automotive industry in South Africa

The history of the automotive and components industry in South Africa dates as far back as 1920 when Ford and, later, General Motors opened assembly plants in the country. At this time, local content remained very low. In 1961, the government introduced the first local content programme, seeking to promote increased local manufacturing for the automotive parts. Subsequently the government updated the local content policies by introducing new policies for the industry, the most significant being the 1995 Motor Industry Development Programme (MIDP) which has been extended and updated to the Automotive Production and Development Programme (APDP). The APDP which is due to expire in 2020, has also been extended to a new policy, South African Automotive Masterplan (SAAM), which is also briefly looked at further in this chapter. The introduction of the MIDP policy led to an increase in investment of Original Equipment Manufacturers (OEMs) into the local industry which also resulted in a decline of locally owned firms as OEMs increased their stakes in local firms (Barnes, 2013). The MIDP is examined in more detail later.

The reinsertion of the local automotive firms into the global value chain has led particularly to an improvement in quality and standards as domestic firms are obliged to meet international requirements (Barnes, 2013). The domestic auto industry, however, continues to face stiff competition from other global producers especially from the East Asian regions and Barnes argues that survival of this industry will depend mainly on three aspects including (1) the size

of the domestic market (2) the productive capabilities of the local environment and (3) the extent to which the national government will continue to provide incentives to OEMs to invest in local production (Barnes, 2013). Barnes also notes that the domestic socio-economic policies such as Black Economic Empowerment also impact on the progress of the industry as do the powerful domestic trade unions in terms of government policies for the country.

4.3 The positioning of the South African auto industry in the global auto value chain

In 2015 vehicle production globally amounted to 90.88 million vehicles particularly, with South African companies increasing their production to 615 658 vehicles for that year. The increase in production saw South Africa's global ranking rise to 21th in vehicle production (up from 24th in 2014), with 0.68% of the world market share and 14th in LCV (Light Commercial Vehicles), with 1.3% of the world's market share. With regards to the production of passenger cars, South Africa was ranked 24th, with 0.5% of the global market share (The South Africa Automotive Export Manual, 2016). The year 2015 also saw China emerge as the biggest vehicle producer globally, having produced 24.6 million cars and sold 24.5 million of them. The huge production levels have confirmed China's dominance in the automotive industry, having outsold both the US and Japan combined, confirming the changing trends in vehicle production and sales from the West to the East (The South Africa Automotive Export Manual, 2016).

Ambe and Badenhorst-Weiss (2010) observe that intense competition, unstable demand and increasingly sophisticated customer demands are only some of the main obstacles facing the domestic automotive industry. Having conducted research at BMW's Rosslyn plants, one of the OEMs that operate in South Africa, the authors submit that one of the ways that automotive manufacturers will increase their competitiveness is by remaining flexible and heeding the demands of their customers. Their research also pointed out that BMW's use of Just in Time concepts helps to save resources while relying on efficient delivery of their suppliers.

One of the factors that made the automotive industry in South Africa uncompetitive was the extent of the low local content of about 35% in locally assembled cars. The Automotive Production and Development Programme, which was introduced as a form of the extended MIDP, sought to encourage OEMs to increase their local content to 70% (Naude & Badenhorst-Weiss, 2011). The cost of car manufacturing in South Africa has been reported to be 20% more

expensive than in Europe and 30-40% more expensive than China and India, which also hinders investment by OEMs in the local industry (Venter, 2009a, 2009b, cited in Naude and Badenhorst-Weiss, 2011).

Sturgeon and colleagues (2008) argued that the automotive industry has broadened and cannot be said to be limited to specific regions or localities. Sturgeon and Van Biesebroeck (2011) add that the industry is influenced by the increasing integration of suppliers seeking to establish their business closer to their clients. The network of suppliers involved in the automotive industry becomes a complex web which, in most cases, sees the production of specific parts clustered together in efforts to speed up the production processes. The industry is effectively driven by automakers and first-tier suppliers as they can sustain a presence in most major industrial regions, maintain production and serve the automakers. These first-tier global suppliers are then able to extend their businesses by contracting local Tier 2 suppliers and gradually getting them onto the value chain.

Political intervention, especially in developing countries, has been identified as a major factor as governments insist on increased local content to boost domestic production. Sturgeon and Van Biesebroeck (2011) observe that governments embark on protective policies for their automotive industries because of the capital intensive nature of the industry, which warrants protection, especially from imports. South Africa, alongside Thailand and Turkey, are highlighted as having established themselves as assembly centres for their regions, because they can financially sustain their local production (ibid). The argument is that small developing countries will experience major obstacles in establishing themselves as car manufacturers unless they can garner a sizeable regional market for their products. This is especially so because established automakers are known not to be accommodating to auto manufacturers from developing countries in their quest to learn and acquire skills that would move them up the value chain.

In the South African context, ownership, infrastructure, capabilities and policies are listed as factors that influence linkage determinants. Morris and colleagues (2012) observe that locally owned or locally integrated firms are more likely to be invested in the local economy than their foreign-owned counterparts. The locally-owned ones are more likely to be invested in domestic operations and therefore more likely to invest in local linkages as well as suppliers and customers. Firms from the North are more likely to experience pressure to introduce corporate

social responsibility schemes to extend the rewards from their operations in local communities where these firms have their operations (Morris et al, 2012)

4.4. Government intervention in the auto industry

The automotive industry in South Africa, like other manufacturing sectors in the country, faces several difficulties. Some of these are typical to the South African context, and others are similar to what automotive industries in other parts of the world experience. In highlighting some of these common challenges, Black (2009) lists import expansion, increasing trade deficits and vulnerability of domestic suppliers as some of the obstacles faced by the industry. He argues that the position of the automotive industry in South Africa has been changing from an emerging automotive production system and division of labour sector previously protected by government, to one that is now more integrated within the global sphere. Although increased global integration comes with advantages for the industry, it also presents new problems for the domestic automotive industry.

To increase the competitiveness of the South African automotive industry, Black (2009) supports government's intervention in the industry through specific industrial policies but argues that such policies should be preparing the industry to compete in a free market, thereby promoting the capacity of the local industry to compete globally. This is because there are already many competing automakers all over the world with which South Africa must share the market. Among developing countries, India and China are highlighted as being placed in advantageous positions because of their relatively stable economic growth and large populations. These two countries also have low vehicle ownership, which translates into potential markets for the manufacturers in those regions.

Citing Humphrey and Oeter (2000), Black and MacLennan (2015) list three requirements that make for a successful automotive industry. These include (1) a significant market that would facilitate scale economies; (2) developing significant manufacturing capacities and competitiveness; (3) introduction of policies that provide some level of protectionism. To achieve this, there needs to be more regional integration to allow for the creation and facilitation of large markets. There would also need to be massive infrastructural upgrades in manufacturing capacities as well as a major investment in developing a skilled workforce which is necessary to grow a successful regional automotive industry

4.4.1. The Motor Industry Development Programme (MIDP)

In addressing some of the challenges in the automotive sector, the South African government has, over the years, sought to intervene by introducing selected policies aimed at improving the quality and quantity of production. One of the major policies introduced was the Motor Industry Development Programme (MIDP). This policy was introduced to liberalise the automotive industry and to promote export while reducing imports in the automotive and components manufacturing industry. The four major aims at the time of its inception were to:

1. Improve the international competitiveness of the domestic automotive industry,
2. Enhance its growth through export,
3. Improve the industry's highly skewed trade balance,
4. Stabilise employment levels (Barnes & Meadow, 2008:27).

Below are some of the concessions offered under the MIDP

- Excise duty of the vehicle category was discontinued.
- An initial rate of 40% customs duty on commercial completely built units (CBUs) was to apply and was to be gradually reduced to 20% within six years.
- Import duties of 50% were to be charged on original equipment (OE) imports.
- A 40% levy was to be charged on vehicles imported, except in completely knocked down (CKD) form.
- No surcharge was to be levied on the importation of original equipment for manufacturing heavy and medium vehicles.
- Rebates of duty on subcomponents for the manufacturing of original equipment were offered.
- Local content requirements were removed (Kaggwa et al, 2007; 56-57).

Despite some misgivings and criticism concerning the MIDP, it was generally applauded as successful for the domestic automotive industry. Having been perceived as more of an export policy, it was seen to have accomplished what it set out to do, which was to increase exports of automotive products. As a policy that encouraged leaders in the automotive value chain to

source parts from South Africa, the benefits of the policies trickled down to other players in the value chain within the South African automotive industry, including component manufacturers. The consensus on the MIDP and other related incentives for the industry was that they could impact significantly on industries, especially when such incentives are complemented with policies that encourage competitiveness among firms (Black 2002).

There have since been reviews of the MIDP, one in 1999 and again in 2002. These reviews extended the MIDP to 2007 and introduced the Productive Asset Allowance (PAA) which provided for earning duty credits equivalent to 20% of qualifying investment extended over five years but which could only be on rebate duties for light motor vehicles. This was limited to investments that facilitated model rationalisation thereby encouraging vehicle manufacturers to produce fewer models at high volumes and rather to use duty credit certificates gained from their investment on productive assets for imports of low volume models. The review also removed the small vehicle incentive and introduced a phase-down of export benefits from 2003 to 2007 (Kaggwa et al, 2007). The PAA was introduced in the form of an import reimbursement earned by manufacturers of particular light motor vehicles registered with the South African Department of Trade and Industry (DTI). To qualify for this incentive, the auto manufacturing companies were supposed to be supplying components and parts to other companies that were manufacturing 'PAA-qualified vehicles for fitment into PAA-based vehicles'. The logic behind this policy was to promote the production of light motor vehicles locally. This would also result in increased investment in local production of parts and components by the original manufacturing equipment companies as they would have to increase their supply to auto manufacturers (Kaggwa et al, 2007).

4.4.2. The Automotive Production and Development Programme (APDP)

The APDP, which complies with the World Trade Organisation rules, was phased in during 2013 to replace the MIDP and aimed to increase local vehicle production to 1.2 million vehicles by 2020. The four key points of the APDP included:

- A stable import tariff of 25% for completely built units (CBU) and 20% for completely knocked down units,

- A vehicle assembly allowance; meaning that manufacturers with a certain plant capacity would be permitted to import a certain percentage of the components duty-free,
- A production incentive which would allow manufacturers to import vehicles duty-free under certain condition, as stipulated in the policy (Department of Trade and Industry).

Researchers have stressed the importance of such policies with Barnes et al (2004) showing that industrial policies can be a positive initiative for the manufacturing industry. As evidence, these authors highlight the positive impact that the MIDP policy has had on the domestic automotive sector, chief among which has been a strengthened capacity for international automotive manufacturers to produce cars locally. It has also resulted in growth in exports, raised ranking of the domestic automotive industry and steady employment levels within the industry which were all evidence of a successful industrial policy. The policy also facilitated the use of South African plants for internationally-bound production which has resulted in more direct investment into local firms by Original Equipment Manufacturers and transnational corporations (Barnes et al, 2004).

There are some, however, who do not agree that industrial policies are entirely beneficial. Pack (2000) is cited by Barnes and colleagues (2004) warning developing countries against adopting industrial policies by arguing that where these policies have succeeded, in countries like Japan and Korea, there were other factors at play, implying that industrial policies only played a minor role. This argument against industrial policies was based on the belief that developing countries lack the necessary bureaucracy as well as the political ability for implementation (Barnes et al, 2004). In response to this, the authors agreed that there had been instances where such policies have not been successful. The drawback schemes introduced for the textile and clothing industry, for instance, did not fare as well as the MIDP due to difficult bureaucratic administration in implementation. Proper planning is highlighted as vital for successful implementation, especially in the context of developing countries. Such policies should be planned in ways that they can complement horizontal and functional policies and be tailored to the local setting, especially by considering the capacity for efficient implementation and administration. Care must also be taken to avoid corruption and unnecessary bureaucracy (Barnes et al, 2004).

4.4.3. The South African Automotive Masterplan (SAAM 2035)

The SAAM is an extension of the APDP, which is due to expire in 2020. SAAM will be implemented on the expiry of the APDP in 2021 and run until 2035.

Table C below sums up the SAAM's objectives and the expected impact on the South African automotive industry:

Objective	Estimated impact on SA auto industry
1. Grow SA vehicle production to 1% of global output	• CBU production to 1.39 million units annually (129% higher than 2015 levels) • Increase value of vehicle production to R314 billion
2. Increase local content in SA assembled vehicles to up to 60%	• Increase of R135.4 billion on 2015 local content levels. Local content increase of 21.3% per vehicle produced (55% increase) • Increase automotive component aftermarket and export production at the same pace as local content growth.
3. Double employment in the auto value chain	• Employment growth of 112,000 • Aggregate employment from 112 000 to 124 000
4. Improve auto industry competitive levels to that of leading international competitors	• Sustainable automotive industry based on comparative price and non-price competitiveness versus leading international competitiveness • Sustained export competitiveness
5. Transformation of the South African automotive value chain	• 25% black-owned involvement at Tier 2 and Tier 3 component manufacturer levels, as well as in dealership networks and authorised repair facilities • Amplified skills development of black South Africans • Enhanced employment equity at senior management, artisan and professional employment levels across the automotive value chain
6. Deepen value addition within SA auto value chains	• Growth in R and D and other innovation metrics within South Africa.

Source: Barnes et al (2018)

According to Barnes et al (2018), the SAAM takes into account current challenges facing the auto industry in the country, which include small vehicle assembly plants and an underdeveloped auto component industry in comparison to competitors in developed countries. The other big challenge for the auto industry in South Africa is that the domestic industry is

mostly export-orientated to distant markets (under trade agreements such as EU-SA FTA and AGOA), in contrast to South Africa's competitors, whose vehicle production targets closer regional markets. The new policy sets out to address these and other pertinent issues plaguing the local auto industry (Barnes et al, 2018).

The SAAM is underpinned by six pillars which the authors emphasise should be focused on throughout the implementation cycle of the SAAM, for it to succeed. Due to space constraints, the six pillars are: 1) local market optimisation, 2) regional market development, 3) localisation, automotive infrastructure development, 4) industry transformation, 5) technology and associated skills development and 6) institutionalising the SAAM. For each of these pillars to fulfil its role, the authors advise that there should be a very distinct institutional process of automotive policies that would facilitate the implementation of each of them. The authors also add that it is crucial that the leadership and other key stakeholders in the automotive industry in South Africa, including NAAMSA, NAAMCAM and NUMSA, be on board to ensure successful implementation of these pillars of the SAAM (Barnes et al, 2018).

4.5. The automotive industry in Brazil

According to the International Trade Administration (ITA) 2016 automotive report, Brazil is the biggest car producer and has the biggest automotive market in South America, having sold over 2 million vehicle units in 2015. Vehicle ownership is estimated at 180 vehicles per 1000 people, indicating that there remains room for growth. The strategy for car manufacturers in Brazil has been to focus mainly on the domestic market, designing models that cater specifically to local needs. This focus on the local market has been successful because the Brazilian automotive industry has been incentivised to produce 'popular cars' which has contributed to high domestic sales. Automakers there tend to specialise in designing and manufacturing vehicles that cater specifically to the local terrain and other specifications favourable to the country, including road conditions, local fuel type and climate. Some Brazilian car manufacturers are particularly known for their expertise in suspension reinforcement, ethanol fuel and low cylinder engines (Consoni 2004).

These types of cars are not technologically advanced, but the fact that manufacturers can offer vehicles that can run on either ethanol or petrol is an advantage for consumers (International Trade Administration Automotive Parts Top Markets Report, 2016). According to this report,

the automotive industry in Brazil is heavily protected with the cost of importing cars reaching more than 100% and used vehicle parts are not permitted except for antiques and in special circumstances where the parts are guaranteed to be as good as the new ones. The success of the automotive industry in Brazil has also been attributed to its ability to sell significant quantities of cars to the Mercado Común del Sur (Southern Common Market), (MERCOSUR in English) an economic and commercial group of countries in South America comprising Argentina, Brazil, Paraguay, Uruguay and Venezuela with associate countries like Chile, Bolivia, Colombia, Ecuador and Peru. Also, the protectionist policies in Brazil further ensure that automotive imports from countries outside of the MERCOSUR region are taxed heavily.

From the 1990s the Brazilian automotive industry was attracted a large portion of foreign direct investment. The industry sought to decentralise by relocating to other states in Brazil, incentivised by the government to establish plants elsewhere around the country. This was also facilitated by the availability of cheap labour, low unionisation and access to raw materials (Leite, 2007). Aggressive automotive regulation seeking to encourage investment and job creation in Brazil also helped grow the auto industry (Carleial et al, 2002).

Pimenta and Correa (2002) and Leite (2007) list four main attributes that were utilised by auto companies that opened in the country in the late 1990s, to enhance the productivity of their workers. These strategies centred on innovation in production as well as labour procedures which included horizontalisation, decentralisation, integration and teamwork and, lastly, a requirement that workers be familiar with the entire car production process.

- Horizontalisation - this meant a decrease in the number of hierarchical levels within the production processes and organisation.
- Decentralisation of structures and decisions - this led to more and more employee involvement in decision-making, participation and responsibility for the organisation and results of their work, albeit limited to their functions and tasks in their workgroup.
- Integration and participation in teamwork.
- An integrated production process whereby workers would be expected to be completely familiar with the vehicle production process (Leite 2007; 184).

These strategies significantly increased production in the automotive industry in Brazil while focusing their specifications to the local market and, in 2004, growth in production within the automotive sector was the highest in the entire economy at 29.9% whereas the rest of the manufacturing sector was growing at a rate of 8.5 % (Leite, 2007).

Moreover, the various incentives offered by the Brazilian government to encourage export and new investment in the automotive industry have resulted in investment amounting to US$30 billion over the last ten years, a huge amount that has resulted in the establishment of some of the biggest and most technologically advanced plants in the world (Pires & Sacomano, 2008). These authors particularly highlight a form of a supply chain model where supply parks are located in the same vicinity of a manufacturing plant to supply parts to a specific automaker, thereby saving time and logistic costs. This system facilitates monitoring from the automakers as they can check on the supplier and the ordered parts constantly, thereby reducing errors and problems. Claro and Claro (2011) agree that the coordination of activities of suppliers on a chain such as the automotive one requires an efficient working business relationship among various parties in the industry because a functional relationship between suppliers and manufacturers/buyers is a vital asset and should be accorded the necessary priority and be invested in accordingly.

Concerning learning and knowledge production, some policies have been introduced over the years to promote the development of the industry and partnerships with educational institutions in Brazil. Among them are:

1. The Innovation Law aimed at regulating relationships between educational institutions such as universities and research centres. This law was intended to promote partnership incentives and innovations among companies.
2. The establishment of "Guidelines for Industrial, Technological Politics and for International Commerce". These guidelines were introduced in 2003 and were also aimed at encouraging innovation. Having been hailed as positive for the industry at first, these guidelines have more recently received wide criticism as they have been perceived to be poorly implemented.
3. The introduction of the Brazilian Agency for Industrial Development. This agency was tasked with coordinating the above-mentioned guidelines with public policies.

4. The creation of new programmes at the National Bank for Economic and Social Development.
5. The coordination of Trade and Technology Ministry and the Fund for Studies and Projects for joint projects between private firms and science and technology institutions.
6. Reduction in the tax on manufactured goods.
7. The government's introduction of Local Productive Arrangements which gave support for clusters formed by small and medium firms involved in the same economic activities. These arrangements were supported by various government ministries which would ensure proper coordination among them and private agencies (Leite 2007; 187).

Leite (2007) argued, however, that these plans and policies instituted by the government were generally not perceived to have yielded the desired success in the manufacturing sector as of yet. Fleury and Fleury (2003), who researched global networks with a particular focus on Brazil, found that most Brazilian firms were involved in vertical types of networks or were operating alone without any affiliation to global networks, as they had not acquired the necessary capabilities to improve their position in the value chain. They found that transnational companies largely occupied the top positions in the industry, while Brazilian firms remained on the lower end of the hierarchy at the time of their research. According to the authors, the Brazilian economy relied greatly on foreign companies in terms of its production system. Fleury and Fleury (2003). Basing their argument on the notion that effective participation in global networks would depend on a firm's competencies, they maintained that firms could not succeed in the existing market conditions because competitiveness had become dependent on collective efficiencies. This meant that firms had to identify other firms with which to partner to supplement each other's competencies and improve both their competitiveness (Fleury & Fleury 2003).

Mesquita and colleagues (2007) observed that firms' investments are not sufficient in improving competitiveness, especially in emerging economies where institutional support from judicial systems or government agencies is not strong. In the case of the automotive industry in Brazil, Mesquita and colleagues (2007) noted that several strategies needed to be utilised to increase competitiveness. These included institutional support, business associations and technical institutes where the managers are aware of the advantages of working with

institutions and, while institutions themselves should facilitate relationships between them and firms, taking on the role of intermediaries between firms and institutions (Mesquita et al, 2007).

Brazil has thus continued to face various difficulties and, despite government support and incentives aimed at the automotive industry, the returns have not been as positive as anticipated. Some auto companies have shut down production, having been unable to meet their targets, due to challenges of operating in a developing country with many infrastructural challenges (Carleial et al, 2002). The projected absorption of workers did not materialise, and employment levels did not rise as anticipated in the regions where the plants are located (Leite 2007). These disappointing results have led to the questioning of government interventions in sectors governed by international companies with headquarters outside the country, which can pack up and leave anytime without any set commitment to local investments (Leite 2007).

4.6. The automotive industry in India

According to Singh and Gupta (2012), the automotive industry in India dates as far back as the 1950s but did not start thriving until the 1970s. In the 1950s the Indian government policy on the automotive industry classified passenger vehicles as luxury goods which led manufacturers to focus more on the production of commercial vehicles. Some multinational companies later abandoned production in India, and it was not until significant liberalisation of the automotive industry was initiated in early 1991 that multinational companies were allowed into the domestic market. Multinational companies were restricted in terms of importation of completely knocked down parts, being expected to source their parts locally (Kumaraswamy et al, 2012). However, as the industry grew, the government abolished many of the restrictions allowing for increased liberalisation, reducing import duties and encouraging the establishment of local R and D to integrate the Indian automotive industry with the rest of the global industry (Kumaraswamy et al, 2012).

Currently, the Indian automotive industry is rated among the top ten producers in the world as the second highest producer of two-wheeled vehicles, third of small cars and fifth of commercial vehicles (Krishnaveni & Vidya 2015). As a notable centre for automobile manufacturing, the automotive industry in India has:

- Fifteen manufacturers of passenger vehicles,

- Nine manufacturers of commercial vehicles,
- Sixteen manufacturers of two- and three-wheeled vehicles,
- Fourteen manufacturers of tractors,
- Five manufacturers of engines (Singh & Gupta, 2012).

The auto industry in India is also emerging as a strategic centre for exporting Sports Utility Vehicles (SUVs), and compact cars to western markets and global and Indian manufacturers are said to rank Indian factories among the best from the emerging economies in terms of production and quality of standards (Krishnaveni & Vidya 2015).

India, with a production of about 2.6 million units in 2014-15, ranked 11th globally in the passenger car market, and with only 1% of the local population owning a car, the potential for the growth of the industry is quite significant. The Indian automotive industry has been ranked as the second-fastest-growing market for the automotive industry worldwide after China (Ray & Miglani, 2016). These authors emphasise the importance of automotive industries in any developing country, due to its backward and forward linkages as well as its capacity to increase manufacturing capabilities, employment and gross domestic product, among other benefits.

In the Indian context, the successful establishment of a low-cost small car industry that caters to both the domestic and international market has improved its competitiveness as it has a readily available skilled, English speaking engineering workforce. Low production costs and government support are some of the other factors that have helped the growth of the industry (Ray & Miglani, 2016).

Ray and Miglani (2016) elaborate on the factors that differentiate India's development model for its automotive industry from other developing countries in the following ways:

1. Unlike countries such as Mexico and China, India did not develop its industry by heavy reliance on foreign lead firms and suppliers, even though foreign acquisitions did prove helpful in developing the industry,
2. The industry in India was not large and rich enough to assemble vehicles without modification (like South Africa, Thailand or Turkey),
3. The Indian industry was, until recently, aimed at the local market,
4. The export market consisted mostly of small cars and trucks,

5. Due to logistical challenges, the Indian industry has not been very concentrated and has thus not been very successful in attracting large local investment.

India is also one of the biggest exporters of automotive products to South Africa, where imports from India have been growing steadily from 2003 at about 73%. The success of the Indian industry has attracted major global automotive companies which have established assembly plants there and used the plants as a base for exports to strategic markets including Africa and Europe (Black & McLennan, 2016).

As the second most populated country in the world, India has a large domestic market and also boasts competitive labour costs as well as government assistance. As is typical of a developing country, a low infrastructure base is one of the challenges faced by industries in that country. Research and design are also not as prominent as they should be for an industry of its size. Other challenges facing the Indian automotive industry are listed below and include:

- Low-quality production compared to other automotive industries in some parts of the world,
- Low labour productivity,
- High interests rates and overhead levels,
- Higher production costs compared to other Asian states such as China,
- Low investment in R and D,
- Domestic demand focused only on low-cost vehicles (Krishnaveni & Vidya; 2015; 116).

Concerning the inadequacies in the Indian auto industry, Nauhria and colleagues (2011) observed that environmental boundaries, poor technical skills and insufficient road infrastructure are some of the other hindrances facing the development of the local automotive industry. They also point out that the quality of locally manufactured automotive products in India has, in some cases, been questioned as not meeting international quality standards. Nauhria and colleagues (2011) argue that Indian automotive companies would have to invest more in innovative productions including processes, upgrading hybrid cars and better cost management. Singh and colleagues (2010) have also advocated for lean production methods

which involve practices such as Just-In-Time and Total Quality Management to maintain sustainable and high-quality production.

In 2011, an Ernst and Young report listed several crucial points which OEMs in the Indian automotive industry would have to address to remain competitive within the global automotive industry. These included areas in skills supply, labour policies and transport infrastructure. Uncertainty in government labour policies as well as skills shortages also presented a challenge to the industry's growth potential. In particular, the already strained road networks were seen to be leading manufacturers in that country to restructuring their operations to clusters and multi-plant systems to maintain control of the supply chain and labour base (Ernest & Young, 2011).

Nevertheless, the potential for the automotive industry in India remained positive due to the country's rising middle class, where, according to Krishnaveni and Vidya (2015), the purchasing power of over 300 million of the population continued to rise, with the ratio of passenger vehicles reaching 7 per every 1000 people.

The success of the auto industry in India shows how important it is for firms in developing countries to maintain high-quality standards as set by lead firms and global Tier 1 suppliers. International quality standards, high productivity and design abilities are some of the vital steps that developing countries must achieve to climb higher up the automotive global value chain ladder (Sturgeon & Van Biesebroeck 2011).

Singh and colleagues (2007) have observed that success in this sector can be associated with a capacity to incorporate new technologies and innovations while simultaneously maintaining lower costs and excellent customer service. The role of government in promoting the industry is also underlined, and this support has been in the form of increasing the investment and loan limits, provision of technology-related subsidies for the small scale automotive component industry as well as enhancements in infrastructure, among others (Singh et al, 2007).

Additionally, the industry boasts significant institutional support, with the two leading Indian automotive associations, ACMA (Automotive Component Manufacturers Associations of India) and SIAM (Society of Indian Automobile Manufacturers) having established connections with other associations abroad, which has assisted the Indian industry in its pursuit

for technology advancement and competitiveness. Auto manufacturers in India have also established relationships with educational institutions overseas as well as Research and Design institutions (Pradhan & Singh, 2009). The increasing investment of Indian firms in developed countries is motivated by the need to acquire advanced technologies, as well as to gain access to markets in these developed countries.

Outward Foreign Direct Investment (OFDI) described by Pradhan and Singh (2009), is geared to acquiring knowledge and technical skills from more developed countries as they are assumed to be better resourced in terms of managerial skills, technological advances and other learning strategies. This trend of outward foreign direct investment is perceived as a quicker method of innovating as opposed to carrying out longer-lasting Research and Design activities on their own (ibid). Mergers and acquisitions are similarly negotiated to speed up the acquisition of competencies and skills in efforts to gain competitiveness from expanded networks and business relationships. Automotive companies perceive the OFDI as an opportunity to access global OEMs, especially the customer base of these established corporations. Indian Automotive companies, Mahindra and Tata Motors are cited as examples, having been successful in improving their designs and building new vehicles (Pradhan & Singh, 2009).

The automotive industry in India, in short, is one that has been evolving over the years with support from the state through interventionist policies. The trend for Indian automotive firms is to increase their competitiveness, gain access to the latest technological advances and innovation as well as skills exchange with the industries from the developed world in which they invest, which in return helps to develop their R and D capabilities in domestic firms. It is an industry that has gone through several policy changes introduced by the state, which has helped its continued growth.

Kumaraswamy and colleagues (2012) argue that, for a domestic industry to survive market liberalisation, local firms should adapt according to how the business environment evolves by first maintaining distant collaboration or agreements, followed by integration into the industry's global chain and eventually attaining the capability to create knowledge from their own R and D. The authors argue that it is not simple for domestic firms in emerging economies to cope in markets dominated by multinational companies from the developed world. They add, however, that market liberalisation leads to the entry of multinational companies into developing countries, bringing with them foreign direct investment. Local firms are thus able

to benefit from the spill-overs from these investments by learning from these global companies as well as by having to invest in the upgrading of competencies to meet international standards set by them (Kumaraswamy et al 2012).

Some local companies may, however, not survive market liberalisation which leads to the easy entry of multinational companies to the local market but, with adequate government support, the local industry can survive and even thrive (Kumaraswamy et al, 2012). Laosirihongthong and Dangayach (2005) point out that, since market liberalisation in 1991, which led to major economic reforms, the automotive industry in India has been facing major competition from global players that have entered the local industry and some local companies have continued to lag in terms of international standards. Consequently, manufacturers in India have been focusing on improving the quality of their products and processes as well flexibility, which is perceived to be a competitive asset for firms in established automotive industries in countries such as the USA, Japan and South Korea. The Indian automakers have particularly had to re-evaluate their quality of production, due to increased competition from multinationals in their local markets (Laosirihongthong & Dangayach, 2005).

The automotive industry in India is also affected by challenges that typically exist in other emerging economies which include inadequate infrastructure and finance, among others. To move up the value chain, improved linkages along the chain is one of the key requirements as well as process upgrading which leads to taking on higher and more sophisticated functions such as design, assembly of engines and marketing, among others. Some developing countries' success, such as that of China, have been attributed to 'aggressive localisation' where component parts are sourced from design centres within China, which are run by lead firms and Tier 1 suppliers. This system allows for local needs as well as government regulations and requirements to be met. This system also reduces costs as the automakers can use local suppliers, consequently offering considerably more affordable cars. This model, however, requires that a country has the necessary local supply base as well as a skilled workforce to ensure that the quality and reliability of brands is not compromised (Sturgeon & Van Biesebroeck, 2011). The success of emerging economies from the East shows how important it is for firms in developing countries to maintain high-quality standards as set by lead firms and global Tier 1 suppliers. This shows that international quality standards, high productivity and design abilities are some of the vital steps that developing countries must endeavour to

achieve to climb higher on the automotive global value chain networks (Sturgeon & Van Biesebroeck 2011).

4.7. The automotive industry in Nigeria

The automotive industry in Nigeria is not new, having been established as early as 1960, when the first assembly plants were started (Agbo, 2011). Later, in the 1970s, the government resolved to boost investment in the industry hoping to promote growth in that sector. However, the industry did not succeed as it failed to achieve economies of scale, among other reasons (ibid). According to Agbo (2011), some of the problems of the local industry, stem from a lack of suppliers of authentic spare parts and the Nigerian components manufacturers have no association with original equipment manufacturers.

In recent moves to restore the struggling automotive industry, Nigeria has instituted some incentives in the form of tax relief for some associated products. The rebates and import duties are all seen as positive for investment in this industry; however, there is concern about other relevant infrastructure that is required for the smooth operation of the industry. Electricity supply has been unreliable in Nigeria for a long time and remains a major concern; a poor road network is also another major challenge. As Nigeria recently overtook South Africa as the biggest economy on the African continent, it is estimated that there is a ready market for the industry as the middle class in that country continues to grow at a fast pace. However, the poor road network would need a massive overhaul to accommodate new vehicles.

As of 2014, many OEMs, including Nissan and another 23 companies, also committed to assembling cars, buses and trucks locally and Agbo (2011) suggests that to protect the local industry, fully built units should not be allowed in the country at all. The big brand manufacturers should be encouraged to assemble vehicles from completely knocked down parts from Nigerian factories. This would, however, be difficult before manufacturing becomes fully operational to meet local demand (Agbo, 2011).

Of the more than 170 million people in Nigeria, 38 million are reported to fall into the middle-class category, numbers that should be very attractive for investors due to potentially high demand for cars. According to Liadi (2015), Nigeria's expenditure on automobile products for 2012 was reported to have exceeded US$ 3.5 billion. Liadi cites the Nigerian Automotive

Manufacturers Association (NAMA), the National Bureau of Statistics (NBS) and the United Nations Conference on Trade and Development (UNCTAD) to show that Nigeria bought 400 000 vehicles in 2012. He adds that further research showed that Nigeria would generate not less than US$ 285 million and employ at least 280 000 people directly and indirectly if the cars imported in the year 2012 were made locally (Liadi, 2015).

Liadi (2015) argues that the government's refocusing on the industry has already started to yield results with some local manufacturing firms starting to develop manufacturing capabilities. He points to a local firm in Anambra State, in the eastern part of the country that has begun assembling light commercial vehicles, buses and sport utility vehicles since the introduction of the Automotive Industry Development Plan scheduled to run from 2014 to 2024 (Liadi, 2015).

This newly instituted Automotive Development Plan outlines some of the goals for the local motor industry, which include developing industrial infrastructure by the creation of supplier parks and clusters to promote shared learning and resources, information, knowledge and technical expertise. This will involve the development of skills by promoting collaboration between educational institutions, including specialised vocational institutions and universities, by offering specific programmes aimed at the automotive industry. Other strategies include increasing production quality, offering more incentives to attract foreign investment and raising taxes for imported vehicles to protect the local industry (Waribugo & Onuoha 2016).

Funds have been earmarked by the government to revive dormant local automotive firms (Olamade & Abubakar, 2014). Currently there exists a cluster of automotive parts manufacturing firms in the eastern part of Nigeria (Nnewi) which, like other manufacturing firms, experience operational difficulties such as high tariffs, crime and corruption, poor infrastructure (especially erratic power supply), low government support and a low domestic customer base, among others (Waribugo & Onuoha 2016). This cluster has, nevertheless, been resilient, having endured various challenges that have seen similar local enterprises fail. Through networking with other developing countries such as China and Taiwan, this cluster has managed to maintain operations, supplying parts, not only in Nigeria but also to other West African countries (Waribugo & Onuoha, 2016).

The overall operational challenges in Nigeria, however, have Olamade and Abubakar (2014) doubtful about the prospects of the local industry, arguing that the entire automotive industry in Nigeria is in crisis, despite efforts by the government to revive it. These authors argue that local manufacture of cars is virtually non-existent and that car sales, under distribution arrangements with foreign companies, so far remain the only flourishing business in the automotive sector, buoyed largely by high demand from a growing middle class. They argue further that most of the pioneer auto firms no longer have operations in the country, having stopped production in the mid-1980s. The authors point to the same challenges seen above as some of the causes that have led to the collapse of the local automotive industry adding that insufficient support for locally assembled cars, as well as a lack of an export market for locally made cars, have been some of the biggest hindrances to growth in the sector. Other factors are said to include insufficient capital, production costs and outdated technology (Olamade & Abubakar, 2014).

The African Association of Automobile Manufacturers (AAAM), inaugurated in November 2015, was established to provide support to potential entrants into the automotive value chain from African countries. It is chaired by the Ford Motor Company sub-Saharan African leader and CEO, with the head of Nissan South Africa, as his deputy, Creamer Engineering News, (May, 2016). It is a body whose objectives include assisting all potential manufacturers in Africa, not only the already established automotive manufacturers in South Africa, Morocco, and Egypt. One of the major goals of this association is to combat used vehicle imports to Africa which, it is hoped, will lead to a higher demand for new vehicles and consequently higher sales of vehicles assembled on the continent. Nigeria, for instance, is known to have been a dumping ground for used vehicles from Europe, many of which are smuggled through the Benin Republic. Ghana, with the assistance of VW and Nissan, will soon implement a policy to restrict the importation of second-hand vehicles, with plans to ultimately phase them out completely. Another problem that has been highlighted about vehicle ownership in Africa is the problem of vehicle finance, as many countries in Africa lack affordable options in this field (Creamer Engineering News, May, 2016).

As Nigeria makes efforts to restore its automotive industry, with a population of more than 150 million people, a rising economy and an increasing middle class and with low vehicle ownership, Nigeria is seen as a potential candidate to benefit from this new association. However, there are still concerns regarding the implementation of policy in African countries.

For example, Nigeria, whose automotive industry is estimated potentially to triple that of South Africa, has been reluctant to implement its automotive policy which was finalised in 2014.
In North Africa, South Africa's biggest competitor, Morocco, is also aiming to produce more than a million vehicles per year and, with their proximity to European markets, incentives for foreign multinational OEMs and high investments into infrastructure, they have an advantage (Creamer Engineering News, Vol. 39, No 13, April, 2019).

4.8. Lessons for the auto industry in South Africa

As seen above, the automotive industry in South Africa plays a marginal role compared to the overall global auto industry. Nonetheless, in Africa, with production reaching 600 000 units per year, it remains a major player on the continent. Compared to other auto industries on the continent, South Africa's industry remains well established and although several African countries, including Morocco, Egypt and Ghana, are all in the process of developing and establishing their existing and new auto industries in their respective regions, South Africa remains at an advantage ahead of most of these other countries.

To improve its position on the global auto value chain, one of the lessons that the local industry can draw from countries such as India and Brazil, it is to focus more on domestic and regional markets. Both Brazil and India have strategically designed and produced cars that are conducive to their domestic markets. It is important for the local industry also to find ways to tap into regional African markets, where vehicle ownership remains relatively low, especially given the long distance to South Africa's primary export markets overseas.

As Black and McLennan (2016) point out, despite the continued economic growth around many sub-Saharan African countries, which translates into a higher demand for cars, production of cars in Africa has been minimal and has largely been serviced by imports, especially as locally made cars are more expensive than cheaper imports from the more developed industries in Asia, Europe and America. These authors advise that the local industry can take advantage of the current regional trade agreements that exists among different parts of Africa, such as the South African Customs Union (SACU) the East African Community (EAC), the Common Market for East and Southern Africa (COMESA) and the Economic Community of West African States (ECOWAS) to establish partnerships to facilitate trade among one another (Black & McLennan (2016). Through the planned increase in local content

and value addition within the South African auto value chain in the new SAAM policy, South Africa will be in a position to establish partnerships with countries with emerging auto industries where South Africa can supply them with automotive products, thereby diversifying its export market to regional markets.

PART III: DATA OBTAINED FROM THE FIELDWORK

CHAPTER V: THE ROLE OF OEMS AND THE STATUS OF SOUTH AFRICA'S AUTO INDUSTRY IN THE GLOBAL AUTO VALUE CHAIN

The section below contains findings that were obtained from the two OEMs that took part in the study. For differentiation purposes, the two OEMs that participated in this study will be named OEM A and OEM B.

OEM A has two plants in South Africa, one in Silverton, Pretoria, which is the assembly plant, and another engine manufacturing plant in Port Elizabeth. The suppliers to both plants are a combination of local and overseas. There is no manufacturing done in the Silverton plant, except where the components are put together on the shop floor. This is a process that starts with the welding of various parts and components from the body shop section before being shipped by a conveyer belt system to the paint shop. As soon as the painting is completed, the body of the vehicle is brought back to the assembly line where the entire car is assembled. At this plant, the assembly of a normal vehicle, starting from body shop, paint shop and assembly would take about two days, but there are hundreds of vehicles assembled simultaneously. At the time of the visit, there were two models with different derivatives and specifications being assembled at the plant. The export market for this OEM includes 148 countries which all have varying vehicle specifications. Automation at this plant assembly is up to 78%, but the human input remains significant.

OEM B is wholly owned by its Japanese parent company and employs roughly 1200 people in South Africa. It produces about 98 000 vehicles in three shifts (one car taking about 2 to 3 days to build), with four models currently built at the company, and with plans underway to add another model. The plant is structured into a paint shop, plastics facility, warehousing, distribution centre, stockyard, part and accessories and air-conditioning unit. The Rosslyn plant assembles chassis for two of the models as well as pressings and ballooning. Ballooning is the process of putting both the top and bottom parts of a vehicle together before the hull is sent to the finishing line where the doors, welding and other final finishes are done the car sent for testing. At this plant, up to 900 people are directly involved in the vehicle assembly process, while an additional 300 are indirectly involved in various other jobs, including testing and quality assessment of the assembled vehicles.

5.1. Technologies at the plants

An interviewee from OEM A explained some of the changes that have been brought about by the new technologies at the plant:

> *With the body shop, we've invested in new technologies from France; some of it is from Kawasaki. The robots cost 1.5 million each, and the technology has changed so much that there's less manpower involved. In the past in the body shop, we used to do a lot of manual welding, CO2 welding and braising – that's stopped. Previously, the part where the windscreen joins the top roof, there is a hole over there, what we used to do was spot weld all around, but on the corner where the metal meets the other metal, you cannot spot weld. So what you would do, you do brazing. After doing brazing, you would do metal finishing. So there were metal finishers, people that will scuff that area to make it smooth so that you would never see there's a difference between the two metals. This has now stopped, because it was taking too much time, consuming too much labour. Now the border panels get pressed as a full side. They get pressed where they are being manufactured as a full panel. What happens now, the roof just comes on top and then the robots just spot weld it together on top. This is something that's reduced a lot of cycle time into the body shop. The body shop now works very fast… So we entirely depend on the robots.*

This particular technology is about 4-5 years old at this plant and 80% of the work that used to be done by humans is now being done by robots. Metals are also now being delivered by the suppliers completely finished. It takes about three months for overseas suppliers to ship to the local plant and most of the suppliers are overseas, but there are still some local suppliers who also supply to other OEMs in the Pretoria region.

The paint shop at OEM A is also highly automated, with the robots playing a major role in spray painting, except for areas where they cannot reach:

Things have changed in the last seven years; we used to spray manually here and here, now the robot does all that. It used to be very difficult to programme the robot to go in the vehicle go and bend and spray inside. Now the robot does it all; we used to have quality inspectors, now in the paint shop the robots are inspecting the cars. They tell you where the problem is, where the dent is… The robot tells you exactly where the problem is with the paint; if it is arc eyes, if it is fish eyes, or drips or swells or if it is thin paint or thick paint so you have to scruff it down and make it thin and polish it again… The robot tells you everything now from the paint shop … the tailgates, the boot; now a robot tells you as the car comes in… It just looks at the computer on the screen and tells them that this car that's coming, that door is misaligned, that light is misaligned, that whatever is misaligned… In the past we would bang everything trying to make sure it's level and whatever but now we don't waste time, we just go where the problem is. That's the technology now on the line currently.

Nonetheless, demand for human input has not been completely eliminated by the increase in automation at the plants because it is still needed for the programming and repairing of the robots and other equipment. The training manager from the OEM stated that:

…because we find that there are other areas whereby you have to spray inside, so you need human intervention. All those areas where the robot can't get to, and then there is the programming of the robots, we need robotic technicians, and we train our robotic technicians. We train our millwrights, and they learn more to become technicians, and then they actually get trained into programming Programmable Logic Controllers (PLCs).

PLCs are also described as industrial digital computers that have been reinforced and adapted for the control of the manufacturing processes:

Basically, it's about PLCs, you know there's Toshiba, there's Kawasaki, there are all sorts of PLCs. They [workers] just need to understand most of the

PLCs because the world of programming robots is all about a PLC. So all you do is just train the guys to understand the language of the PLCs.

On the contrary, OEM B's Rosslyn plant is not highly automated, and technology use is not highly advanced. There are some robots used for welding and other tasks, but generally the automation level is low as the plant is relatively old. There is a division within OEM B that is responsible for research and introduction of new technologies, and there are plans to advance the use of technology at the plant, some of which were shared during the visit. This will involve equipping workers with tablets as well as the installation of high-resolution cameras in strategic areas on the shop floor to assist with diagnosing problematic areas and faults on the assembly line. The tablets are expected to assist the supervisors when checking on the work of the operators by enabling the recording of all the work at once without going back and forth, having to manually record their observations:

We will have a phased-in procedure on the assembly line with new technology which will include wave 1, wave 2, and wave 3; that's the plan for the year. For the first wave, we will have cameras on the line to help monitor quality which can and then be tracked back to stations. So if you find quality problems here on the final line, or maybe at buy-off trim mechanical, if we have cameras in these places, we can track it back and say okay, at that position we didn't have that problem, so we can go back and trace the problem; that's part of what we call root cause analysis…and then we're going to roll out tablets to our supervisors to make their jobs easier. So when they need to do certain things here in their daily management, such as job observation, [like checking up on] one of the operators or staff members and see if they are actually doing their job … here we will have a tablet that can make videos and take pictures. They will also have the SOS which is the Standard Operation Sheet on the tablet, and they can share that with the staff members while they are there, so there's no going back and forth to the green area, [to get all the files together to write with a pen]. I think we're now pushing for that to happen by end of Q1, which is April, May, June.

For the operators, OEM B had plans to introduce better technology to improve efficiency by guiding them through their functions on the assembly line. These plans will include a system which would identify operators as soon as they walk into a station, issuing them with instructions or a list of duties to be carried out and guiding them through the process. There will also be a system in place to remind workers of simple tasks such as keeping their tablets charged before ending a shift:

> *This system, we call it the Book of Life; when an operator comes to his station, he will have the tablet; the idea is [as soon as] he walks into the station, he would be recognised by the station and guided by the system to make sure that he knows exactly what to do [what their tasks are for the day]. We will also have a system for tablet movement so that when you come to the gate [at the end of the work day], and the tablet has not been put on charge, the [system at] gate will actually stop you and remind you [that your tablet is not on charge], you need to go back and put it on charge.*

Additionally, the company planned to introduce 3 million megapixel cameras which would enable detection of the smallest dents and scratches on the vehicles; these cameras would also have the capacity to determine where on the assembly line the scratches took place.

The GVC analysis highlights the importance of innovation in the process of upgrading because a firm's technological development determines its industrial capability and, as a result, it's standing on the global value chain (Morris et al, 2008). In this case, both of the OEMs appeared to be heading in the right direction concerning process upgrading because both companies appreciated the crucial role that innovation plays in increasing competitiveness. The level of automation in production for OEM A as well as the planned technological improvement for OEM B indicates that upgrading their technological capacities at the plants was being prioritised.

5.2. Sourcing of parts and components

Both OEMs indicated that their local procurement in sourcing parts is not where they would like it to be. OEM A stated that:

> *The law says we need to source 35% [locally], and if we can't find, then we have to make a plan; it means you now have to involve another [overseas] company to come and partner with a local supplier to get a licence agreement and then [arrange for] knowledge transfer, to bring the technology to South Africa, so that we can produce locally, where we can then also increase the employment rate through that, and we can advance our people also in terms of experience, and of course when the supplier is local and close by, it's cheaper for us.*

The issue of increasing local content in the auto manufacturing industry is very important to the local auto industry and the executive director of the National Association of Automotive Component and Allied Manufacturers (Naacam) has reiterated that the central objective of the South African Automotive Masterplan (SAAM) is to increase local levels in the automotive value chain from 38% to 60%. Stating that South Africa lacks sufficient production of high-value components including electronics, telematics and powertrain, he indicated that the ability to produce these components would increase localisation levels, Creamer Engineering News, Vol. 39, No 13, (April, 2019). The chairperson and MD of Volkswagen Group South Africa (VWSA), who is also the chairperson of the African Association of Automotive Manufacturers (AAAM), stated that Volkswagen South Africa (VWSA), at 45% has one of the highest local content of all vehicle manufacturers in the country. He went on to express optimism at the newly approved revised APDP which should provide some much-needed certainty and stability in the industry, making it easier to seek more investment in the local auto industry (Creamer Engineering News, Vol. 39, No 13, April, 2019).

OEM A stated that their import rate was about 50% with a lot of parts still being sourced from outside South Africa. They stated that, ideally, they would like to increase their local procurement to at least 60%, which would also give them more import rebates, among other advantages. OEM B also indicated that most of its components are sourced from suppliers overseas including India and Japan, with a few being obtained locally from some of the suppliers located in the Supplier Park in Rosslyn Pretoria.

5.3. Quality standards expected of supplier companies

When it comes to quality standards, the OEMs impose very stringent quality requirements from their suppliers, leaving no room for mistakes. Should there be any errors, their suppliers are expected to assume financial responsibility for correcting them. OEM A's STA (supplier technical assistants) team works closely with the suppliers to ensure quality in product output whereby they (the STA) check, verify and assess the quality plans, efficiencies and the scrap rates to ensure that all products are inspected against specific standards set by the OEM before delivery to the OEM:

> *The STA guys are with the suppliers all the time, making sure the product output that's coming here has been checked and verified… They [the STAs] look at their quality output, they look at their efficiencies, and they look at their scrap rate. They look at all those things and make sure that whatever comes out of there is inspected according to a particular standard before it's delivered here. When something is wrong in the plant, we call them first [the STAs] to come and check what's going on there, to go and check the quality plans at the suppliers. They will take that part and go with it back to the supplier, [to] compare with the sample that is hanging there and see if it's exactly the same. They go and look at the jigs, at the tooling … if it is getting worn or is it misaligned.*

The overseas suppliers, on the other hand, are expected to deliver quality products, as they are expected to have more expertise in manufacturing to international standards and there are usually no problems with the products from these suppliers except rust which sometimes occurs as a result of lengthy stays at seas during shipping to South Africa. The training manager from OEM A stressed that the OEM insists that the supplier delivers complete component units to reduce the need for technical expertise in assembling the component parts at the plant. Should the supplied components need repair, for instance, in cases where parts supplied sustain damages such as dents or scratches during transportation, the OEM A technicians are equipped to carry out the repairs. The manager added that they endeavour to maintain close relationships and communication with their overseas suppliers:

> *There's a partnership. We give them a headache if anything goes wrong, remember if something happens on their end, if there's a strike in Japan or if they can't get a particular material and they can't make parts for us, they interface us, so we have to communicate on everything so that we know what's going on… Because [for instance] if there's a tsunami in Japan, everything stops here in South Africa…*

Kaplinsky and Morris (2016) stress the importance of standards in GVCs where different final markets and GVCs impose different standards on producers, some of which are set by governments or lead firms in their GVCs. This is evident by the strict and high-quality standards that suppliers to OEMs are expected to adhere to, as prescribed by the OEMs.

5.4. Functions carried out by OEMs on the global auto value chain

Rainbird-Ramirez (2012) observe that, although lead firms in GVC global value chains have vested interests in assisting firms in their chains to upgrade and improve quality of production and that some are willing to share and transfer technical knowledge, some are reluctant to assist firms to upgrade to higher functions such as design and research and development, preferring to keep those higher-value functions for themselves.

The OEMs both indicated that they only carry out assembly functions and that there are no design functions performed in the South African plants, as these are handled at the headquarters of the parent companies, and then handed down to their assembly plants all over the world. Once designs for new models have been approved, the designers work with component manufacturers to iron out all the details before the final designs are issued to assemblers. The design experts work with the assembly plants and component manufacturers who supply to them to ensure that production runs smoothly. Consequently, there is some transfer of knowledge from design experts to component manufacturers and to technical teams at the assembly plants because, once the design experts return overseas to the head offices, the suppliers are left to work with the teams at the assembly plant to sort out all problems that may arise and ensure smooth production.

5.5. The Auto Chamber

Both OEMs indicated that there is no formal cluster involving auto companies in the Pretoria region except for the Auto Chamber, which is facilitated by merSETA. The chamber is used as a forum to facilitate information-sharing on training. The training manager from OEM B explained how this works:

> *Through the auto chamber, which is controlled by MerSETA, BMW, VW, Nissan, all of us, we meet as training managers every three months and share almost everything when it comes to training… So you will have the shop stewards in there as well ... We discuss training from the operators to the graduates… In terms of benchmarking, we all communicate; I send them my information [from OEM B], and then all of them will also send theirs… Remember we're still competitors at the end of the day, but when we need to benchmark, we do share, because for example someone who leaves here [at OEM B] with level 2 [of the manufacturing operator qualification] to go to the other side [to work at another OEM], they will take that Level 2 with them and become a Level 2 that side and the salary is the same. Level 3 here is the same as at BMW and Level 4 [and so on], so that's how in sync the whole thing is.*

As explained by the manager from OEM B above, information-sharing among OEMs and other auto firms in the region is only limited to common training that is aimed at streamlining some of the qualifications of employees. Apart from this, they are all very secretive about their learning and knowledge production strategies and consider such information equal to trade secrets or intellectual property, especially those that produce similar vehicles. In this sense, the Auto Chamber serves as the main medium by which auto companies and other stakeholders address pertinent issues of common interest such as labour matters and BEE laws, among others.

This can be detrimental, as pointed out by Gereffi et al (2011), who suggest that lack of information-sharing among stakeholders in the value chain denies firms the opportunity to

work together to remain abreast of the trends and practices in their industry, thus hindering the acquisition of new knowledge which would otherwise benefit them collectively.

Some of the participants explained that the only (informal) exchange of information among the companies is likely to take place through personal networks where friendships would have been developed among colleagues, so from one friend to another and not from one company formally communicating with another.

Lorenzen (2007) notes that it is possible for regions to be abundant in social relations, yet lacking in institutions that contribute to social capital. As seen earlier, Lorenzen explained that collaboration among firms leads to innovation and technological learning where firms are able to innovate from their associations with other firms, as they study each other's innovative practices as well as from labour movements which lead to knowledge transfers and reciprocal evaluation for firms within the same level of a value chain (Lorenzen, 2007). The lack of collaboration can, therefore, be disadvantageous for auto firms in the region.

5.6. Learning and knowledge production at the OEMs

There are different categories of workers at the plants, including operators, artisans, technicians and engineers. For both OEMs, some of the qualifications that the interns and apprentices have include National Accredited Technical Education Diploma, (NATED) N3, N4, N5 and N6. They go through the millwright, mechanical and electrical training programmes which are the specialisations focused on at the plants, especially as the cars being manufactured currently involve a lot of electrical engineering. Millwrights trade test, electronics and mechanical tests tend to be combined because, when the students are writing their trade tests, it doesn't matter that they are sitting for either electronics or mechanical tests as both contain subjects relating to mechanics and electronics which is an advantage for the trainee who will qualify for both specialisations. While previously electrician and fitter used to be two different specialisations, they have now been joined into millwright. Although this does not include as much electrical training as would have been preferred by the OEMs, the trainers at the plants that were interviewed stated that they were happy with the fact that the two specialisations were joined.

5.6.1 Operators

The operators also called 'associates,' work on the shop floors, adding different components to the car as it moves from one stage to another on the assembly line. Each operator is typically assigned a basic function of adding or carrying out checks on a specific component to the vehicle before it moves to the next stage. The operators are sourced from the communities around the plants and trained to fulfil basic functions on the shop floor. The OEMs only recruit those with matric qualifications, including passes in mathematics and English language. The training manager from OEM A explains why:

> *We take people with matric, who have passes in maths and English because we take them through a learnership [programme], so that we can induct them into a production environment... And the learnership [programme] that we do has to be relevant to our operation; we are assembling here, so we do a qualification that's relevant to assembling. We call it a National Certificate in Assembly and Manufacturing. Nissan [or any other OEM] may focus on something similar, such as component manufacturing, but they are all similar in terms of fundamentals and in terms of electives and the skills that must be learnt in the workplace … So if we take a person through a year programme with that, they would have understood what is production, what is safety, what is waste elimination, maintenance of equipment, your behaviour when you work in the plant, your safety, protective environment, your gloves, your apparel and all sorts of things. So the person understand that this is a different environment … In terms of quality of output, how to perceive quality, making sure it is fixed right the first time because there's no other opportunity to fix it…*

This short skills programme is provided to school-leavers from the 'streets' and is a programme that OEM A started in the last 5-6 years and those who are lucky enough to be absorbed as permanent workers at the plant can study further and even obtain bursaries from the company, provided it is in the fields that are relevant to the production work of the OEM.

The structure of this short skills programme seeks to build practical capabilities – tacit knowledge among unemployed youth recruited off the streets. Its primary content is to transfer existing production knowledge to novices who, through practice and experience, learn how to

do the job. It is simultaneously a formal qualification, the National Certificate in Assembly and Manufacturing. This training example shows the integration of formal codified knowledge and emerging tacit capabilities among novice workers who learn the trade through both mechanisms.

5.6.2. Artisan, apprenticeship and internship programmes

An artisan, in the definitions of the industry, is a qualified tradesperson and, in the auto industry, they are not involved in the assembly of the vehicles but rather maintain the machines that are used in the plants. There are also specialised artisans whose work is to carry out checks on the final product when the assembly of the car is complete to ensure that there are no faults.

OEM A indicated that it has full accreditation to provide training and workplace training, but they do not conduct any testing. Upon completion of training, the apprentices are taken for Trade Testing in different testing centres in Benoni, Midrand and Olifantsfontein. If on successful completion of the training programmes and the OEMs have vacancies, the trainees would be retained and, if not, they have to find employment in other companies.

OEM A runs an Artisan Development Programme that was designed to assist artisans progress to a higher technical level for them to carry out higher-level repairs. In this way, with additional training, artisans can progress to become technicians, where they can carry out high-level technical jobs. For instance, artisans can carry out maintenance and repairs, whereas the technicians can do that as well as programming. Artisans undergo three years training and have to pass the National Artisan Moderation Body (NAMB) test before qualifying. Technicians come from either technical universities or colleges, and part of their qualification requirements include completion of P1 and P2 (Practical 1 & 2) which they carry out at the plant before they qualify as technicians and engineers.

The artisans are trained to dismantle and repair equipment that is in use at the plants so that, if machines that were procured from overseas break down, the artisans can repair them. Robot technicians would have studied mechatronics at the Universities of Technology before undergoing practical training at the plant. Mechatronics comprises a lot of electronic work and those who do it would also have studied light current and auto electrical, all of which are necessary to understand PLC. The millwrights, on the other hand, can be trained to work in

many areas at the plant, including fitting, mechanical and electrical work. Some would have come from (TVET) colleges as apprentices and then undergone a three-year training programme to gain practical experience. The trainees from the universities, however, are expected to have prior knowledge including Programme Limit Switch (PLS), programming, communications, calculations, binomials, how to work around a Programmable Logic Controller (PLC). But most of this prior training at universities is theoretical and, when they come to the plant, they are exposed to the practical aspect of it.

5.6.3. Collaboration between the two OEMs and universities

Every year OEM A takes in about 22 experiential student trainees from technical universities in Tshwane and Johannesburg to gain technical and practical experience, especially in mechanical, industrial, electrical engineering and mechatronics. There is, however, no formal exchange between the OEM and the universities and the placement of students at the OEM only works on a need-to-need basis, depending on whether the company has a budget to fund the training because the trainees are paid a stipend by the company during the duration of training.
The accreditation comes with trades and has to be accredited with merSETA to provide class, institutionalised or practical workplace training. Trade qualifications are offered to those that come from TVET colleges, with qualifications ranging from N1 to N6.

At OEM B at the time of the interview, there were about 400 University of Technology students at the plant who were there to complete their P2, having done P1 in industrial and mechanical engineering, which is more about management. The company takes them in to assist with experiential learning, which is a requirement for the National Diploma Certificates. OEM B also runs a graduate programme for university students who have completed their BTech or BSc in various fields, including engineering and administration. At the time of the interview, there were 88 graduates from various universities all around the country. The OEM endeavours to make their graduate programme more attractive by making it a two-year as opposed to a one-year programme, which is more common in other companies, and also by offering some benefits including a monthly stipend, medical aid and a 13^{th} cheque, among others. OEM B also offers bursaries and had about 40 bursary students at a University in Pretoria at the time of the interview, who are expected to work for the company on completion of their studies. The strategy of the OEM is to recruit the best-performing students starting in high schools, offer

them sponsorship through universities and then employ them on graduation. They do this to create a larger pool from which to draw prospective employees without having to rely on external recruitment processes. This is the reason they recruit graduate students from all programmes without limiting themselves to only those in engineering or manufacturing-orientated courses. Applicants must have a pass in mathematics to qualify for apprenticeship at the OEM. Recruitment also depends on other aspects such as availability of space in the plant and senior or experienced artisans to train the apprentices.

In the two years that OEM B has been running the graduate programme, 40 of the students have been retained and offered full-time employment. The OEM also endeavours to source their workers from the surrounding community by advertising with their existing employees to bring their relatives, friends and neighbours.

Situated and relational learning is quite evident at OEM B, by the various forms of knowledge development programmes offered for their employees. These include computer literacy classes, coaching sessions and mentoring programmes between newer or younger recruits or trainees and the older, more experienced workers. These are aimed at helping the workforce to develop professional skills and other soft skills.

OEM B also runs a bursary scheme which is open to all employees, including the interns. The bursary is for up to R50 000 a year, with the main requirement being that the courses taken be relevant to the skills needs of the company and that they must be undertaken at an accredited tertiary institution. The employees who qualify for the bursary are offered 16 days of study leave. One of the aims of the scheme is to increase and open opportunities to graduates, especially to young black graduates, to gradually transform employment equity at the plant by increasing the number of black employees in the company. Applications are open to all university students with BSc and BTech qualifications and for operators.

These opportunities for further professional development offered by OEM B to their workers can be interpreted as an indication of an expansive work environment, as suggested by Evan et al (2004), who describe expansive workplaces as those that offer opportunities to facilitate further learning and development of skills.

5.6.4. Collaboration between the OEMs and other education and training institutions

There are various partnerships between the OEMs and some training institutions. Both OEMs reported that they had established relationships with both private and public training institutions, including TVET colleges.

OEM A has donated up to 40 cars and car engines to colleges to assist with the training of students. OEM A did, however, point out that, even though there are TVET colleges near their plant, they prefer to work with a specific TVET college even though it is located much further away. The interviewee from OEM A expressed disappointment with the misuse of equipment donated to them:

> *This particular [TVET] college we sponsored, we gave them a full bakkie, [to assist with the teaching] but when we went back there, there was no engine, no tyres, no rims, everything was gone.*

OEM A stated that at the time that they were looking for a training partner, none of the TVET colleges near them were accredited, hence the partnership with the TVET college further away.

Similarly, OEM B stated that it has no partnership with the TVET colleges in their vicinity, mainly because the particular TVET college near the plant has a poor reputation. The training manager at OEM B explained:

> *The college right next door, we don't take people from there. We should be having a relationship, but … I mean it's a reputation thing. What we've heard from there and when we went for a visit as well, it was not professional what we found there. So we took all our apprentices to another TVET College.*

The manager acknowledged that it is a missed opportunity for both the OEM and the college because of the proximity to each other but emphasised that they are running a business and would not tolerate mediocrity in any of their partners.

There is successful collaboration with TVET colleges, however. For instance, OEM A stated that it does not have to carry out training of auto mechanics anymore as they are now contracting a TVET college to do it for them, having provided them with the necessary equipment. Other partnerships with educational institutions include one with the private auto

academy to handle some of the OEM's administrative work and learnerships. These learnership programmes run for nine months and are aimed at training apprentices who come from high schools to complete NQF Level 1 and 2 before they can work as operators in the assembly line. From NQF Level 1, the apprentices can progress to Level 4, after they complete another three years of training at the company. The duration of the training at the plant is two years because this is the requirement for experiential training before sitting for trade tests.

When it comes to input in curriculum development, the trainers at OEM A said that they are asked to provide input by educational institutions from time to time. At the time of the interview, they had just been requested by the QCTO and merSETA for their input in a curriculum that was being designed. OEM B also indicated that they offer input and advice regarding the needs of the industry to universities. For example, they advise the universities on content, such as informing them that:

HR and supply chain issues should be included in a curriculum.

Input is also provided for courses intended for managerial staff, where some local universities work with the OEM to design curricula with content that is as close as possible to the skills requirements of the company. The collaboration has proven effective because they can partner with an accredited institution to design an accredited programme to meet their requirements.

5.7. SETA support

Some of the government's support to the industry is channelled through merSETA where it provides grants through the skills levy, which is determined by the number of trainees taken in by the auto companies (the skills levy is paid from the 1% profit that goes to the government who provides the grants). To encourage investment in the country, the government also offers various other forms of support to OEMs. As an example, a few years ago when OEM A started assembling a new vehicle model, the government assisted with funding for the development of training material for operators and artisans. This support was in the form of spending and investing in training first by the OEM and then claiming it back from government.

merSETA also supports the industry through the 'normal' Workplace Skills Plan, Automotive Training Reports, annual training reports and the grants for learners. The OEMs, however, indicated that this support is inadequate as it does not cover the cost of training that the OEMs

incur. The source from OEM A observed that sometimes after spending up to R1 million, they might only receive a small portion of that amount back. The challenges of the industry are communicated by the Auto Chamber and the merSETA, and every region has what is called Client Liaison Officers (CLOs), who are the point of contact between the auto industry and the relevant authorities.

5.8. Perspectives from trainers at the OEMs

Two senior artisans from OEM A who are in charge of training argued strongly that the training that is provided at the Universities of Technology is inadequate, observing that:

> *In the past, when a student came from a technikon, there was no additional teaching that was done but that, lately, the students that come to them, have to be taught everything.*

It was also pointed out that it was not a question of a lack of resources at the Universities of Technology. Referring to one of them, they had this to say:

> *They've got the best equipment… They've actually got more equipment than us. But what's surprising is that there are certain components that a mechanical guy should know in the industry, especially in a manufacturing plant, which they've got there, but those students have never been exposed to it. We went and visited those places… And we would check what equipment they've got, and they are state of the art! I have only acquired the electro-hydraulics [equipment] you saw here recently, but they [the university] already have it … I would also say that the lecturers are very well-qualified … I can honestly say that the guys know what they're doing… And the graduates, they have maths and science, and they know drawing, and they are very good with computers, there's no question about that. But when it comes to the practical part of it, it's very problematic… What we're experiencing is that the practical side is being neglected very, very badly.*

When asked if the trainers in the industry are offered opportunities to provide input on curricula in the educational and training institutions such as the Universities of Technology, the trainers from OEM A stated that there is not enough (regular) direct communication between

themselves (the trainers) and the lecturers at the universities. The trainers said they would have liked to have a closer relationship with the lecturers so they can access each other more directly and regularly to communicate their observations regarding the shortcomings of the students who come to the industry. These observations were specifically aimed at university graduates, because they are expected to have obtained a higher level of training but, according to the senior artisans at the plant who work with them, many of these graduates lack the basic practical skills expected of them.

Concerning the changes that they would like to see in solving the issues that they raised, the trainers from OEM A emphasised that the students need to have more practical training, "they need to be much more hands-on" since it is not a problem of inadequate equipment or facilities. The trainers emphasised that the Universities of Technology need to ensure that the focus on theory does not happen at the expense of the practical aspect. The same was said for the lecturers at the TVET colleges, that there needs to be a much closer relationship between the trainers and instructors in the industry and the lecturers as the trainers argued that the 12 months needed to complete the P1 and P2 (practical knowledge) which they obtain at the workplace, is far from sufficient for the students to get all the practical training that they need.

To illustrate this, the trainers from OEM A stated that, when asked to identify the components of the equipment and machinery which they would have studied in theory, the graduates would often fail to identify them correctly. The trainers stressed that the need for highly skilled graduates is especially vital due to the constantly evolving nature of the auto industry:

> *We must realise that technology is moving forward, and even though we've got 30 or 60 robots, it doesn't mean that we're going to cut certain amount of labour because we need people to maintain [this machinery]. Robots need to be maintained, we've got a little bit of a misperception on the technology … that if we put technology in, we get rid of 50 people – no, it's not entirely like that. Somebody needs to man those robots. People need to fix them, they need to be repaired, and those people [that would fix them] need to be very highly skilled.*

Gereffi et al (2011) have highlighted technical education as being crucial in GVCs because efficient participation in GVC requires high technical expertise due to firms having to innovate

to increase their competitiveness. The authors point out that this is even more important for companies in developing countries, as they seek to climb to higher positions on the value chain to attract more value-added in their production. For the auto industry, this would require a highly technical workforce that is capable of meeting the ever-evolving technological advances in the industry. The process of developing highly skilled workers entails both new formal knowledge such as computer diagnostics, robotics and automation, electric cars and, after that, the harnessing of new tacit knowledge through repetitive practice in real work contexts.

5.9. Perspectives from interns and trainees at the OEMs

At OEM A, one of the apprentices interviewed at the plant, praised the training programme but indicated that she was not satisfied with the practical aspect of it. She felt that the students did not spend enough time on the shop floor to acquire actual practical experience and argued that the trainers should have structured the programme in a way that allowed for more practical work on the shop floor. Her observation is particularly interesting because the trainers at this OEM bemoaned a lack of practical experience from the students who come to them. It became apparent that neither the student nor the trainers were satisfied with the practical aspect of the training.

Another trainer at the same OEM pointed to a lack of passion for the chosen career path on the part of the learners, blaming it on inadequate career counselling and guidance while still in school and arguing that the learners chose careers without fully understanding what the selected courses would entail. He observed that students ended up doing engineering courses for the wrong reasons, which is why they struggled once they enrolled in these programmes.

At OEM B, two graduates from the Walter Sisulu University and University of KwaZulu-Natal (UKZN) were interviewed. As part of their internship duties at the OEM, they were involved in the recruitment of apprentices for the company. Even though they were both still under training, the OEM entrusted them with the responsibilities involved in recruitment including selecting the candidates, setting up the interviews, sitting in on the interviews, liaising with the managers for the interviews, drawing up contracts and monitoring the performance of the successful candidates.

The two stated that the training they were receiving was quite intensive and that this applied to all the trainees and interns at the OEM. The trainees are placed in various departments at the company and given responsibilities. One of the trainees put it this way:

> *They [interns]even get to go meet the suppliers themselves... Some even got to travel to different parts of the country and overseas even before they were permanently employed by the company, to wherever the companies sources for parts … the advertising and marketing graduates also get to go meet certain dealers; they are assigned to dealers and get to work directly with them, during launching of new cars etc … They are all given opportunities to do the actual work in order for them to gain the experience that they came for. It is also the same for artisans, although there is more training for them in order to ensure that when they go for trade tests they would be prepared. So they are shown what to do the first time, but the next time they are left to do it on their own.*

The two interns stated that they were happy with the mentoring and support that they received from the management. One of them had this to say:

> *When I was applying for the post, I was asked what kind of manager I would like and now that I am working I have realized that the kind of manager I wanted then is different from the type I want now because I have a lot of responsibilities and I have the freedom to make decisions and come to the table with my opinions… We are given enough opportunities to say this is the direction we would like to take...*

Once again, the opportunities offered to the workforce at this OEM, indicated that it tries to provide an expansive work environment to provide room for growth of the workers by affording them exposure and access to develop professionally.

Equally, the training manager at OEM B stated that she was satisfied with the calibre of their graduate interns, stating that:

> *…with graduates, I have seen that they come with a level of confidence even with things they have never done before … They have that attitude that they*

can do it ... That's why I think it is easy to give them work, to let them run with it because they think they can do it.

The training manager made different observations about apprentices from high schools, saying that they do not come with confidence because they are probably not adequately equipped with those soft skills and confidence at school level:

They are not as ready for the workplace environment as their graduate counterparts, which is understandable… To the extent that we have realised that they need more basic skills… Because they are even afraid to touch the equipment...

In the case of school leavers, it is clear that they come to the workplace as complete novices in need of significant guidance and mentoring even in the most basic aspects, such as how to conduct themselves in the workplace. Although, there was evidence of situated and relational learning at the company, through various learning programmes aimed at these new, young recruits, some of the older and more experienced workers that were interviewed indicated that they do not really have enough time to mentor the young recruits because, not only do they have production targets to meet, there also is a question of having enough patience with the young novices. This conforms to the criticism of situated learning by Evans and Rainbird (2006) which points out that the relationship between novices and experts in the workplace does not automatically result in learning because acceptance of apprentices as members of the community of practice is not always guaranteed.

CHAPTER VI: RELATIONAL DYNAMICS BETWEEN LEAD FIRMS, COMPONENT FIRMS AND COLLEGES-MEETING THE HIGH DEMANDS OF THE OEMs.

6.1. Introduction

This chapter contains a discussion of evidence obtained from component manufacturers who supply the OEMs. Three of the companies are large manufacturers and the other two, one of which happens to supply mainly to OEM A, are small., The chapter also includes evidence from a TVET college and a private training academy, which offers automotive-related specialisation and training. There is also input from the AIDC, which acts an intermediary between the government, auto companies and educational institutions to facilitate learning and knowledge production for the auto industry in South Africa.

6.2. Supplier Company No 1

The first of the component manufacturer firms that was interviewed is a small company that employs about 30 people. Its main client is OEM A, and the company is located in the Rosslyn plant of OEM A. Its main function involves spray painting bed lines for select Pick-Up vehicles produced at OEM A, which implies that most of its production output is dependent on what is prescribed by its client.

The company employs people with basic school-leaving qualifications with a preference for maths and English, as the production system and the value-added that is given to the OEM does not require any high-level skills or qualifications. However, the location of the company within the plant of OEM A means that its workers are exposed to some of the best technologies in the industry but are not benefitting because the OEM's training programmes are aimed solely at its workers.

The CEO of the company stated that, since credentials are a basic requirement for progression within the industry, the workers at this firm are only able to work and gain practical experience because, without formal recognition of their experience, it is difficult for them to advance professionally. As much as practical experience is valued, it remains a credential-driven industry, and those without formal qualifications struggle to gain entry to higher positions. The

CEO indicated that he is in discussion with the SETAs to find ways to offer formal training to his workers leading to qualifications so that they can broaden their horizons and develop professionally.

The CEO complained about a lack of support for opportunities for skills and personal development for his workers which, he says, is a demotivating factor for them. His biggest challenge is to find a partner to share the cost of training, be it a TVET college, the AIDC or an OEMAs of the time of the interview, he indicated that there had not been much progress in winning support from the AIDC.

6.3. Supplier Company No 2

The second component manufacturer interviewed is also a small company that manufactures solely for a German-based OEM. This company also bemoaned a lack of adequate collaboration between TVET colleges and agencies such as the AIDC in supporting the training needs of their workers. The manager at the company complained that there is a TVET college right there on their doorstep but wondered:

> *Why the management does not leave their offices to walk across and see how they can work with small firms such as theirs.*

The manager believed that even the AIDC seems to be more interested in working with big firms to facilitate skills development and training and has not shown interest in supporting smaller firms. The firm stated that the only form of support they receive is from their overseas client who carries out audits every two years to assess their production capabilities, and how they can assist in helping the firm to meet their (client's) needs. The merSETA was also mentioned as having been supportive by giving Grants that are used to run apprentice programmes, although there are very limited opportunities due to inadequate funding.

Conversely, according to the source from the AIDC, the AIDC does offer support to the supplier companies and runs a proficiency programme which teaches the suppliers efficient production, waste minimising and green production, cost-cutting mechanisms, how to cut scrap metal and other interventions for improved production, for them to meet their targets. However, from the views of the two small firms, it appeared that small companies such as the ones that took part in the study were yet to benefit from this support.

6.4. Component manufacturer No 3

The third supplier company is a large steel manufacturing company whose business divisions include mining, automotive and construction. Unfortunately, during the visit, the use of a recording device was not allowed which hindered the recording of information and limited the scope of information obtained during the interviews.

The company has branches in Rosslyn Pretoria, Johannesburg, Port Elizabeth, Cape Town and Durban, as well as some plants in other parts of Africa. Although it started as a construction and mining company, the automotive arm of the company has become its largest source of revenue. It was selected for participation in the study because it is a major component manufacturer to the automotive industry in South Africa, supplying steel either directly to some OEMs or indirectly through other component manufacturers who then provide additional value-added services to the components before supplying to the OEMs.

6.4.1 Technology use at the plant (Component manufacturer No 3)

The plant that was visited is located in the east of Johannesburg, where most of the production and processing of the raw materials is carried out. This plant is divided into sections that process raw materials for both the automotive clientele as well as construction. For this study, the visit to the plant focused on production aimed at the automotive industry.

Although overall automation at the plant is not high, production in the automotive section is more sophisticated due to the higher technological demands required in the auto industry. Vehicle parts that manufactured include bonnets, boots, hoods and fenders and at any time there are different models being built, as well as different tooling machines that are allocated for the production of each part of the model. One of the interviewees explained the production process:

> *It is a very intricate process because as you can see, each part of the vehicle has its own tool. You could have more than three different tools which are all just for making one model belonging to one OEM; with one tool making the boot, the other making the bonnet and the other making fenders and so on… So what we do, is we make these parts and then send them either directly to the OEMs or to another company who may refine it before sending it to the OEM.*

The source from this firm stated that the OEMs are strict in terms of the production process, stating that they set specific standards which must be followed during production, especially regarding the raw materials:

> *The steel that we use is mostly sourced from overseas, not because we don't have steel here in South Africa but because the OEMs require a specific kind of steel. But for our mining and construction divisions, our steel is sourced almost 100% locally here in South Africa, because construction and mining are not as demanding in terms of the types of steel that we use.*

The level of automation at the company is not high, and there is no use of robots at the plants, mainly because the company deals with processing raw material (steel) to transform it into metal sheets. The tooling and the machinery that processes the raw material, which mainly involves the pressing of the coil to transform it into vehicle metal sheets, are both manually and automatically operated. In addition to the artisanal qualification that the tool makers who operate the machinery come with, the company offers more training to familiarise them with the machines. In situations where there are difficulties with the machines, the manufacturers are contracted to come and carry out repairs and offer additional training to the tool makers. In this way, as was seen in other auto manufacturers, there is some knowledge transfer from the equipment manufacturers to the workers in the plants.

6.4.2. Collaboration between the company and OEMs to which it supplies

The interviewees at the company stated that there is no assistance or collaboration between them and the OEMs regarding operations or upgrades on production capabilities:

> *The OEMs don't offer us any assistance. We are on own. It is our responsibility to make sure that the products that we supply to them are of the highest quality. Remember it is a competitive environment; if we cannot meet their standards, they would go to another company and we would lose a customer. So it is up to us to ensure we know what they want and we produce exactly what they want. Where we need to upgrade our technologies to make sure that we are using the latest method; that is up to us, they only want a perfect product…*

This is also similar to what was seen in other manufacturers, who also stated that they do not receive any support from the OEMs that they supply. The plant was located in a densely industrial area, where there are companies involved in similar manufacturing businesses, but there is no collaboration or any type of knowledge-sharing between them and the neighbouring companies. The source, who is a training manager at the company, added that, although they (the company) belong to some automotive associations such as National Association of Automotive Component and Allied Manufacturers (NAACAM) and Durban Automotive Cluster (DAC), the exchange of information among members is quite limited:

> *We are all in the same business, and there is no way we are going to share information that would reveal our production [strategies]. The only information that is freely shared is through seminars, and it is all open to the public. There is no one [company] that would come to these forum and risk-sharing their operational strategies to the competition…*

As other companies that took part in the study stated, this company cited the need to remain ahead of their competitors as the reason for not being open about sharing information through any clusters or organisations to which they belong.

6.4.3. Learning and knowledge development at the company (No3)

Concerning learning and training programmes, their mining division runs a training department which carries out most of the training for the company. Of specific interest is a millwright programme which is run by this training centre, aimed at developing technological skills for its

automotive operations. The company recruits apprentices who may be interested in studying to be millwrights both from within their existing workforce and from outside in the surrounding communities. These recruits have to be less than 28 years of age, and they must have passed mathematics and science at secondary school level. They also have to undergo aptitude tests:

> *It is not enough for them to simply have maths and science, we have to see if they are technologically inclined because what we have seen is some of them have no interest or natural gifts in terms of technology and that can be a problem in the end.*

Those who are successful go through different levels of training, which takes up to four years, before they qualify as artisans.

Situated and relational learning at the company is evident through the structure of the programme, which seeks to develop learners' technical capabilities before they are formally enrolled in the training programme. This is an addition to the aptitude tests that the learners undergo to determine whether they are technologically inclined. The training programme is structured into a theoretical component which is taught at the sister company and the practical component which is carried out at various intervals in the plant.

6.4.4. Collaboration with educational institutions

The company indicated that there was no with any training and educational institutions at the time, although some TVET colleges had approached them seeking to establish a relationship where their students can be sent there to gain some practical experience. The interviewees added that, although there is no formal agreement in place with universities of technology or other technical and training institutions, there have been some engineering students who have approached the company seeking opportunities to complete their practicals and who are then allowed access to the company.

6.4.5. Learning and knowledge-related challenges at the company

The interviewees observed that the main challenges they had related to some of the qualifications that their employees obtain from universities and colleges. They complained that

these qualifications did not align properly with their production needs. A procurement manager explained:

> *If you look at our salespeople for instance, their knowledge is limited; in terms of procurement, they do not know that we need different kind of steel; the steel we need for cars is not the same as the one we need for construction or for mining. They just order any, and sometimes it is the wrong one, and the company loses money…*

The manager blamed this on inadequate training offered at education institutions, which he said was too generic and not designed to meet such a specialised industry. He indicated that there are additional training programmes that their staff could undergo to gain the required specialised skills but that these programmes were often very costly. Moreover, in terms of human resources inadequacies, the interviewees pointed out that they foresee a problem arising in the future from loss of expertise as more and more experienced staff approach retirement. This particular challenge was also noted at another component manufacturer.

There was also some evidence of efforts to make the work environment expansive for the employees in the form of bursary schemes, paid study leave, computer training and opportunities for progression to different positions within the company, as well as short training programmes to develop soft skills.

6.5. Component manufacturer No 4

The fourth component manufacturer is a multi-national company that supplies vehicle parts to several OEMs operating in South Africa including Ford SA, Mercedes SA, Nissan SA and BMW SA. The company has six plants operating in South Africa supplying parts such as fenders, doors, bumpers and more. Four of the plants are in the Rosslyn area, and two are in Port Elizabeth.

As soon as the company receives orders from any of the OEMs, it appoints a team in the plant and tasks them with ensuring the best quality production of parts supplied to the OEMs. Occasionally, the OEMs come to the plant to check up on progress and, if there is any

dissatisfaction on the quality of production, the OEMs then work with quality inspectors to address the areas they are unhappy with.

At the time of the visit, the company was in the process of manufacturing and assembling parts for two models of two different OEMs located in the Rosslyn area. The production involved assembling different parts including bonnets, fenders, doors and other parts that make up the hull of the car, for the two different models. Sources from this company included the training manager, a toolmaker, an instrumentation technician, a fitter and an automation supervisor.

6.5.1. Training and knowledge production at company No 4

Most of the workers are sourced from TVET colleges as well as the Universities of Technology. A familiar observation from this company was on the inadequacy of practical experience in their recruits. The recruits have to undergo more training provided in conjunction with TVET colleges that the company partners with.

The training manager stated that they used to have their own training division which helped meet their exact needs and said he had raised the possibility of reopening it with the management of the company observing:

> *It would be in the company's interests, to have our own training division on-site again because our workers and recruits can be trained directly by the company in the exact areas that are relevant to us… And using the equipment and machinery in the plant in order for them to become familiar with them.*

6.5.2. Scarcity of skills-instrumentation technician

Technology use and automation at the company are quite advanced, and the company requires highly trained artisans to operate, service and repair the machinery. One of the vital skills at the company was said to be that of instrumentation technicians whose duties were described as:

> *Being in charge of keeping the lines running by keeping watch on the robots and by fixing any errors immediately in order to minimise the interruption on the production line.*

The instrumentation technician interviewed at the company stated that there was a lack of experienced workers in the auto industry, especially the ones with specialised skills such as instrumentation technicians:

> *…we do get quite a few of instrumentation technicians from the mines and other factories but, even though what we do is similar, the instrumentations that we use here is different. Everyone doesn't use robotics.*

For instance, the robots with which he was working are used for handling, welding, sealing and screwing, which may be different from what other instrumentation technicians are used to, which is where, according to him, experience becomes an issue.

When asked about the qualifications required for entry into the auto industry, he stated that:

> *In my personal opinion, a few things you can do to get into the industry, specifically in my occupation, is electrical, millwright, and fitters… If you have all of that, I would say you are the crown of the place!*

It becomes complicated for jobseekers because the industry requires experienced workers, but the same industry is reluctant to hire novices or newly qualified graduates and to assist them with obtaining the required experience. Agreeing with this, the interviewees noted that some of the skill and practical experience could be attained with time but acknowledged that any worker would need the basic knowledge to work in such an industry.

He stated for instance, that he started at the company with only electrical training but that he already had some experience in the area:

> *I was lucky enough to obtain the experience, which if I didn't have, I wouldn't have got the job.*

The experience he had was gained from working at an OEM nearby where he did electrical work which he started doing as a volunteer:

> *I would go to work on weekends without pay, just to observe and learn from the more experienced people … I would hang around, hand them toolboxes and so on… And that's how I learned. I became familiar with the environment.*

Elaborating on valuable practical experience obtained from working in the plant, he stated that:

> *…my theory has helped me; I would say 15%, the rest is experience. When I was an electrician … I approached one of the guys [worker at the plant] and told him, listen I really like this, would you mind if I sit here behind you … I will not ask you anything; I will just observe … Then [later on] he started asking me to hold this here, do that for me there… And that is how I got my foot in.*

The interviewee went on to reveal that he still does not have a formal qualification for his current job at the company:

> *When I started here, I had no qualifications [in this specific field], and they said, unfortunately, they can't employ me. They said once I have get my qualifications I should reapply again, but because at that stage, they were short of staff and luckily for me I had experience in other areas, they hired me without any qualifications.*

Six years later, he is still in the process of obtaining formal qualifications.

How this informant was able to develop his skills shows how learning and knowledge can develop successfully from observation and participation. This is in agreement with Evans et al (2007), who point out that situated learning does not only take place in schools, colleges or training centres but also through other informal channels including the workplace, which also serve as learning environments. Evans and Rainbird (2006) view situated learning as encompassing experiences and capabilities which are developed through participation and not only acquired through passive acquisition of knowledge in a classroom.

It can, however, be argued that there are a lot of unemployed youth who are not fortunate enough to have access to unpaid work in industries to gain practical experience and this informant acknowledged that he was very fortunate to have had that access. Highlighting the importance of practical experience in the auto industry, he observed:

For someone coming fresh out of college, if you step into this industry, you are 'a zero on paper'... The reason I am saying this is because experience [matters most] it is also vital to understand the language of the industry because for example... If PLC is talking to robots, robots talking to PLCs and in between them there is hardware components talking to each other, you need to know what waits for what, who waits for who… And what needs to happen, because I can be a professional in PLC while I don't know the standards of the way they structure the PLC programme, [which would make] you take a lot longer to find the problem because you don't know the programme and what you are looking for… That's why I am saying, it doesn't matter what your qualifications is, if you haven't got the experience, it's a problem.

He also pointed out that, if he started working at any of the other OEMs, he would struggle a bit but not as badly as someone completely new to the industry because, even though the technologies in use at other auto companies may be different, he would still have some basic knowledge:

You know as there are robot technicians and car technicians, if I was a car technician and had worked on a Toyota for 10 years, I would know it very well, but now if I resign and go to Chevrolet, you know the basic components inside a car are the same but Chevrolet approaches their cars differently than Toyota does, so it is the same if I go to Nissan, I am used to a car. I just need to become familiar with their way.

He stated that the company does offer opportunities for students in need of practical training, and pointed out that some of their current workers in the plant came as students to gain experience and were fortunate enough to be retained:

If the company does recognise certain skills in students or trainees, they advise them to apply for jobs upon completion of their studies.

He thought that increased automation in assembly plants such as this one does have effects on jobs:

Which can go both ways; in Germany they have got more guys like me in specialised jobs because there are more robots… But because the economy

in South Africa is not that good, they cannot afford [lots of] guys like me, but for instance, in Germany they have got one guy per four robots… And for each guy like me, you get another specialised guy that comes with it…

To stress the level of skills scarcity in his specialisation area, he commented:

In the past, you signed a contract [stating that] you need to give two months' notice before resigning. When I started here they increased it to three months and now some of the guys even sign six months … that tells you how scarce the skill is… Because they know, when they lose us, they can't replace us easily. They can replace us with any instrumentation technician, but the guy that knows this [is familiar with the technology here] is scarce. The companies steal each other's employees when it comes to this. They even make gentleman agreements, for example, (mentioning one of the OEMs) agrees that they won't employ me if I apply for a job there…

With it comes to continuous learning, he stated that the only thing that motivates him is the interest he has in the field, indicating that he does not receive any particular motivation from management to study or specialise further.

6.5.3. Fitter

Another informant from the same company was a fitter whose responsibilities include maintenance and mechanical repairs of some of the machinery in use at the plant. He also helps in maintaining the jigs, pipes and water leaks, ensuring that they are clean and also checks on:

All aspects of what is running on the assembly line.

In addition to the qualifications that fitters and turners like him have from the colleges or universities, it would include additional specialised training to work in the auto industry, because of the tooling and machinery in use.

In some cases, depending on the specifications of clients (the OEMs), they would undergo even more training to familiarise themselves with new technologies per the specifications of clients. This particular fitter was sent to Germany earlier in the year for three weeks to acquire more expertise on maintenance of the tools which were to be used to manufacture parts for a new vehicle model at the plant. This type of knowledge transfer is commonly carried out before

components for new vehicle models are manufactured. The training is usually done by manufacturers of the tools, machinery and the robots, and the technicians, toolmakers or fitters travel overseas to learn from the manufacturers how to service, maintain and repair the equipment.

A supervisor on the production floor explained that this category of worker has to undergo rigorous technical tests in addition to the formal Trade Tests after which, should they pass, they first work to gain more practical experience before they can qualify to work in the various technical capacities in the company. She stated that most of the workers are sourced through a recruitment agency and others, like her, would have obtained their qualifications at Technical Universities and qualified in various fields and would have initially joined the company to complete their practical training. She had also had some previous practical experience in instrumentation, having worked at another component manufacturing company and, because of that, she was fortunate enough to be retained. This informant reiterated that the practical component offered at universities is insufficient, considering the level of practical experience expected of graduates by employers.

6.5.4. Toolmaker

The last informant from this company was a toolmaker in charge of the machinery to be used in the production of the parts of the model that was being assembled for a German OEM. Showing the machinery involved, he explained a toolmaker's role in the process of making the panels that, upon completion, become part of the body of the car. This process involves building the tools to the specifications of the OEM, to ensure that the design of the vehicle being assembled matches all the parts manufactured at the plant:

> *So the company first uses the specifications provided by the client (OEM) to manufacture a 'demo', and when this is approved by the client, the company then starts mass production of the parts.*

The tools that the company would have put together ensure that all the parts are identical and:

> *…in the event that there are some defects here and there, it is the responsibility of the toolmaker to fix all the issues...*

He explained the intricate process involved in manufacturing a car door:

> *To make a door is a process; you need tools to make the outer, you need tools to make the inner, plus all the brackets inside… There are about five stages, and in every stage there is a tool [involved]. Each tool would normally cost around R1.5 million, then let's say its five stages, R1.5 million multiplied by five, just for the outer part. And the inner, also the same price, plus all your brackets and everything. At the end of the day to make only one door can cost you nearly R30 to R40 million… But because they are making thousands of cars, somehow they would break even, but then sometimes they break even at over 100,000 units. All the machinery is expensive. Then you have to train somebody to operate the machine… To programme the machine, [in order] to operate, you need to understand some not-so-fancy programmes; you need to do [design] them yourself… People who are doing mechanical engineering [at the universities] are exposed to machineries at the training institutions, but then those guys… They only show you the basics…*

An N6 certificate is the basic entry requirement for beginners to work in the plant. As the company does not have a training division anymore, all trainees are sent to colleges around Pretoria for about eight months, after which they return to the plant to gain practical experience. He explained:

> *When undergoing training, they are taught how to operate machines, and when they return to the company, they start accessing and working with the tools.*

When it comes to training to meet specific requirements for OEMs, the toolmakers generally draw from their experiences in tool making:

> *…because we are already toolmakers, like myself I have been here 17 years… With this experience, it is a little easier…*

A common theme that emerged from the interviews with senior and experienced artisans and technicians in these component manufacturing companies was the ability to draw from their previous technical experience in the process of generating more capabilities. As Hodkinson and Rainbird (2006) put it, one of the layers of workplace learning relates to how each worker takes advantages of available opportunities at the workplace to produce new knowledge. The evidence shows that these workers can adapt to the high technological demands of their work

environment (as prescribed by the OEM) by drawing from their experiences in working with different equipment, to develop new expertise to meet the clients' high standards. It is not about going back to school or to universities to acquire more (formal) codified knowledge, but their ability to incorporate their existing knowledge and use it to produce more knowledge, which they then use to navigate the increasingly sophisticated demands of auto manufacturing. The importance of situated and relational learning over more traditionally acquired knowledge is clear in this instance; although they need the credentials and formal qualifications for entry into the workplace, once in, the role of tacit knowledge developed from participating and learning from their more knowledgeable colleagues becomes evident.

6.5.5. High standards prescribed by the OEMs

Concerning the high manufacturing standards expected of the component manufacturers, the toolmaker explained that when a defect is noticed on a finished vehicle, the company has to buy and then destroy it and also receives a penalty from the OEM. Therefore, he explained that:

> *The tool making machines and robots have to be very carefully maintained and serviced because the process of making the car parts has to be perfect… Even a piece of hair can make a difference and totally ruin a component. Sometimes it is very difficult to tell if there is a defect … and normally we have diamond stones, with which when you polish, you see a bump or something… But the problem is you will only be able to see it after the car is finished.*

It is thus the responsibility of the toolmakers to ensure that there are no defects. The inspectors (the set of people that are stationed at the end of the conveyer to check on the work of robots) inspect the panels, fenders and other manufactured parts:

> *It is the job of the toolmaker to go in and inspect the machines and robots and find the cause and fix the defects.*

The final check of the assembled body of the car involves a computerised inspection to ensure that there are no defects in the paint job and assembly or any bumps that would have happened during the pressing of panel beating.

These high standards in auto manufacturing are in place because international assembly specifications have to be met, and as Kaplinsky (2000) pointed out, successful participation in GVCs requires the participant to meet the expectations, as determined by the lead firms who govern the value chain. As seen in earlier chapters, due to their position on the value chains, lead firms and big multinational producers are well-positioned to wield influence and make demands on firms at the lower end of the chain, such as insisting on higher operational standards or other specific requirements (Morris & Barnes 2006). These strict rules and stringent specifications eventually lead to improvement in operational and production standards in firms located in developing countries, because they are required to meet international standards to compete effectively in GVCs.

For the robots used in tool making, the toolmakers benefit from knowledge transfers, whereby the manufacturers of the tools come to the local plants to assist with the installation and programming and to conduct training on servicing, maintenance and repairs. Depending on their experiences in toolmaking the toolmakers would have developed varying capabilities. The interviewee in question indicated that he could build some of the machines in use at the plant himself, based on his many years of experience in tool making. The informer stated that, for tool making, the plant usually works with TVET colleges. The training manager also indicated that he prefers to work with colleges to save money:

> *I prefer to use TVET college graduates than engineering graduates from universities, because, the salary of a university graduate will cost me up to R70 000 and with this money, I can employ two [TVET] college graduates...*

6.6. Component manufacturer No 5

The fifth automotive company that participated in the study is also a large multinational manufacturer of various household appliances in addition to automotive components. The plant that was visited for the study is an auto manufacturing plant, which supplies parts to major OEMs including Ford, VW, Toyota, Mercedes and Nissan. The plant is in Brits outside Pretoria north, while the head office is in Johannesburg. Other divisions are in other parts of Gauteng, in African countries and overseas.

The plant's core processes spread widely and include machining, assembly and, within assembly, there are different technologies involved such as welding, tightening, pressing,

hydraulics, pneumatics, PLC, automation control and more. The plant has two robots, but only one was being used at the time as the lines are mainly operated manually.

Automotive parts manufactured at the plant include wipers, brake pads, computer boxes, starter motors, alternators, wiper systems, brakes and others. Other automotive components such as wiper blades, computer systems and petrol pumps are manufactured at other plants of the same company in various other locations.

6.6.1. Automation at the plant

One of the technical managers interviewed stated that the plant is very advanced compared to the other companies in the same industry, but far behind compared to sister plants of the company worldwide. He explained that:

> *In South Africa things are a bit slow; money is an issue because when you talk about automation, you talk about installing robots, automizing the whole line and the conveyers… We are semi-automated because our lines are mostly manually operated, with a lot of manual labour and few automatic machines.*

He added that other reasons for not using highly automated equipment, apart from the financial implication, have to do with the productivity levels

> *If you automize the lines, your output is going to be very fast… For instance, a line produces 500 parts per shift, but if you automize that, you can reach up to a 1000 per shift. Now you are looking at issues such as whether to cut labour- do you really want to [do that]? It is always a question of quantity. Do you want to invest so much money for so few products? The two have to balance. If your production volumes are low, then, then you'd better remain manual or semi-automatic. That's why most of our competitors are still very manual-oriented. Obviously we would like to be highly automated, but it doesn't make sense; the amount of investment and the output we would be getting wouldn't make sense.*

The technical skill required to maintain highly automated lines was also mentioned as one of the challenges in terms of operating a highly automated plant.

6.6.2 Collaboration with clients (OEMs)

On the issue of relationships with customers, the technical manager indicated that a relationship exists between the company and its customers, which goes as far as meeting the standards of the client:

> *We have to meet their standards, quality-wise, and in terms of stock … some of our customers conduct audits, where they come to check, if we have five-day stock in our inventory in case something happens in our production line; they want to ensure that they would still have their parts while we try to fix whatever issues … So they would tell us, this is how I want my parts [to be] fixed; the grease level, the material that must be used and all those things. In cases where we may feel that we may need some expert assistance, we have our own team of developmental experts, but if we need external help, we go to the customer as we maintain very good relations.*

He went on to say:

> *If we need to create a new product, we would sit with the customer, and they would give us a scope of what they expect….*

If it is a new product, the technical manager said that there are processes and stages involved before mass production; a sample has to be built, errors have to be corrected and perfected, by working with the customer to ensure that all the standards of the client are met:

> *They (the customers) look at the equipment to see if they are satisfied with the way the product will be produced; they check the way the material will be handled.*

Once the first sample has been built, both the company and the customer would carry out their own tests, and if there are small issues, there are opportunities to iron them out:

> *There is always constant communication with the customer.*

Once again, the evidence points to the influence that the clients (who are mostly OEMs) exert on the component manufacturers, about specific quality standards that must be met during production. This also shows, again, that the supplier companies have the responsibilities of

developing the required technical expertise and resources required to meet the high-quality manufacturing standards, without expecting much in the form of assistance from the clients.

6.6.3. Information-sharing with other (manufacturing) companies

The interviewees (as observed in other companies) indicated that there is no formal forum or clustering of automotive manufacturers in the area and that sharing hardly happens except in common areas of concern such as electricity supply or other issues affecting all of companies. This was attributed to the competitive nature of the business which requires privacy and confidentiality.

The only knowledge and expertise sharing was said to take place internally within the company, among the company's various global locations. In this regard, they have a system they call 'Lesson Learnt' where two or more plants in different locations, locally or globally, which happen to manufacture similar products would exchange information on challenges encountered during production, as well as methods used to solve them:

> *Someone could come up and say I had the same issue, and this is the way I solved it. We have a forum where we discuss these things, but all within the company. The only instances where we share information externally would be when we share information with the customer, where it affects a certain customer, then we have to share with them.*
>
> The company has a yearly conference where all the engineers and technical managers gather in Spain to discuss improvements and other issues affecting production:

From different locations, everyone comes up with their own ideas on how to move forward; problems that you might have encountered and how they were solved … I mean I can share information with you, but there would be a whole other locations that are not getting what I have to share; so when we meet in Spain, the lead plants (these are the major plants with more expertise) would have checked with other plants to see how the problems encountered were handled and then communicate these solutions to everyone. They can, for instance, inform you that the issue that you are having was observed in Brazil, so contact them to find out how they were solved; we can tell you how to resolve it, but it would be best to find out from them directly how to solve them. Our community [in our company] is very large and we help each other.

The form of learning described above relates to learning that takes place through communities of practice as described by Wenger and colleagues (2002), who define communities of practice as groups of people who share a concern, a set of problems or a passion about a topic and who deepen their knowledge and expertise in this area by interacting regularly. Although the kind of knowledge that is produced through these kinds of interactions may not necessarily be codified or documented, the participants can benefit from one another's experiences and each other's strategies in problem-solving. The authors add that, through these interactions in communities of practice, members are able to reduce the amount of time spent looking for solutions and are able to learn from each other in terms of innovations and practices that would have developed in their respective fields, while also being able to benchmark their capabilities against those of their peers (Wenger et al, 2002).

6.6.4. Ensuring quality in production

The company runs a competency management programme which is aimed at running quality checks on products that they manufacture. The training manager explained how it works:

This programme does not only focus on empowering our staff but also our suppliers, and in this regard, suppliers are also invited for periodic training… And the curriculum for this programme is designed by us as part of our training plan … We take compliance very seriously, and we train our employees in this regard while also ensuring that our suppliers are equally brought on board…

Bessant et al (2003) underscore the importance of these kinds of interactions within and between firms which result in inter-firm learning, stating that continuous and sustained learning among organisations is a vital source of maintaining competitiveness as research from various countries points to benefits of inter-firm learning. For organisations, Wenger, (2009) argues that learning is an issue of sustaining the interconnected communities of practice by which an organisation knows what it knows and thus becomes effective and valuable as an organisation.

6.6.5. The Mechatronics project

The president of the company in Africa currently leads a project called the Mechatronics Project Development in South Africa. Participants in this project include some OEMs including Nissan, Ford, BMW, other companies such as Siemens, merSETA, the German Chamber of Commerce and some TVET colleges who have all partnered to develop mechatronics in South Africa. This project has various working groups including technology, recruitment, accreditation, and funding.

The training manager elaborated on the project:

> *Each participating company would select candidates to train in mechatronics with the aim of training up to 44 apprentices from all over South Africa. To qualify for selection, candidates are required to have at least maths and science or engineering graphics and design, for matriculants; and for N3, maths, electrical or mechanical engineering are required. Each company then has to identify an accredited college to carry out the mechatronics training. We have selected AIDC to conduct the theory aspect of the training. Out of the 44 mechatronics that would be trained under this programme, we have committed to train four. The curriculum that will be used is a combination of the German and South African curriculum, and the programme is scheduled to run for approximately four years. The training is structured in a manner that allows for both practical experience and theory; three days the apprentices would be at AIDC, and the rest of the time they will be here. Each participating company will structure the training according to their needs… We have submitted to the committee what a mechatronic would need in this company, the competencies that the mechatronics should possess…*

The mechatronics programme is expected to produce highly trained artisans, who are in high demand within the industry.

Regarding the high technical expertise they require, another technical manager from the company, put it this way:

> *When you graduate, especially from the engineering field, and you come to the industry, the industry differs so much, when you get to other industries, yes they may be more in line with what you did at school, but like [here] it is not really the same. It is like you start from scratch; you might have your basics, in terms of, you know what your basic tools are, but the environment [can be different], you can be an engineer but for the motor industry, it's completely different…We find that the graduates are not equipped enough to just jump in and move on…*

The informant made a comparison to the way it is done in Europe, stating that:

> *The requirements for their students is to undergo on-the-job practice before entering university, whereas with us it is the other way around; you study, and then you come in for an internship.*

This leads to problems when it comes to the much needed practical work experience. She stated that discussions between TVET colleges and them as employers were underway to find ways to design work-integrated learning programmes to address this challenge.

Another key challenge for the company is to find people who are familiar with the company's equipment and machinery. "Our equipment are a bit of a niche" the second technical manager stated. Special training that may be required for the workers is provided as needed; a provider is asked to design some programmes for technicians as may be needed and, in cases where it is necessary, the workers are sent overseas for specialised training.

6.6.6. The intern's perspective

Another participant from this company was undergoing training as an intern in the HR department, where she worked closely with the training manager. She attended one of the TVET colleges in the area, and she was in the sixth month of her 18-month internship at the company. The intern explained that the company provides several professional development programmes for the workers:

> *We have HR learning days during which employees are taught how they can grow professionally; and another programme called Mind Development, where you say, okay this is me, this where I want to be, where you can self-nominate to the talent pool, this is to encourage employees not to wait on managers, but to take the initiative themselves and say: I want to develop; how can you HR and management help me?*

These programmes open up opportunities to connect with other employees in other locations worldwide where the company has branches, from where employees may obtain online mentoring and have a 'consultation hour' during which information is shared between employees in different locations. It is an innovative method that the company uses to encourage learning within the company as well as with sister-companies across other locations.

6.7. The role of the AIDC in supporting the auto industry in South Africa

The Automotive Industry Development Centre (AIDC) located in the automotive supplier park in Rosslyn, Pretoria, is perceived as an efficient intermediary through whom governmental support is channelled to the auto industry. Weaver and Osterman (2014) describe intermediary agencies such as AIDC as entities that connect labour market members. Their roles may include facilitating knowledge and learning in firm networks thereby strengthening the impact of cluster and value chain organisations to increasing competitiveness and productivity (Clarke & Ramirez, 2011).

In the innovation environment, intermediaries can move on to more complex roles such as providing technical advice on upgrading production facilities (Clarke & Ramirez, 2011). Both OEM A and B had positive observations regarding the supportive role played by AIDC in the auto industry, especially about training. Both OEMs also reiterated their satisfaction with the equipment in the AIDC training centre, stating that they regularly use their facilities to carry out training of their workforce.

The training manager from OEM A explained that the AIDC is the first provider he approaches when wanting to conduct training of workers, should there be a need to provide any additional training:

> *We get a lot [of assistance] from them; we actually insist that the government use them. They're efficient, and they have a very good training centre as well. [For instance] if I really need to train 300 people, the first people I think of is AIDC… I approach them and ask, can you train 300 people for me? How long? Six months. Good, how much is it going to cost me? So much. Okay let me see if I've got the budget and I'll send them to you.*

For instance, there was a case where an OEM was faced with the possibility of closing its plant. An informant from AIDC explained how they assisted this OEM:

Our roles is to facilitate direct foreign investment. So whoever comes into the country, we need to make sure we've got resources to assist, because we've got the logistics… And we can approach government because we are also a government subsidiary. So we would say to the government, here's an initiative, there's a potential of so many jobs being created, so many trainees being absorbed by the industry… So they [government] are willing to fund, to assist in that case. When (mentioning one of the OEMs) wanted to build the new [model] one of the options they had was to either close [the plant], and retrench everybody, and wait to see if they got the tender to build the new model … So part our intervention was to say that, we'll come on board, we'll train these [existing] people at no cost to the company, with the condition that they are not retrenched. We offered the OEM, that while they [the OEM] are setting up for the new model we would have these guys and train them and when production of the new vehicles starts, they would be ready, because if they had said let's shut [the plant] down, they might have lost these guys to other companies because it's a competitive industry.

The AIDC informant elaborated further on the systematic support offered to the automotive sector regarding training:

From our side, we've always supported the OEMs, [and] the automotive sector, and even though because of our capacity, we are scratching the surface… Because if you look at the global space, you will see that we are still lagging behind in terms of the units of cars that we produce per year. And it goes to show that one of the hampering reason is that we don't have the right sort of skills and neither do we have [the] capacity to reach that ultimate goal. But our intervention is more around a targeted kind of training, where we would only come where there's a specific need…

6.7.1. AIDC as a recruitment agent for the auto firms

The AIDC Learning Centre is equipped with laboratories where training in mechatronics, vehicle assembly line, spray painting, panel beating, welding and a simulator that depicts the

vehicle assembly process from various stages involved in the production of a car, are carried out. OEMs are thus encouraged to utilise the AIDC's trainees in their factories because it is of no cost to the OEMs (trainees are sponsored by stipends from SETAs and other sources) and encourages the OEMs to absorb them into their employ if satisfied with their capabilities, especially as it cuts down on recruitment costs and training processes:

> *As a government agency, we need to make sure that whoever we're training get absorbed into positions. We don't want to be seen as training for the sake of training, whereby once you train people, you don't know what to do with them … Because the whole idea, is we're trying to market them in such ways that once these learners complete their theory with us, and then they go to the industry for the practical; while there, we give the companies an opportunity to assess these guys … We say to them [the companies], you've got people, extra hands that come into your business at no cost to you, you have an opportunity to observe them, and should you be interested, firstly, you can then absorb them into a position in your structures, secondly it will cut your cost in terms of your recruitment. You don't have to interview them; you already know what they are able to do … And because you have not really hired them [yet], if you are not happy [with their performance], you don't have to [retain them]. After they have completed [their training], they can go. But for these learners, we motivate them and say, look, you are there to market yourself. If you do very well, [you have a job] … And we've got a high success rate, up to 80% of our learners get absorbed into the positions. And those who don't get hired by the OEMs, they would work in the other manufacturing companies on the value chain.*

These methods offer the companies a more flexible process to recruit workers because they are allowed to assess the competence of the prospective workers before hiring them, thereby avoiding the difficulties involved in dismissing ill-qualified workers. The type of training offered depends on the skills needs of the companies. Companies may state that they need boilermakers; the AIDC then trains accordingly, sourcing the trainees from the surrounding communities and townships. The AIDC also maintains a database from which it selects trainees and also takes students from universities and colleges who want to complete their P1 and P2.

6.7.2. The collaboration of stakeholders through the Automotive Forum

Through the auto forum, which it helped establish, AIDC endeavours to work with other stakeholders in addressing concerns of the auto industry. One of the ideas that have emanated from the forum is the issue of recognition of prior knowledge (RPL) which aims to recognise the experience and skills of workers who have held a profession for years but do not possess a formal qualification. The AIDC indicated it is working to find solutions on how to have these experiences recognised and incorporated into formal qualifications, because, in the auto industry, for progression and career advancement formal qualifications remain crucial for workers.

The AIDC has carried out benchmarking exercises to investigate the quality of training offered at TVET colleges, the results of which indicated that it was outdated. On this collaboration with other training institutions, the informant explained the strategy of the AIDC in bringing other educational institutions especially the TVET colleges, on board:

> *We don't want to be in a state of competition, because it defeats the whole purpose. So, we've established a forum, which we call Automotive Forum. The purpose is to get all the stakeholders in one room, have one voice, one direction, and to give everybody an opportunity to say where are they battling? What are the gaps, how can we start now closing the gaps? This is where the idea of RPL came up, from the existing workforce. Because some of them have been in the position for 15 years with the same skills, but they are not formally qualified, although they can do a good job like any artisan ... but our education [system] emphasises certification, irrespective [of] whether you've got the skills, knowledge or the experience ... what's good enough is the paper [certificate]…With the [TVET] colleges, we've picked up that what they are teaching is outdated. As for the lecturers, they've never been into the industry. They don't even know what the machinery looks like; they only know about theory ... So what we've met with DHET to propose to them [to design] a lecturer development programme to assist TVET colleges.*

The first of these lecturer development programmes involved Ekhuruleni College. The full-scale programme was due to start in 2018 and it was anticipated that other colleges would also be interested in participating and ultimately all college lecturers would be properly trained.

The forum undertakes to convene quarterly (four times a year), assigning tasks during each quarter, which need to be accomplished, and a progress report issued the next quarter. The AIDC elaborated further on how the forum works regarding training:

> *We, as an automotive industry, sit and talk about how we can provide employment opportunities; what kind of Learnerships we can design at the low level so that the people that are on the street, [those] that couldn't get formal education ... We try to absorb them whenever we can, but obviously, a product runs on Required Jobs to Operate (RJTO). So we cannot operate more than that because it's going to make the cost per unit too expensive and as soon as the cost per unit becomes too expensive, then it means they [the parent company] would just build it overseas.*

The auto industry is also allowed to set the theme of the meeting, and the AIDC listens to their current and future needs and the assistance they would require. The inclusion of universities in the forum is aimed at helping to understand the concerns of the industry regarding the inadequacies of university graduates to promote the synchronisation of the skill needs of the industry and the university training. The AIDC informant elaborated on what they hope to achieve:

> *We have got different stakeholders because the industry complains to the [education] institutions that some of the graduates that are produced don't meet expectations [of the industry]… If we get professors to sit in these forums, they have an understanding of what things they need to do right, and for the industry, they are even ready to avail some of their experts to go and lecture at the universities as part of some kind of exchange between the two.*

Some relationships have been formed between the industry and the training institutions through the forum, and exchange programmes established where industry experts are invited to universities to lecture and offer practical courses at as well as lecturers coming into the industry to obtain a clearer indication of the industry's skills needs.

Gereffi and colleagues (2011) criticise both the industry and the educational institutions in developing countries for lack of effective communication, which could facilitate collaboration between the two to address the mismatch between the needs of the industry and the training that is carried out at education institutions. The authors submit that this absence of information exchange among these key stakeholders hinders efficient learning and knowledge production in value chain. The intervention by the AIDC where all key players come together at the auto forum to address issues affecting each of them can be seen as a step in the right direction in addressing these shortcomings arising from a lack of collaboration.

6.8. Perspectives from a TVET college

Having heard about the experience of the OEMs about working with TVET colleges, it was necessary to seek the input of colleges to find out about their problems and their views on the negative perceptions that are associated with the colleges. The TVET college that participated in the study is in Pretoria; it was selected due to its location, which is where some auto companies that participated are also located.

6.8.1 Programmes offered at the college

Some of the programmes offered fall under 'ministerial programmes', which are issued and registered by the DHET, for example, N1-N6 and NCV2-4, with the syllabus also coming from the DHET. These programmes cannot be altered and must be taught exactly as they are issued, as they are funded and examined by the DHET. There are occupational programmes, such as learnerships, which are also under the DHET, which are not funded by the Ministry of Higher Education but by the National Skills Fund. They come from the same ministry but are managed differently. These are not prescribed and can be altered to align with the needs of the industry, but they must be aligned with QCTO and SETAs because they still have to be accredited for the students to receive accredited qualifications.

6.8.2. NCV and NATED programmes: provision for practical training

There are different streams that the college follows, including the National Certificate Vocational (NCV) and the NATED (National Accredited Technical Education Diploma), of

which courses were first linked to the artisans training system. The engineering, N-level programmes have one-trimester duration and each business and general N-level programme has one-semester duration. The college started offering NCV in 2007 because the college had been following the NATED programme which had been standard post-1994.

During this period, students would go to the industry for three months for practical training and then return to the college for the theory aspect of their training. Since their practical training was guaranteed, the colleges started focusing more on theory because it was expected that the practical aspect would be undertaken when the students went into the industry. According to the informant from the college, it is at this point that the problems with inadequate practical training started:

> *These colleges used to be called Technical Colleges… They were located next to different industries. Students would be placed within the industry for a period of three months... Eventually they [colleges] started accepting even private people who were not aligned to any industry and they [colleges] focused more on theory than practical, because it was expected that practical would be covered [during placement at the companies]. But the truth is, for the industry, you find that they wouldn't have time to train … Eventually, the government noticed there was a high number of unemployed graduates because they could not fit in the industry because they only had theory. As a result they [government] came up with a new programme that would integrate both practical and theory. That is where the National Certificate Vocational came in.*

The NCV was introduced to integrate both theory and practical knowledge at the colleges. The duration of the NCV programme is one year starting at N1 which takes three months to complete. After three months or ten weeks, if a candidate successfully passes the examination, they can proceed to N2 and N3 after they can either study up to N6 at the college or seek employment. If a student or trainee is fortunate enough to be retained by a company at N2 level, they then undergo an apprenticeship and enter into an employment contract for three to six years. After three years an apprentice can write the Trade Test examination and, if they pass, they would be issued with a certificate called a Red Seal after which they would be

officially recognised as an artisan. If a candidate elects to carry on to N6, they would then apply to the Department of Education (which is now the Department of Higher Education) for a National Diploma.

NCV starts at Level 2, 3 and 4, the training comprises 30% theory and 70% practical and the duration for each level is one year, running from January to November, after which if all the levels are completed successfully, they obtain a Matric-equivalent qualification. The minimum entry requirement into the NCV programme is a pass at Grade 9 although, in some cases, the colleges can use their discretion to admit students who do not have Grade 9 qualifications. The main advantage of NCV is that it comprises both practical and theory.

6.8.3. Challenges relating to the placement of students in the industry

To secure placements for the students to complete their practical training, the colleges need to establish partnerships with companies for it to happen smoothly and according, to the college employee, it is not easy because TVET colleges do not have a very good reputation and many companies do not like to partner with them, which disadvantages the graduates:

> *Due to lack of practical training, many of our graduates end up working in retail shops or as petrol attendants because they couldn't find jobs in the industry when they graduate… Remember the industry doesn't have time to take on a student without [adequate] practical training because their objective is to make money; they don't have time to train.*

The source did, however, mention that with the facilitation of merSETA, some companies, including an automotive component manufacturer, had recently agreed to enter into a partnership with the college. There was also another partnership facilitated by and another SETA (FOODBEVSETA), where lecturers from the college and some students are placed at the company for 30 days to partner in training and for employment:

> *I've placed two lecturers for a period of 30 days, and out of that, we started a very good relationship. They wanted me to give them 20 learners for permanent admin employment…. So at the moment [collaboration with the industry] is improving a bit; it's not at the level that we desire, but there is some improvement…*

He stated some of the SETAs have been instrumental in establishing relationships with the industry to assist with practical training for the students:

> *The SETAs also are really helping, because those companies stand to benefit with their levy that they pay … I can say that has also assisted us in terms of companies now relaxing their recruitment processes regarding student absorption; I can attribute that to the involvement of SETAs.*

However, the majority of their students still struggle to find places to carry out practical training, even though, as he put it, at least four major OEMs are "right in his doorsteps." This difficulty was blamed on the poor reputation of the syllabus in use at the colleges:

> *If you look at our textbooks, the syllabus is dated in the 1980s… It is very old and does not meet the current skills needs of the [auto] industry, which are constantly evolving… We design our programmes assuming that these are what the industry requires, whereas it was going to be easy if auto companies would advise the government and say, before your design the syllabus, talk to us and we will tell you what the current technology is, what it is that industry needs… Then from there, the government can consider the input of the industry, and design the syllabus for the TVET colleges in accordance with the needs of the industry.*

The informant believed that it would have been a good idea to have the lecturers receive some training from the industry, but remarked that the industry is not in the business of training as they are driven primarily by making a profit and are not willing to spend their resources in other ventures. The best option for colleges, he argued, is using the occupational programmes which can be amended to suit the needs of the industry, although he noted that these also come

with their challenges as they need to be accredited. He expressed optimism, however that the Minister of Higher Education and Training has been holding consultations with the industry to introduce a new dual training system. This follows an EU-SA dialogue where some countries in Europe, including Germany, discussed their training systems, which showed (for instance in Germany) that the industry should lead in terms of what needs to be taught at colleges. Some TVET colleges have been identified to pilot the study of the dual system which has been ongoing since 2017, with stakeholders from all provinces meeting under PEDSECK (an organisation for artisan development) to track and assess its progress.

The informant indicated that the college has been able to establish partnerships with AIDC and some SETAs where lecturers from the college take their students to AIDC to expose them to the equipment and machinery used in the auto industry. With SETAs, they can raise funds for student funding and other forms of assistance. One OEM has also donated a chassis of a bus to be used for educational purposes at the college; the same company is also assisting with artisanal development from their college.

6.9. Perspectives from a private training institution

The other training institution that participated in the study is a private academy located in Pretoria which mainly operates within the Gauteng region but also has clients in other parts of the country, as well as from other African countries including, Zimbabwe, Botswana, Uganda and Nigeria. At the time of the interview, the academy was involved in training people from a Ugandan automotive company which wanted to produce electric vehicles.

The academy is accredited with several SETAs including merSETA, and it is a member of the South African Quality Institute (SAQI). The qualifications offered at the academy are SETA qualifications, mostly Level 2 and 3 as well as Level 4 in some cases. They also carry out human resource work for their clients, which consist mainly of auto manufacturers. The training offered for the auto companies is aimed mainly at operators and supervisors, the majority of who would already be working in the industry.

The informant observed that, from his experience in dealing with some of the auto companies, there is a failure to project and plan for their future skills needs:

Some of the companies fail to plan properly; they are merely doing the Learnerships to gain benefits from their BEE scorecard, in which case their trainees become unemployed when the training is complete… But when their recruitment strategy and their BEE strategy are aligned; if for instance they anticipate that they are going to need 40 guys in a year's time, and plan and train accordingly then they [trainees] are retained. I've seen examples where the company's HR strategy is lacking, but I can't tell them what to do. I'm the service provider, I can see here's a train smash, and I see there are 40 guys that are not going to get work because the company did not do their planning properly.

With regards to the curriculum, one of the qualifications offered is called the Automotive Manufacturing Industry Certificate (AMIC), to facilitate the transferability of skills among workers within the auto industry. The qualification is recognised in the industry, and the AMIC is required for an employee to become a supervisor.

The academy offers training tailored to a company's skills needs which can vary from trying to score higher BEE points to improving the worker's skills. If it is for the skills component for the BEE status, there would be a need for a SETA accredited course, which, according the informant, are outdated and irrelevant and are thus only done to satisfy the scorecard as required by the client. On the other hand, the informant pointed out that, if a client needs their workers to master or develop specific capabilities, then the training offered would be designed to accommodate the specific needs required, which might not necessarily be SETA accredited:

We adapt our curriculum; when a company phones to ask me, can you do this training? The first question I ask them is, do you need this training to satisfy your skills element of your BEE strategy, or is it really a need? Tell me because if it's for the skills development element of the component to BEE strategy, then you need to have accredited courses. Now again, these accredited courses at the SETAs are so outdated. But you do it to satisfy the requirement… If it's a real need, they say no, forget about that, this is a need. These guys can't do X, Y, Z… In this case, the type of training that we do would be different.

This would be because, according to the informant, the SETAs (except for the transport SETA and the merSETA whose content were deemed to be relevant) do not have the capacity to update the courses regularly to comply with the constantly changing requirements of the industry. For instance in the case of the Ugandan team, the training designed for them was not necessarily concerned with accreditation because the company was more interested in acquiring specific technological expertise which they needed for production in their plant back in their home country.

On the obstacles facing the sector, the informant suggested that training policies tend to be politically motivated and are not instituted after consultation with those who are more familiar with the actual needs of the industry, hence the reason some of these policies were ineffectual and irrelevant to the industry.

CONCLUSION

The findings of the study indicate that there are many issues to be taken into consideration when analysing the question of learning and knowledge production in the local auto industry. It is a very complex industry with a large network of role-players, all of whom face different obstacles. The challenges faced by the OEMs and their major suppliers differ, depending on many factors, and these cannot be categorised simply. For them, the picture is largely different as they seem to have the learning and knowledge production under control. The smaller supplier companies on the other hand indicated dissatisfaction and reported that they face several obstacles while having inadequate support. The educational and training institutions, more especially the TVET colleges, face challenges which hinder their effective functioning, some of which relate to government policy over which these institutions have little or no control.

The ability of national social institutions to support the upgrading efforts of firms and their workforces is a critical factor in establishing the benefits from participation in GVCs and in this regard, a central concern of the GVC approach relates to examining the extent to which insertion in the global economy offers developing countries and firms opportunities for learning, skills upgrading and the enhancement of technological capabilities. However, the GVC literature only partially explains processes of innovation and labour upgrading (Ramirez and Rainbird, 2010). While the importance of national social institutions for the development of GVCs has been acknowledged, (Gereffi, 1999; Humphrey and Schmitz, 2002), the literature on GVCs does not highlight the role of national social institutions into the analysis. Ramirez and Rainbird, (2010) argue that if social institutions are to be incorporated into GVC analysis, this needs to be understood as a two-way relationship where social institutions influence the supply and regulation of labour, impacting on local firms' capabilities, skills and labour practices. In turn, national and multinational firms inserted in GVCs would have the potential to serve as channels for the dissemination of new technologies and new forms of work organization (Ramirez and Rainbird, 2010).

7.1.Government support for the auto industry

As observed by Ponte and Sturgeon (2014), the intense competition arising from globalisation has resulted in challenges in global value chains, for both the developed and developing countries, which has left small and large firms in all parts of the world exposed to global

competition. The authors add that there are various factors that impact on each country's economic system, and there is no single theory that can be used to study how specific countries can maintain a competitive edge over others. However, their governance concept on the GVC theory shows that the government in South Africa does, to some extent, contribute to the governance functions described by the authors, alongside and in partnership with lead firms and OEMs.

Through its policy for the automotive sector over the years, the South African government has been encouraging investment of lead companies in the country which, in turn, drives OEMs to upgrade their production capabilities, resulting in increased numbers and quality of vehicles produced in the local auto industry. It is important that industrial policies clearly identify the role played by leading players and the preferred form of linkages to them. Producers need to be made aware of the consequences of different strategies followed by different OEMs in the automobile value chain. Policies in this area are not just related to fiscal incentives, but rather to the provision of science and technology infrastructure and a robust policy for the supply of highly skilled human resources. Policies to support local learning and the technological upgrading of local suppliers are also required (Quadros and Consoni, 2009).

In Brazil for instance, as was shown in chapter four, the industrialization process under protective policies stimulated a significant technological learning process among local firms, building forward and backward linkages between companies at different stages in the production process (Posthuma, 2005). The know-how gained during the development and expansion of the Brazilian automotive industry enabled the country to achieve a level of integration and manufacturing capability that would prepare it for this new stage in the international automotive industry (Posthuma, 2005). Inter-firm relations have been strengthened as relations between assemblers and suppliers have been transformed in that lead firms now pass on greater responsibilities to their first-tier suppliers. Assembler-supplier relations were traditionally founded upon price-based competition, where the assemblers would use a broad base of component suppliers to attain greater flexibility in price negotiation and parts acquisition (Posthuma, 2005). Relations between firms in the supply chain have been strengthened, as first-tier suppliers have become specialized manufacturers, responsible for the effective management of the supply chain and product assembly. This new range of functions includes responsibility for product design, and the assembly of modules which must be delivered directly to the final vehicle assembly line, with the guaranteed quality and cost

specified by the client. Posthuma's study among Brazilian automotive firms also showed that improved manufacturing practices were diffusing throughout the production chain, whereby the practices of smaller firms would be upgraded via contact with larger companies as a result of these closer inter-firm relations (Posthuma, 2005).

In South Africa, the assistance provided to the auto industry through agencies such as the AIDC can also be seen as a strategic method of creating steady linkages among various stakeholders. This strategy encourages collaboration between different institutions to address the challenges in the auto industry, especially about developing a highly-skilled workforce. With specific reference to the Pretoria region, the creation of a supplier automotive park in Rosslyn in the vicinity of several OEMs and a number of their suppliers can be interpreted as further evidence of the government's effort to facilitate and encourage cooperation among the automotive companies. Nevertheless, even though there is clear evidence of commitment on the part of the government to support the auto industry, the observations and input from various participants in the study indicate that these measures are not enough and that still more remains to be done to stimulate faster growth in the domestic automotive industry.

The evolution of the auto industry in India shows how industrial policies can positively impact on the development of innovative capabilities in auto manufacturing companies (Kale, 2017). Kale's study on the Indian auto industry points out that in developing countries, government policies play an important role in stimulating technological capabilities especially among local supplier firms. Such industrial policy should encourage the development of local capabilities by requiring auto makers to develop products via a higher percentage of local suppliers as is the case in India-which helped develop innovation and technological capabilities for local component manufacturers.

7.2. Obstacles relating to practical exposure and workplace experience

The study has endeavoured to focus solely on problems relating to learning and knowledge production in industry, and the evidence gathered shows that different stakeholders face different challenges but one of the main themes found to be common to most of the participants, revolves around the issue of inadequate practical experience and exposure for students and potential workers. The OEMs and component manufacturers reported that the recruits that they hire are inadequately equipped with practical skills. The students and trainees both complained that they do not receive adequate training, even when placed in firms for experiential training.

The TVET colleges also stated that they struggle to find placements for their students in the industry.

Due to ever-increasing advancements in technology in the auto industry, practical exposure for workers and potential workers is undoubtedly crucial for the automotive industry in South Africa to thrive and elevate its positioning in the automotive global value chain. However, as important as it is to find solutions to how the industry and the educational institutions can address the inadequacy in practical exposure for students, it is equally crucial for the industry to find other ways of developing learning within their workplace. This can be a complementary aspect to collaborating with educational institutions in producing a workforce that is ready to meet the needs of the industry.

It would be important to not only focus on formal education, acquired in formal educational institutions, but on processes that promote situated learning, through which tacit knowledge is produced at the workplace. Workplaces within the industry are well resourced enough to promote this kind of learning, and it is in their best interests to create expansive work environments that produce workers capable of meeting the high technological demands of the industry. It is thus important to give less emphasis on the traditional approach of education, which focuses on the acquisition of formal qualifications and credentials, and to give equivalent priority to situated and relational learning, which recognises the important role of tacit knowledge that is developed within the workplace. This would require more cooperation and interaction between OEMs, supplier companies, education and training institutions and other stakeholders, which was found to be largely lacking.

The TVET college system, in particular, has the potential to be a useful partner in learning and knowledge production within the workplace. The country's universities, some of which are ranked among the top in the world, are equally well positioned to support the local automotive industry to increase their value-added on the value chain by partnering to establish research and development centres, which can increase the functions in which the locally based OEMs participate in the global automotive value chain. India, for instance employs strategies to narrow the gaps between the human capital needs of GVCs and the skills supplied by national education systems, in order to help recent graduates and workers develop high-demand skills which make them more employable, consequently increasing workforce employability.

Of more importance however, is South Africa's poor emphasis on practical training, compounded by an insufficient production of highly qualified formal artisans. As seen earlier, training and educational institutions are not producing highly skilled artisans that possess the much needed robotic, digital and technological expertise that is in high demand in the auto industry. TVET colleges are institutionally well placed to partner with the auto industry to meet these skills but this is not happening due to several obstacles that have tainted the reputation of the TVET colleges. One of the strategies as suggested by this study is to employ the *dual approach* which emphasises a combination of both formal education with informal forms of learning and knowledge acquisition which take place outside of traditional education and training institutions.

7.3. Lack of support from lead firms

The influential positioning of lead firms in global value chains allows them to place high demands on the firms on lower positions in the value chain which, in some cases, involves assisting such firms in upgrading to meet high production quality standards (Morris & Barnes, 2006). According to the findings of this study, however, most of the supplier companies indicated that they do not receive support from lead firms in upgrading their production capabilities. On the contrary, the evidence obtained from most of the supplier firms indicated that it is their (suppliers) responsibility to do everything they can to meet the specifications of their clients, failing which they risk losing the business. The role of lead firms, especially concerning the transferring of knowledge and competencies across various stages of the value chain in firms in developing countries, is highlighted by the authors, but the findings of this study show that it is not the case in the South African context. This lack of support from the lead firms underscores the importance of coming together as auto suppliers, to form relationships and alliances to learn from each other and develop strategies aimed at increasing capabilities and innovation in their various production areas.

One way of achieving this would be to develop innovation centres, which would work with global players to spur growth in local auto component manufacturing. This is a strategy that has been utilized in India, with some auto component multinationals (such as Bosch LTD) setting up a world-class technical centre in India which is also export–oriented. In this case, lead firms would focus on a fewer number of suppliers, who are in turn encouraged to foster closer relationships amongst themselves. Similarly in Brazil, Bosch has advanced the process

of regional specialisation of Brazilian subsidiaries, by raising them to the status of global centres of excellence for certain types of components.

For instance, as regards starter electrical engines, the Brazilian subsidiary of Bosch was given the global mandate for the design and manufacturing of starters applicable to vehicles up to 1600 cc. The transfer of competences and knowledge for product development activities occurs in an informal and contextual manner, consistent with the prevalence of tacit knowledge in the automotive industry. This process involves the headquarters and its suppliers and clients (multinational and local), universities and local training or qualification institutions (Quadros and Consoni, 2009). The local development needs of the OEM which determine partnerships with the education institutions and the universities also determine the competence development needs of suppliers, especially those participating in co-design. Co-design practises themselves create an engineering network in which there is a daily exchange of experiences and knowledge, especially tacit knowledge, increasing the competences of the network as a whole (Dias et al, 2012).

In this way, supplier firms are given greater responsibility in product design and development, ensuring quality and delivery and deepening collaboration and integration practices, which pushes them to be more innovative, adopt modern technologies and supply chain best practices (Bhattacharya et al, 2014). These authors submit that collaboration and trust-building are going to be the mainstays for development of the auto manufacturing sector in the future. They advise the establishment of performance metrics for both suppliers and buyers and for supplier involvement in product development, trust and collaboration, quality criterion, cost control and information sharing. This requires a new era of collaboration and trust between present-day competitors, which would also simplify current supply chain complexities (Bhattacharya et al, 2014).

Sahoo et al (2011) also advises that firms need to continuously keep ahead in terms of technology capabilities to remain competitive. Describing technology leaders as those that are capable of developing the capacity to provide technologically superior products, to compete at the global level, to afford state-of art technology competence as well as the capability to make breakthroughs and radical innovations, Sahoo and colleagues add that developing a *technology strategy* is essential for long-term competitiveness in dynamic industries such as the automotive sector (Sahoo et al, 2011). Using the case of India, the researchers observed that

many auto component manufacturers in that country have gone in for technical alliances and joint ventures for acquiring new technologies. In such cases, the authors argue that long-term success will depend on how well a company's technology strategy is integrated with its business strategy as well as how firms are able to develop their in-house capability to absorb, adapt and develop new technologies. The auto component manufacturing sector needs to have a clear long-term strategy for building competitiveness which should reflect decision making process in general and regarding technology in particular. The authors point out that quick and effective adoption of the product technology to local conditions, developing capabilities to adapt manufacturing technology, promoting continuous improvement culture and formation of core technology group are a few determinants of such a technology strategy (Sahoo et al, 2011).

Further, using findings from their study of Volvo's strategy in India, of assisting local supplier firms, Ivarsson and Alvstam, (2005) point out that long-term relationships are important ingredients for close interfirm learning and collaboration between suppliers and their clients. The authors submit that technology transfer from industrialized to developing economies are to a large extent based on local interfirm linkages, arising from the regular production for lead firms and not only from more advanced R&D operations. They go on to add that the high levels of local sourcing does not necessarily lead to technological learning by local suppliers. Rather, they observe that the strategic role of the acquired local affiliate determines the level of engagement in technological collaboration by lead firms with suppliers. For instance, Volvo's production of heavy duty trucks in India was based on Volvo's global design, which resulted in a need to transfer technology to local suppliers. Their findings might not agree with other studies which contend that host market oriented affiliates generate less deep technological linkages to local suppliers even though local sourcing may be substantial. The authors rather found that even in cases where production was aimed for the host market, suppliers still received technological support from the OEM (Ivarsson and Alvstam, 2005). However, as this OEM specializes on buses and heavy duty trucks, the components were less standardized than is typically the case in the passenger vehicles sector, where the volumes are also higher.

Brazilian lead firms endeavour to reach a certain level of relationship with their suppliers, which is marked by commitment, cooperation and interdependence in the supplier-manufacturer relations. They develop procedures and standards, organize their structures, attribute specific functions to each supplier, define the interactions and the way of evaluating them. All of this is oriented towards encouraging the growth of their relations with suppliers (e

Grisi et al, 2004). The technological progress and the accumulated experience allow a higher level of integration between suppliers and manufacturers and leads to the establishment of second-level relations. at this level, suppliers are not only able to meet the needs of customers concerning their product requirements but also establish a high level of R&D, and are faster than the market with regards to highly reliable products, services and innovations. Lead firms only specify the performance expectation and efficacy of products and services, fully delegating the development and implementation to suppliers, with minimum quality control. Eventually the relationship between the lead firms and suppliers would progress to the next level where the both players start experiencing a high level of mutual confidence (e Grisi et al, 2004).

7.4. Lack of cooperation between component manufacturers and other stakeholders

The findings of this study do not show the automotive industry as a highly connected community whose members regularly interact to share and exchange ideas. A description of a community of practice by Wenger et al (2002) as groups of people who share a concern, a set of problems or a passion about a topic and who deepen their knowledge and expertise in this area by interacting regularly, did not seem to apply in the case of the local automotive industry.

The findings point to a community of firms that operate separately with limited collaboration among them, even those that are located nearby, due to the competitive nature of the industry to which they belong. The interactions among the companies are instead limited to their participation through some national and regional automotive associations which do not cover any sharing of operational or learning strategies among the firms except for basic information of common interest.

Similarly, as noted by Gerefi and Psilos (2011), the present study found that there is a lack of information exchange among stakeholders in the value chain which hinders efficient learning and knowledge production within firms whereas, as seen earlier, a number of researchers point to benefits associated with collaboration and integrated firm networks (Gereffi & Psilos, 2011; Bessant et al, 2003; Gereffi et al, 2012).

Research has shown that clusters can perform the role of a critical node in GVC, where supplier firms work together to provide crucial input in the auto manufacturing industry. The government, for its part, did try to encourage this by building the auto cluster in Rosslyn, Pretoria, where the AIDC is also located. Participants in the study, from both the auto firms and training institutions, praised the intermediary role that AIDC plays in the industry,

observing that the agency has been an efficient source of support, especially in mitigating their training and skills requirements. As an entity trusted by most of the players in the industry, AIDC is seen a key agent in initiating a culture of cooperation and integration among the various stakeholders including OEMs, component manufacturers, education and training institutions, to advance and address the interests of the industry in South Africa.

7.5. Future priorities

Finally, the evidence in this thesis shows that vocational training policy needs to focus much more on building tacit capabilities in all workplaces. There is a need for an approach that emphasises both codified and tacit knowledge and their interaction in sites of work. Vocational policy should encourage firm cooperation and the transfer of tacit knowledge- linking vocational policy to specific sectoral dynamics and needs (for example, auto, metal or agricultural) as opposed to the one-size-fits-all approach of current national policy (Kraak 2008). The policy should also endeavour to elevate the importance of practical learning, which is being ignored because of the educational emphasis on classroom instruction through programmes such as the NCV which do not render adequate attention to the practical component of training.

The suggested recommendations for future study would include a focused investigation into roles that education and training institutions, especially TVET colleges, can play towards the development of situated and relational learning in the workplace. In light of the major theme that emerged from the findings of inadequate practical exposure for students and new workers who come into the auto industry, it would be beneficial for the industry to examine how tacit knowledge, that is produced through informal learning in situated and relational contexts within the workplace, can be supported to contribute to the production of a highly technically skilled workforce for the industry. Second, as evidenced from the findings of the study, collaboration among automotive companies in the Pretoria region is lacking, even though several researchers have pointed to benefits associated with firms working together on the value chain. Future studies could examine the underlying issues that prevent firms from opening up to one another, especially with sharing information relating to learning and knowledge production.

In conclusion, it is clear that there are many challenges that are facing the auto industry in South Africa. These challenges are however not insurmountable given the support that the auto sector enjoys in the country. Although it may not be so simple to compare the auto industries in South Africa and other developing economies such as a Brazil in India, it may be helpful to

note how these two countries have strategically focused on domestic and regional markets. Being the most established in Africa, the auto industry in South Africa has advantage over other auto manufacturers in the region, which can be utilized to further grow and reinforce its positioning on the continent. However, the obstacles discussed earlier, most notably those that are hindering the developing of the much needed technological capabilities, must be addressed. It is vital for all role players, especially education and training institutions to co-operate and work with the industry in order to develop the much needed technical capacity that is required to build a robust competitive automotive industry both regionally and globally.

REFERENCES

Automotive Industry Export Council (AIEC). (2016). *Automotive export manual* 2016-South Africa. Pretoria: AIEC.

Agbo, C. O. (2011). A critical evaluation of motor vehicle manufacturing in Nigeria. *Nigerian Journal of Technology*, *30*(1), 8-16.

Ambe, I. M., & Badenhorst-Weiss, J. A. (2010). Strategic supply chain framework for the automotive industry. *African Journal of Business Management*, *4*(10), 2110.

Archer, S. (2010). Key Issues in the Assessment of Seta Performance in South Africa's National Skills Development Strategy. A Southern Africa Labour and Development Research Unit Working Paper Number 52. Cape Town: SALDRU, University of Cape Town

Arndt, S. W., & Kierzkowski, H. (Eds.). (2001). *Fragmentation: New production patterns in the world economy*. Oxford: Oxford University Press.

Barnes, J., Black, A., Comrie, D., & Hartogh, T. (2018) Geared for Growth. South Africa's automotive industry masterplan to 2035. A report of the South African automotive masterplan project. Department of Trade and Industry.

Barnes, J., Bessant, J., Dunne, N., & Morris, M. (2001). Developing manufacturing competitiveness within South African industry: the role of middle management. *Technovation*, *21*(5), 293-309.

Barnes, J., Kaplinsky, R., & Morris, M. (2004). Industrial policy in developing economies: Developing dynamic comparative advantage in the South African automobile sector. Competition & Change. 8(2), 153-172.

Barnes, J., & Morris,M. (2008). Staying alive in the global automotive industry: what can developing economies learn from South Africa about linking into global automotive value chains? *The European Journal of Development Research (*1), 31-55

Barnes, J., & Meadows, B. (2008). On the brink? Skills demand and supply issues in the South African automotive components industry.

Barnes, J., & Lorentzen, J. (2003). Learning, Upgrading, Innovation in the South African Automotive Industry. Workshop on Understanding FDI-Assisted Economic Development, TIK Centre, University of Oslo. 22-4 May.

Barnes, J. (2013). Capital structure of the South African automotive industry: Historical perspectives and development implications. *Transformation: Critical Perspectives on Southern Africa*, *81*(1), 236-259.

Barnes, J., Black, A., & Techakanont, K. (2015). Industrial Policy, Multinational Strategy and Domestic Capability: A Comparative Analysis of the Development of South Africa's and Thailand's Automotive Industries. *European Journal of Development Research*.

Bhattacharya, S., Mukhopadhyay, D., & Giri, S. (2014). Supply chain management in Indian automotive industry: Complexities, challenges and way ahead. *International Journal of Managing Value and Supply Chains*, 5(2), 49.

Bessant, J., & Tsekouras, G. (2001). Developing learning Networks. *Ai & Society*, 15(1-2), 82-98.

Bessant, J., Kaplinsky, R., & Lamming, R. (2003). Putting supply chain learning into practice. *International Journal of Operations & Production Management*, *23*(2), 167-184.

Billett, S. (2016). Apprenticeship as a mode of learning and model of education. *Education+ Training*, *58*(6), 613-628.

Black, A. (2002). The Export" success" of the Motor Industry Development Programme and the Implications for Trade and Industrial Policy. Trade and Industrial Policy Strategies.

Black, A. (2009) Location, Automotive Policy, and Multinational Strategy: The Position of South Africa in the Global Industry since 1995. *Growth and Change* Vol. 40 No. 3 (September 2009), pp. 483–512

Black, A., & McLennan, T. (2016). The Last Frontier: prospects and policies for the automotive industry in Africa. *International Journal of Automotive Technology and Management*, 16(2), 193-220.

Buchanan, J., Jakubauskas, M., & Schultz, H. (2009). From preserving to renovating Australian Apprenticeships: Insights from recent international experiences. University *of Sidney. Sydney.*

Carleial, L., Meza, M. L., & Neves, L. S. (2002). The role of institutions in the preparation of industrial workforce in the automotive sector of the State of Parana (Brazil): limits and possibilities. In *3 RD International Congress of the Work & Labour Network. Labour, Globalisation and the New Economy, RLDWL, Osnabruck, Anais*.

Clarke, I., & Ramirez, M. (2011). Intermediaries and capability building in an emerging resource based cluster. Science Policy Research Unit, Sussex University, Brighton, Electronic Working Paper Number 197.

Creamer Engineering News. (2019) Volume 39, N0 13, April 12-18

Creamer Engineering News. (2019) Volume 39 N0 7, March 1-7

Creswell, J. W. (2014). Qualitative inquiry and research design: choosing among five approaches. SAGE publications.

Creswell, J. W. (2007). Qualitative Inquiry and research design. SAGE publications.

Creswell, J. W. (2003). Research design: qualitative, quantitative and mixed methods approaches. SAGE publications.

Consoni, F. (2004). Final report on the automobile sector, presented to FINEP (Funding Authority for Studies and Projects), Rio de Janeiro: FINEP

De Backer, K., & Miroudot, S. (2014). Mapping global value chains. *ECB Working Paper No. 1677*.

Dent, R., (2001). Collective knowledge development, organisational learning and learning networks: an integrated framework. Swindon: *Economic and Social Research Council*.

Denzin, N.K. (2009) the research act: a theoretical introduction to sociological methods. New York, Aldine transaction. 200-219.

Department of Higher Education and Training (2017) Draft Post-School Education and Training Information Policy. November, 2017

Department of Education (2008) National Plan for Further Education and Training Colleges in South Africa, Government Gazette Number 31712, 12 December.

Department of Finance [DoF] (1996). Growth, employment and redistribution: A macroeconomic strategy. Pretoria: Government Printers.

Department of Trade and Industry [DTI] (2002). South Africa: Current Developments in the Automotive Industry. Pretoria.

Department of Higher Education and Training (2013). White Paper for Post-School Education and Training. Building an expanded, effective and integrated post-school system. *Department of Higher Education and Training, Pretoria South Africa.*

Dias, A. V. C., Pereira, M. C., & Britto, G. (2012). Building capabilities through global innovation networks: case studies from the Brazilian automotive industry. *Innovation and Development*, 2(2), 248-264.

e Grisi, C. C. D. H., & Ribeiro, Á. H. P. (2004). Supplier-manufacturer relationships In the Brazilian auto industry: an exploration of distinctive elements. *Journal of Business & Industrial Marketing*.

Evans, K., Kersh, N., & Sakamoto, A. (2004). 13 Learner biographies. *Workplace learning in context*, 222.

Ernest & Young. (2011). Mega trends shaping the Indian passenger vehicle industry. EYG. No. EDOO50

Evans, K., Hodkinson, P., Rainbird, H., & Unwin, L. (2006). *Improving workplace learning*. London Routledge.

Evans, K., & Rainbird, H. (2006). Workplace Learning; Perspectives and challenges. Place. London: Routledge.

Fernandez-Stark, K., Bamber, P., & Gereffi, G. (2012). Upgrading in global value chains: Addressing the skills challenges in developing countries. *Background Paper. Paris*: Organisation for Economic Co-operation and Development.

Fleury, A., & Tereza Fleury, M. (2003). Competitive strategies and core competencies: perspectives for the internationalisation of industry in Brazil. *Integrated Manufacturing Systems*, *14*(1), 16-25.

Fuller, A., & Unwin, L. (2003). Learning as apprentices in the contemporary UK workplace: creating and managing expansive and restrictive participation. *Journal of Education and Work*, *16*(4), 407-426.

Fuller, A., & Unwin, L (2004). Expansive learning environments: integrating organisational and personal development. In Rainbird, H, Fuller A and A Munro [eds] (2004) Workplace Learning in Context, Abingdon: Routledge.

Gamble, J. (2016). Work and Qualifications Futures of Artisans and Technicians. *Labour Market Intelligence Partnership Report*, *19*. Pretoria: HSRC.

Gauteng Employment Growth Policy. (2010).

Gereffi, G. (1999). A commodity chains framework for analysing global industries, in Background Notes for Workshop on the Spreading of the Gains from Globalisation. Brighton*:* Institute of Development Studies.

Gereffi, G, Humphrey, J & Sturgeon, T. (2005). The governance of global value chains, *Review of International Political Economy,* 12:1, 78-104.

Gereffi, G., Fernandez-Stark, K.,& Psilos, P. (2011). Skills for Upgrading: Workforce development and global value chains in developing countries. Duke University: Centre on Globalization, Governance and Competitiveness.

Gereffi, G. (2015). Global value chains, development and emerging economies. Maastricht Economic and social Research Institute on Innovation and Technology, UNU-MERIT *Global Value Chains, Development and Emerging Economies*.

Giulio, B., Giancarlo, C., & Stefano, M. (2013). Rethinking the Role of Manufacturing in Global Value Chains. Industrial and Corporate Change, 1-30.

Guile D. (2010). The Learning Challenge of the Knowledge Economy, Rotterdam: Sense Publishers.

Guile, D. (2012).Working and Learning in the knowledge-based creative and cultural sector: vocational practice, social capital and entrepreneurability, in Livingstone, DW and D Guile [eds] (2012) The Knowledge Economy and Lifelong Learning: A Critical Reader, Rotterdam: Sense Publishers.

Grosshoeme, D. H. (2014). Research Methodology overview of qualitative research. *Journal of Health Care.* Chaplain, 20(3), 109-122.

Hager, P (2009). Current theories of workplace learning: A critical assessment, in Bascia, N, Cumming, A, Datnow, A, Leithwood, K and D Livingstone [eds]. *International Handbook on Education Policy*, Dortrecht, Springer.

Henning, E., Van Rensburg., & Smit, B. (2004). Finding your way in Qualitative Research. Pretoria: Van Schaik.

Humphrey, J. (2000). Assembler-supplier relations in the auto industry: globalisation and national development. Competition & Change, 4(3), 245-271.

Humphrey, J., Schmitz, H (2002). How does insertion in global value chains affect upgrading in industrial clusters? *Regional Studies* 36(9): 1017–27.

Humphrey, J., & Oeter, A. (2000). Motor industry policies in emerging markets: globalization and the promotion of domestic industry. In *Global Strategies and local realities* (pp. 42-71). London: Palgrave Macmillan.

Hodkinson, P., Biesta, G., & James, D. (2007) Understanding learning cultures. *Educational Review*, 59(4), 415-427.

Hodkinson, P., & Rainbird, H. (2006). Improving workplace learning: An integrated approach. Improving workplace learning, 163-175.

Ivarsson, I., & Alvstam, C. G. (2005). Technology transfer from TNCs to local suppliers in developing countries: A study of AB Volvo's truck and bus plants in Brazil, China, India, and Mexico. *World Development*, *33*(8), 1325-1344.

James, L., Guile, D., & Unwin, L. (2013). Learning and innovation in the knowledge-based economy: beyond clusters and qualifications. *Journal of Education and Work*, 26(3), 243-266.

Kaggwa, M., Pouris, A., & Steyn, J L. (2007). South Africa government's support of the automotive industry: prospects of the productive asset allowance. *Development Southern Africa*, 24(5), 681-681.

Kale, D. (2017). Sources of innovation and technology capability development in the Indian automobile industry. *Institutions and Economies,* 121-150.

Kaplinksy, R and M Morris (2001) A Handbook For Value Chain Research, International Development Research Centre, Ottawa, Canada.

Kaplinsky, R., & Morris, M. (2016). Thinning and thickening: productive sector policies in the era of global value chains. The *European Journal of Development Research*. 28(4), 625-645

Kaplinsky, R. (2000). Globalisation and unequalisation: What can be learned from value chain analysis? *Journal of development studies*, *37*(2), 117-146.

Kraak, A. (2011). The post-school system and its contribution to Human Resources Development and Vision 2025', Research Report commissioned by the National Planning Commission, Pretoria, May 2011.

Kraak, A. (2013). Sector Skills Councils in International Perspective: In Search of Best Practice, Final Research Report commissioned by the Skills System Review Technical Task Team (SSR-TTT), Human Resources Development Council (HRDC) of South Africa, The Presidency.

Kraak, A. (2017). Examining the role of non-governmental organisations as labour market intermediaries in South Africa', unpublished paper, Researching Education and Labour (REAL) Centre. School of Education, University of Witwatersrand, Johannesburg.

Kraak, A. (2010). A critique of South Africa's National Human Resources Development Strategies. *South African Review of Education with production*, *16*, 59-82.

Kraak, A. (2009). The need for alignment between industrial and skills development policies. *Sectors and skills: the need for policy alignment*, 1 (2), 2-17.

Krishnaveni, M., & Vaidya, R. (2015). Growth of Indian automobile industry. *Int. J. Curr. Res. Aca. Rev*, 3(2), 110-118.

Kruss, G., Wildschut, A. & Reddy, V. (2012). Skilling for employment and employability: the success of learnerships and apprenticeships under the National Skills Development Strategy II. *U, Pillay, G, Hagg & F, Nyamnjoh, (Eds) State of the Nation: South Africa, 2013*.

Kumaraswamy, A., Mudambi, R., Saranga, H., & Tripathy, A. (2012). Catch-up strategies in the Indian auto components industry: Domestic firms' responses to market liberalization. *Journal of International Business Studies*, *43*(4), 368-395.

Kochan, T, Finegold, D and P Osterman. (2012). Who Can Fix the "Middle-Skills" Gap? *Harvard Business Review*. December: 3-10.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Boston: Cambridge University Press.

Lave, J., & Wenger, E. (1998). Communities of practice. Encyclopaedia of Informal Education.

Lave, J. 2009. The practice of learning, contemporary theories of learning: learning theorists. *Their Own Words, 200-208.* Routledge: London; New York.

Laosirihongthong, T., & Dangayach, G. S. (2005). A comparative study of implementation of manufacturing strategies in Thai and Indian automotive manufacturing companies. *Journal of Manufacturing Systems*, *24*(2), 131-143.

Lee, J., & Gereffi, G. (2015). Global value Chains, rising power firms and economic and social upgrading. *Critical Perspectives on International Business*. 11(3/4), 319-339.

Lejeune, M. (2011). Tacit Knowledge: Revisiting the epistemology of knowledge. McGill Journal of Education/Revue des sciences de l'éducation de McGill, 46(1), 91-105.

Liadi, A. A. (2015). Rethinking the automobile industrial policy and foreign direct investment in Nigeria. International Islamic University Malaysia.

Lorenzen, M. (2007). Social capital and localised learning: proximity and place in technological and institutional dynamics. *Urban Studies*, *44*(4), 799-817.

Mzabalazo Advisory Services (2014) Expenditure Performance Review of the National Artisan Development Programme. A report prepared for the National Treasury, the Department of Performance Monitoring and Evaluation and the Department of Higher Education and Training.

Mays, N., & Pope, C. (1995). Rigour and qualitative research. *BMJ: British Medical Journal*, *311*(6997), 109.

Marock, C., Harrison-Train, C., Soobravan, B., & Gunrthorpe, J. (2008). Seta Review: Development Policy Research Unit working Paper, 08/132.

merSETA. (2013) Sector Skill Plan Update. 2013/14-2017/18. Promoting Artisan Development for Employability.

Mesquita, L. F., Lazzarini, S. G., & Cronin, P. (2007). Determinants of firm competitiveness in Latin American emerging economies: Evidence from Brazil's auto-parts industry. *International Journal of Operations & Production Management*, *27*(5), 501-523.

Mirvis, P., Herrera, M. E. B., Googins, B., & Albareda, L. (2016). Corporate social innovation: How firms learn to innovate for the greater good. *Journal of Business Research, 69*(11), 5014-5021

Morris, M. (2002).The value chain Approach-Organising Cluster Cooperation. In *Executive Forum on National Export Strategies, Managing Competitive Advantage: The Values of National Strategy*.

Morris, M., & Barnes, J. (2003, June). Policy lessons in organizing vertical and horizontal cooperation in value chains and industrial clusters. In *Industrial Districts and Firms: The Challenge of Globalization. Conference in honour of Professor Sebastino Brusco. Modena, Italy:* 17th May.

Morris, M., & Barnes, J. (2006). Organising cluster cooperation and learning networks in South Africa. *African studies*, *65*(1), 79-104.

Morris, M., Bessant, J., & Barnes, J. (2006). Using learning networks to enable industrial development: Case studies from South Africa. *International Journal of Operations & Production Management*, *26*(5), 532-557.

Morris, M., & Barnes, J. (2006). Regional Development and Cluster Management: lessons from South Africa. Centre for Social Sciences Research, University of Cape Town.

Morrison, A., Pietrobelli, C., & Rabellotti, R. (2008). Global value chains and technological capabilities: a framework to study learning and innovation in developing countries. *Oxford Development Studies*, *36*(1), 39-58.

Nauhria, Y., Pandey, S., & Kulkarni, M. S. (2011). Competitive Priorities for Indian Car Manufacturing Industry (2011-2020) for Global Competitiveness. *Global Journal of Flexible Systems Management*, *12*(3/4), 9-20.

National Business Initiative (NBI). (2007). Skills Development: The Role of Business: Johannesburg.

Naude, M. J., & Badenhorst-Weiss, J. A. (2011). Supply chain management problems at South African automotive component manufacturers. *Southern African Business Review*, *15*(1), 70-98.

Nelson, R. & Winter, S. (1982). An evolutionary theory of economic change. Boston: Harvard University Press.

Nigam, S. (2016). Role of developing economies in global value chain: A critical evaluation. *International Journal for Research in Business, Management and Accounting (ISSN: 2455-6114)*, *2*(4), 65-81.

Olamade, O. O., & Abubakar, K. (2014). Impact of Total Innovation Management on Supply Chain in Nigeria's Automobile Industry. *Journal of Entrepreneurship and Business Innovation*, 1(1), 36-47.

Onuoha, S. W. P. B. (2016) Organizational Learning Capability, Perceived Organizational Support and Growth of Auto Parts Manufacturing Firms in Nigeria. *European Journal of Business and Management*. Vol.8, No.17. 104-117

Osterman, P. (2004), Labour market intermediaries in the modern labour market in RP Giloth (ed) Workforce Intermediaries for the Twenty-First Century, Temple University Press: Philadelphia.

Pack, H. (2000). Industrial Policy: Growth Elixir or Poison. The World Bank Research Observer, Vol. 15, No. 1, pp 47-67.

Pimentel Claro, D., & Borin de Oliveira Claro, P. (2011). Networking and developing collaborative relationships: evidence of the auto-part industry of Brazil. *Journal of Business & Industrial Marketing*, *26*(7), 514-523.

Pires, S.R., & Sacomano Neto, M. (2008). New configurations in supply chains: the case of a condominium in Brazil's automotive industry. *Supply Chain Management: An International Journal*, 13(4), 328-334.

Pradhan, J.P., & Singh, N. (2009). Outward FDI and knowledge flows: A study of the Indian automotive sector. *Institutions and Economies*, *1*(1), 156-187.

Pavitt, K. (2003). *The Process of innovation*. (Vol.89). Brighton: Science Policy Research Unit, University of Sussex.

Pimentel Claro, D., & Borin de Oliveira Claro, P. (2011). Networking and developing collaborative relationships: evidence of the auto-part industry of Brazil. Journal of Business & Industrial Marketing, 26(7), 514-523.

Pimenta, S & M. Correa (2002). Organizational innovations and subjectivity mobilization: the Mercedes-Benz management system, in Nabuco, MR., Almeida Neves, M.R., & Carvalho Neto, AM (eds) of the productive sector, Rio de Janeiro: DP&A

Psilos, P., Gereffi, G. & Fernandez-Stark, K. (2011). Workforce Development in the Global Economy: Linking Skills and Capabilities to Upgrading. Skills for Upgrading: *Workforce Development and Global Value Chains in Developing Countries*, 1-12.

Ponte, S., & Sturgeon, T. (2014). Explaining governance in global value chains: A modular theory-building effort. *Review of International Political Economy*, 21(1), 195-223.

Posthuma, A. C. (2005). Industrial renewal and inter-firm relations in the supply chain of the Brazilian automotive industry. Geneva: *International Labour Organization.*

Ramirez, P., Rainbird, H. (2010). Making the connections: bringing skill formation into global value chain analysis. *Work, Employment and Society* 24(4): 699–710.

Rainbird, H., Fuller, A., & Munro, A. (Eds.). (2004). *Workplace learning in context*. London: Routledge.

Rainbird, H., & Ramirez, P. (2012). Bringing social institutions into global value chain analysis: the case of salmon farming in Chile. *Work, employment and society, 26*(5), 789-805

Ray, S., & Miglani, S. (2016). Innovation (and upgrading) in the automobile industry: the case of India: Working Paper 320. Indian Council for Research on International Economic Relations.

Sahoo, T., Banwet, D. K., & Momaya, K. (2011). Strategic technology management in the auto component industry in India. *Journal of Advances in Management Research*.

Schatzki, TR., Knorr Cetina, K and E. von Savigny (2001). The Practice Turn in Contemporary Theory. London: Routledge.

Schoenherr, T., Griffith, D. A., & Chandra, A. (2014). Knowledge management in supply chains: The role of explicit and tacit knowledge. *Journal of Business Logistics*, 35(2), 121-135.

Scott, G. (2018). The role of TVET colleges in the delivery of skills for the economy, paper commissioned by the NSA Review of NSDS 3, Johannesburg.

Simon, F., Pauline, M., & José-Luis, Á. G. (2014). *OECD Reviews of Vocational Education and Training a Skills beyond School Review of South Africa*. OECD Publishing.

Singh, A., & Gupta, D.V. (2012). Indian Automotive Industry: A Review. *International Journal of Research in Mechanical Engineering and Technology*, 2 (2), 22-24

Singh, B., Garg, S.K., & Sharma, S.K. (2010). Development of index for measuring leanness: study of an Indian auto component industry. *Measuring Business Excellence*, *14*(2), 46-53.

Singh, R.K., Garg, S. K., & Deshmukh, S. G. (2007). Strategy development for competitiveness: a study on Indian auto component sector. *International Journal of Productivity and Performance Management*, *56*(4), 285-304.

Singizi Consulting (2007). Seta Review: Towards a Rating of Individual Setas. Johannesburg: Singizi Consulting.

Sturgeon, T.J., & Van Biesebroeck, J. (2011). Global value chains in the automotive industry: an enhanced role for developing countries? *International Journal of Technological Learning, Innovation and Development, 4*(1-3), 181-205.

Sturgeon, T., Van Biesebroeck, J., & Gereffi, G. (2008). Value chains, networks and clusters: reframing the global automotive industry. *Journal of Economic Geography*, 8(3), 297-321.

SSACI. (2017). Tracking Study of Trainees in Artisanal Training Programmes, Johannesburg.

Sutherland, J. (1998). Workplace learning for the twenty first century: report of the Workplace Learning Task Group. *Unpublished report to the National Advisory Group for Continuing Education and Lifelong Learning (NAGCELL).*

The Development of an Industrial Policy for Gauteng Province. (2010). Report prepared by Corporate Strategy and Industrial Development for Gauteng Province Department of Economic Development. University of the Witwatersrand.

Venter, I. (2009 a). SA auto industry could be dead in 7 years, warns VWSA, Engineering News, 7 October.

Venter, I. (2009 b). Auto bosses wring their hands over SA's declining competitiveness: Can the situation be salvaged? Engineering News, 30 October.

Weaver, A. P. & Osterman. (2014). The new skill production system: Policy challenges and solutions in manufacturing labour markets. In Locke, R. and R.L. Wellhausen [Eds]. Production in the Innovation Economy. Cambridge, MA: MIT Press.

Wenger, E., McDermott, R. A. & Snyder, W. (2002). Cultivating communities of practice: A guide to managing knowledge. Harvard Business Press.

Wenger, E. (1998). Communities of practice: Learning, meaning, and identity. Cambridge University.

Wenger, E. (1999). Learning as social participation. *Knowledge Management Review*, *6*(1).

Wildschut, A., & Meyer, T. (2016). Why changes to occupational domains matter for artisanal skills planning in South Africa. Labour Market Partnership Project.

Woolcock, M. (1998). Social capital and economic development: towards a theoretical synthesis and policy framework, *Theory and Society*, 27(2), pp. 151–208.

APPENDIX-1: INTERVIEW SCHEDULE

Questions for the lead firms (OEMs)

1. Can you please tell me about this plant, in terms of the kind of production system you run, the manning of the plant, technologies involved, level of automation, etc.…?

2. With regards to sourcing of the auto parts, how much it is sourced locally, from local manufacturers, especially within the Pretoria region?

3. How much assistance do you provide to your suppliers with regards to precision around quality and benchmarking against minimum international quality standards?

4. Do you provide assistance to your supplier firms to upgrade to higher functions in order for them to, for instance meet some specific productions needs or standards that you may require?

5. Do you for instance assist suppliers to upgrade their capacity to handle new technologies such as increased levels of automation?

6. With regards to governance in the auto value chain to which you belong, how are the instructions and information on the needs as well as the available capabilities communicated across the value chain to your supplier firms?

7. Are you involved either formally or informally in any cluster activities in the local auto firms in this region?

8. If yes, can you please tell me how these clusters work and the kind of advantages that are derived from being part of the clusters?

9. Are there any inter-firm collaborations with regards to training, learning or knowledge sharing among auto firms in this area that you are involved in?

10. Do you receive any support/ input from both national and provincial government agencies such as the AIDC or DST, (with regards to training and skills developments for artisan training for instance or other forms of support)

Learning and knowledge production

1. With regards to upgrading capabilities (such as design, production) in your firm, what role do artisans play in shaping these capabilities in your firm?

2. Are there any partnerships/ assistance that exist between your firm and the supplier firms that supply to you, with regards to learning or training their artisans in terms of developing the necessary expertise required to meet your quality standards?

3. With regards to the training of artisans in your firm, what specializations or fields are the artisans expected to be skilled in?

4. From where do you source your artisans?
    - Do they come to you adequately trained?
    - How much additional training do you provide for them?
    - How does this training take place (duration, training providers involved, etc.)

5. With regards to training of artisans in your firm, what collaborations or partnerships (if any) do you have with training institutions?
    - Do you for instance work with specialized training institutions such as the Automotive Training Academy and other mainstream educational institutions such as TVET colleges or universities?

6. Do you conduct your own in-house training for your artisans/ apprentices? (If yes) how extensive is this training and is it accredited by an education and training quality assurance body and/or registered by the Department of Higher Education and Training?

7. What other opportunities offered to your artisans for (professional) development? (such as paid study leave or any other opportunities towards their career development)

8. What other (informal) methods of learning that are used in your firm to assist your apprentice/artisans to sharpen their skills/ increase expertise?

9. What kind of input/ partnership (if any) do you offer to training institutions such as the ATA or other educational institutions including local TVETs or universities? Are you for instance, involved or consulted in designing curriculum content? Do you offer bursaries or other kind of support to students at any of such institutions that specialize in auto-related qualifications?

Questions for supplier firms

1. Can you please tell me about this plant, in terms of the kind of production system you run, the manning of the plant, technologies involved, level of automation, etc.?

2. Can you tell me which are the main OEMs that you supply to and what kind of parts you supply to them?

3. What kind of partnership/relationship exists between you and the OEMs that you supply to with regards precision around quality, benchmarking against minimal international quality standards?

4. Do you received any assistance from the OEMs in upgrading/ adopting new technologies in auto manufacturing?

5. Do you belong to any auto clusters in the region with other auto manufacturers/ suppliers?

6. If yes, can you tell about the kind of collaborations/ benefits that emanate from participating in such clusters?

Learning and knowledge production

10. With regards to upgrading capabilities (such as design, production) in your firm, what role do artisans play in shaping these capabilities in your firm?

11. Are there any partnerships/ assistance that exist between your firm and the lead firms to which you supply, with regards to learning or training of your artisans in terms of developing the necessary skills required to meet their quality standards?

12. With regards to the training of artisans in your firm, what specializations or fields are the artisans expected to be skilled in?

13. From where do you source your artisans?
    - Do they come to you adequately trained?
    - How much additional training do you provide for them?
    - How does this training take place (duration, training providers involved, etc.?)

14. With regards to training of artisans in your firm, what collaborations or partnerships (if any) do you have with training institutions?
    - Do you for instance work with specialized training institutions such as the Automotive Training Academy and other mainstream educational institutions such as TVET colleges or universities?

15. Do you conduct your own in-house training for your artisans/ apprentices? (If yes) how extensive is this training and is it accredited by an education and training quality assurance body and/or registered by the Department of Higher Education and Training?

16. What other opportunities offered to your artisans for (professional) development? (such as paid study leave or any other opportunities towards their career development)

17. What other (informal) methods of learning that are used in your firm to assist your apprentice/artisans to sharpen their skills/ increase expertise?

18. What kind of input/ partnership (if any) do you offer to training institutions such as the ATA or other educational institutions including local TVETs or universities? Are you for instance, involved or consulted in designing curriculum content? Do you offer

bursaries or other kind of support to students at any of such institutions that specialize in auto-related qualifications?

Questions for the provincial government agency

1. The Gauteng province and City of Tshwane have initiated projects to support the local auto industry, especially with regards to training; how effective have they been and how satisfied are you with the progress in this regard?

2. With regards to skills development for artisans, specifically for the auto industry, do you run/ support programmes aimed at artisans in the industry (Within Gauteng)?

3. What kind of support do you offer to training institutions (such as the Automotive Training Academy and TVET colleges) towards the training of artisans? Do you assist with accreditation of courses for instance? Are there any other form of support offered?

4. Concerning curriculum development for educational institutions such as the Automotive Training Academy, TVET colleges or universities that provide specialized training for the auto industry, how do you ensure that the courses/ programmes offered remain compliant with regulations of accreditation and registration requirements?

5. Are there any partnerships between your agency and TVET colleges within Gauteng or support offered to TVET colleges aimed at facilitating the training of artisans for the local auto industry?

6. Is the agency involved in the local auto industry cluster?
   - If yes, in what ways does the agency support the auto cluster?

7. In terms of upgrading on the auto global value chain, what role does the AIDC play in assisting various role-players in the local auto industry (such as supplier firms) in this process?

Questions for the artisans

1. From which institution did you obtain your qualifications and what was the duration of the training? Did you receive apprenticeship/ training placement while studying?

2. How did you secure employment at this company?

3. Did you have to undergo further training once you arrived here/ do you periodically undergo further training at work? If yes, is the training provided by the company or sourced from outside?
4. What are your main responsibilities here, as an artisan?

5. What kind of support do you receive or transfer from older or younger artisan (as the case may be) during the learning/ teaching process?

6. Are you active in the auto cluster in the region?
   - If yes, is there any form of learning/ knowledge transfer that takes place in these clusters?
7. What are the ways in which learning takes place in these clusters?
   - What kind of interactions exist between artisans/ workers from different auto firms in the clusters?

8. As a younger artisan/ apprentice, would you also say there are some valuable skills/ knowledge that you bring with you to the firm, which you are able to share with the more experienced artisans/ workers?

9. What ways are you able to learn or develop knowledge and keep abreast of the latest developments as an artisan? (Please explain)
   - Through monitoring other artisans from this company or competitor-firms?
   - Through interactions with clients/ more knowledgeable colleagues/ suppliers?
   - Professional networks or clubs?
   - Social interactions with your peers here or from other firms?

10. Are you offered opportunities to study further such as bursaries, (paid) study leave by your employers?

11. Are there opportunities for artisans/ apprentices to progress to higher levels, from one production or specialization to another within your firm?

Questions for a TVET college

1. What types of qualifications do you offer at this college? Do you train artisans here?

2. What is the nature of the relationship/ partnership with the local auto cluster with regards to training/ skills development? (If any).
   - Do you for instance work with any of the auto firms to design/offer qualifications or training aimed specifically for (artisans) in the local auto sector?
   - If not, what do you think is the reason for the lack of such a collaboration?

3. Are you able to secure apprenticeships for your students at auto firms in the area?

4. What do you suppose hinders auto firms from sourcing their artisans from TVET institutions such as yours?

5. What role (if any) do you envisage TVET colleges such as this, playing in the local auto sector, especially with regards to learning and knowledge production?

Questions for a private automotive training academy:

1. Are you training students who have other qualifications? (such as school leaving qualifications)
2. What qualifications or other requirement, if any, do your students need to be accepted at your academy?
3. How do you adapt your curriculum to suit the auto industry and also ensure that it remains compliant with accreditation guidelines of the Department of Higher Education and Training?
4. Can you please tell me about programmes offered at your academy?
5. What are some of the factors affecting your students' performance at the academy?
6. How easy/ difficult is it for the students who have successfully completed training at you academy, to find placements in auto companies?
7. Is there a defined role/partnership between the academy and the auto companies and government/ SETA or others? If yes, please explain.
8. What is the rating of the academy's qualifications in terms of the National Qualification Framework?