BENCHMARKING AND PRODUCTIVITY ANALYSIS IN SOUTH AFRICA'S AUTOMOTIVE INDUSTRY

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ABSTRACT

Despite being the biggest beneficiary of industrial policy, South Africa's automotive industry has struggled to remain competitive relative to its peers. This is partly a result of increasing global competition, structural shifts and changing demand. At the same time, the local industry remains constrained by a slowdown in economic growth, increasing labour costs and insufficient economies of scale. By analysing the role of policy in improving competitiveness and export performance in South Africa's automotive industry, this paper provides an overview of driving forces, challenges and trends in the local industry. The study uses benchmarking data to analyse productivity improvements in the industry. It finds that South African component firms have implemented lean and world class production techniques, improving their operational competitiveness with significant improvements in quality, inventory reduction and delivery reliability to customers. Although South Africa appears to be catching-up to its competitors, it still ranks poorly among auto-producers in emerging markets. Its competitors in the Far East, South America and Eastern Europe enjoy low production costs, rising FDI inflows and proximity to end markets. Policy interventions influence competitive advantages. This therefore highlights the important role of government in developing a policy mix that aims to increase firm-level competitiveness through minimising operational costs, improving production flexibility and encouraging higher local content to foster industrial development.

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LIST OF ACRONYMS AND ABBREVIATIONS

AA	Automobile Association
AGOA	African Growth and Opportunity Act
AIEC	Automotive Industry Export Council
AIS	Automotive Investment Scheme
APDP	Automotive Production and Development Programme
ASEAN	Association of Southeast Asian Nations
B&M	Benchmarking and Manufacturing
CBU	Completely Build Up
CKD	Completely Knocked Down
DEA	Data Envelopment Analysis
DTI	Department of Trade and Industry
EU	European Union
FDI	Foreign Direct Investment
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEIS	General Export Incentive Scheme
GM	General Motors
GVC	Global Value Chain
HCV	Heavy Commercial Vehicle
IEC	Import –Export Complementation
IMVP	International Motor Vehicle Program
IRCC	Import Rebate Credit Certificate
ISI	Import Substitution Industrialisation
JIS	Just in Sequence
JIT	Just in Time
KPI	Key Performance Indicator

LCP	Local Content Programme
LVC	Light Commercial Vehicle
MIDP	Motor Industry Development Programme
MIT	Massachusetts Institute of Technology
MNC	Multinational Corporation
MCV	Medium Commercial Vehicle
NAACAM	National Association of Automotive Component and Allied Manufacturers
NAAMSA	National Association of Automobile Manufacturers of South Africa
NUMMI	New United Motor Manufacturing Inc.
OECD	Organisation for Economic Co-Operation and Development
OEM	Original Equipment Manufacturer
OES	Original Equipment Supplier
OICA	Organisation Internationale des Constructeurs d'Automobiles
OTIF	On Time in Full Delivery
PAA	Productive Asset Allowance
PI	Production Incentive
SACU	Southern African Customs Union
SAABC	South African Automotive Benchmarking Club
SAAM	South African Automotive Masterplan
SEDA	Small Enterprise Development Agency
SCM	Supply Chain Management
SME	Small Medium Enterprise
SVI	Small Vehicle Incentive
TDCA	Trade Development and Co-operation Agreement
TFP	Total Factor Productivity
TIPS	Trade and Industrial Policy Strategies
TMC	Toyota Motor Corporation

TPS	Toyota Production System
TQM	Total Quality Management
US	United States
VAA	Volume Assembly Allowance
WCM	World Class Manufacturing
WTO	World Trade Organisation

SECTION 1: INTRODUCTION

1.1. Introduction

This dissertation is titled '*Benchmarking and productivity analysis in South Africa's automotive industry'*. The study examines the impact of globalisation and increasing competition on the South African automotive industry. Its objective is (i) to provide a comprehensive view of productivity changes in the automotive industry, (ii) to examine the role of the South African government in response to rapid globalisation and changes in global production networks, and (iii) to give an assessment of the current state of the domestic industry. Moreover, a comparative benchmarking analysis of productivity in the South African components industry relative to the Indian and Hungarian components industries has been undertaken.

1.2. Background and scope of the study

The global automotive industry has gone through several significant changes in the past few decades. The industry, however, remains highly vulnerable to changes in global markets. South African based original equipment manufacturers (OEMs) and suppliers struggle to remain competitive in this global industry. Firms are required to improve productivity and efficiency, cut costs and better their quality standards as a means to ensure their survival and growth. Lean production and world class manufacturing techniques are identified as methods that OEMs and component suppliers should adopt to better their operational performance and advance organisational work practices.

According to OICA (2016), the automotive industry is the single greatest engine of economic growth in the global economy. The automotive industry has high relevance in the Triad economies being Japan, North America and Europe, in terms of national development, job creation and output. The industry is also the backbone of many developing economies. Over the last century, the industry shaped global economic development, influenced culture and changed national economies. In 1890, the automotive industry was characterised by craft production dominated by European craftsmen and artisans. From 1910, Henry Ford in the United States (US) led a mass production revolution. Following this, in 1937 the Toyota Motor Corporation (TMC) in Japan pioneered the concept of lean production combining elements of both craft and mass production leading to the establishment of a management philosophy aimed at continuous improvement, eliminating waste and cutting costs (Barnes, 1999: 2). Ever since then, the industry grew rapidly with a large multiplier effect on domestic economies with its impact extending far beyond manufacturing to include automotive retail and associated services.

The Japanese automotive industry grew rapidly following the pursuit of lean manufacturing, which resulted in higher productivity, improvements in efficiency and greater processing capacity. North American and European firms struggled to match the competitiveness of manufacturers from Japan and failed to emulate their production and supplier strategies. The results from the global assembly plant study of the International Motor Vehicle Program (IMVP) by Womack *et al.,* (1990) explored the differences between craft, mass and lean production techniques used in automotive industries in Japan, North America and Europe. This is further discussed in Section six of this study.

'The Machine that Changed the World' by Womack *et al.,* (1990) highlights the significance of lean production as a strategic management philosophy grounded in continuous improvements to produce components and assemble vehicles incorporating improved productivity, quality and shop floor efficiency. The ease of transferability of lean production outside of Japan led to almost all OEMs and component suppliers across the global industry moving towards adopting lean manufacturing. Lean production became a widely adopted best manufacturing practice across industries and countries.

The centre of vehicle production began to move to lower cost producing countries in the developing world. Subsequently, Japan's competitive advantage greatly diminished owing to the growth of the South Korean, Chinese and Indian automotive industries, as well as smaller players in Eastern Europe and Latin America. Globalising trends in the 1990s saw automotive industries in competition with each other at a country-to-country level. The impact of globalisation, integration processes and the changing competitive dynamics in the automotive industry influenced trade and investment policies in developing economies aiming to better the competitiveness of their domestic industries.

Increasing competitiveness is a key factor in the automotive industry. Competitive firms are able to identify changes in internal and external environments and better their capability to adapt to the changes in a way that enables them to deliver quality products to customers and generate profitability in the long term (Gelei, 2011:43). Holweg (2008:14) notes that competitiveness is not static. Because of this, OEMs can no longer solely rely on the use of superior production techniques, especially since the benchmarking performance gap between auto- producing countries is closing. Firms in the industry need to acquire new capabilities and align their strategies to structural shifts and changing market demands in the global industry to deal with increased competition.

In order to develop the domestic industry, increase competitiveness and attract new FDI, the South African government introduced the Motor Industry Development Programme (MIDP) in 1995. As a step towards liberalisation, the MIDP incentivised a boom in exports and competitiveness through the import-export complementation (IEC) scheme and the reduction in tariffs. The industry also experienced low levels of local content and reduced protection for component suppliers. The MIDP was phased out and replaced by the Automotive Production and Development Programme (APDP) in 2013. Under the MIDP, restructuring took place which saw OEMs become wholly-owned by their respective multinational corporations (MNCs) leading to structural changes in the domestic industry. This benefitted South African based firms as they were forced to adhere to standards set by their respective MNC parent company or customer. South

African based component firms grew globally competitive and OEMs demonstrated improved productivity gains and delivered high quality products.

Barnes and Black (2013) report that South African firms improved their operational competitiveness between 1997/8 – 2012, particularly in quality, inventory holding days and absenteeism. However, they fell behind international competitors in other benchmarked areas over the study period. Despite several policy interventions in South Africa's automotive industry and MNCs' attempt to integrate South Africa into the global supply chain network, many South African firms continue to face challenges of low production volumes, high cost structures, scale inefficiencies and low productivity gains.

It is necessary to evaluate the impact of policy reform on the automotive industry and to assess which structural factors influence(d) productivity and competitiveness. Benchmarking measures have a significant impact on the control and management of a firm and provide information for a number of tactical, strategic and policy related decisions. Labour productivity is a revealing benchmark as it offers a measure of economic growth, competitiveness and living standards of the population within the domestic economy. Moreover, the automotive industry is responsible for job creation and it is the biggest beneficiary of industrial policy and government incentive schemes in South Africa. This raises the question of whether industrial policy is making progress in achieving the policy objectives set out for the industry. It is also important to measure whether policy support has enabled South African firms to improve enough to catch up with their international competitors and reduce existing competitiveness gaps.

1.3. Research problem

The aim of the research is to analyse South African based component suppliers' adoption of lean production processes with a focus on changes in operational competitiveness and productivity levels measured using the International Motor Vehicle Program (IMVP) benchmarking tool.

Biondi *et al.* (2013: 7) highlight the need for effective evaluation methods going beyond the limits of traditional performance assessment methodologies in the automotive industry. The research is motivated by a) the gap in literature when it comes to analysing changes in productivity in the South African automotive industry, b) drawing on a comparison between two different evaluation methodologies in productivity measurement; labour productivity and benchmarking, and c) understanding how structural reform and global competitiveness have impacted the industry.

The study will identify key challenges experienced in South Africa's automotive industry. Various productivity methodologies will be used in assessing and determining the operational competitiveness of the domestic industry. Following this, a comparative benchmarking study between South Africa, India and Hungary is analysed in detail over a five-year period. The paper also aims to contribute to existing literature through enhancing the understanding of lean production processes and operational performance in the South African automotive industry.

SECTION 2: LITERATURE OVERVIEW

2.1. Introduction

The purpose of this section is to provide a theoretical overview of the significance and development of lean production in the global automotive industry. This section is divided into two parts. Part one looks at exploring the historical background of modes of production, with a specific focus on the role of lean production in transforming and restructuring the industry. It highlights the difference between mass and lean production as well as investigating the influence of global value chains on the globalisation and competitiveness of auto-producing countries. The second part of the section introduces theories of productivity. A number of theories have been developed to examine the usefulness of lean production on the productivity of firms.

PART ONE: LEAN PRODUCTION

2.2. The evolution of modes of production and restructuring in the global automotive industry

Automotive production has radically changed global manufacturing processes. The Triad economies made significant contributions to the organisation, processes and product development of the automotive industry throughout the twentieth century. The evolution of production and logistic techniques in the industry was first marked by the divergence between craft production in Europe and mass production in the US, then from mass production towards lean production in Japan driven by the *kaizen* model of continuous improvement (Womack *et al.,* 1990:19).

2.3. Craft production

From 1890 to 1908, small enterprises in craft production dominated automotive production in which activities were carried out by highly skilled craftsman producing one car at a time based on individual customer preferences (Womack *et al.,* 1990:20; Barnes, 2001:6). Craft production involved manufacturing using hand tools, and there was no system in place that could ensure consistency, reliability and the interchangeability of component parts. Because of its production process and the high costs incurred in labour, material and time. The production and assembly of completely built-up (CBU) vehicles in craft production thus became too costly and unaffordable (Womack *et al.,* 1990:21).

2.4. Mass production

Mass production was driven by Henry Ford in the US who manufactured the Model T vehicle using an entirely new manufacturing system which became the industry standard. Womack *et al.,* (1990:12) note that the most critical feature of mass production was the complete and consistent interchangeability of component parts and the ease of attaching them, therefore replacing skilled artisans with unskilled workers in an assembly line. The establishment of task cycles in the assembly of a CBU vehicle; the Model T, reduced the amount of time it took to assemble a vehicle from 8.6 hours to 2.3 hours (Womack *et al.,* 1990: 16). The development of a moving assembly line comprising of low skilled workers with very specific job functions created a virtuous cycle of growth. Ford realised the following big changes; i) an increase in production from 6.8 vehicles per worker in 1909 to 11.4 in 1912, ii) high efficiency gains and a 90% increase in productivity from 1913 to 1914, and iii) dramatic cost cutting in production which led to doubled wages for workers and a price decrease in vehicle prices making them affordable and therefore facilitating mass consumption (Womack *et al.,* 1990:20; Barnes, 2001:9-10). However, following these big changes, Holweg (2007: 423) writes that Ford became complacent, lacked innovation and was unable to cater to the differentiated preferences of consumers.

In the late 1920s, General Motors (GM) under Alfred Sloan improved on Ford's assembly line through the introduction of a functional divisional system of corporate control. The new system involved moving from a centralised vertically integrated system to a decentralised system which allowed production flexibility and faster changeovers from one model to the next. This enabled GM to cater 'for every purpose and purse' providing different coloured models at a relatively higher price than its competitors (Sloan, 1972: 520 cited in Gartman, 2004:178). Milestone changes in GM's advanced and sophisticated mass production led to the firm acquiring a larger market share in sales and overtaking Ford as the leading automotive manufacturer. Critically however, given the performance advantages of GM's model, it still operated under mass production practices (Gartman, 2004:179). For this reason, in the late 1980s GM along with other OEMs in North America and Europe were constrained as a result of inefficiencies and poor quality standards.

Barnes (2001: 17) highlights that the 1973 oil crisis changed the landscape of the automotive industry and altered the dominance of North American based OEMs and large first tier suppliers. Firstly, the slowdown in economic growth saw supply exceeding demand as fewer consumers could afford cars. Secondly, US based OEMs did not produce fuel efficient cars, and for this reason the spike in gas prices deterred customers from large and fuel demanding cars. These weaknesses in the US automotive market paved the way for a shift towards the Japanese automotive industry. Japanese based OEMs offered better price and non-price performing factors including better quality and improved innovation.

2.5. Lean production

Toyota Motor Corporation (TMC) in Japan developed the Toyota Production System (TPS) which led Japan to a position of global economic significance. The rise was facilitated by large production cost advantages experienced in Japan, innovative technology and effective industrial policies. The TPS, which came to be known as lean production, was developed with the objective of improving the flow or smoothness of production. Lean production was not a single point discovery, but instead it was the outcome of a combination of elements from both craft and mass production (Nordin *et al.,* 2010: 376). Leoni (2013: 5) describes the two foundations of lean production as firstly; the philosophical perspective of a set of guiding principles and methods, and secondly; as a practical perspective stemming from a set of organisational work practices to better performance.

Instruments of lean production are emphasised as; i) a highly flexible system that produces small batches according to market demands, ii) the elimination of waste and inventories allowing for production to take place on a just-in-time (JIT) basis, iii) small batches and buffers designed to facilitate the handling of a wider variety of product designs, iv) higher degree of integration in the value chain from conceptual activity with the execution of production tasks, and v) well-equipped and multi-skilled workers capable of detecting quality problems at the source and suggesting improvements, therefore ensuring quality problems do not occur. Production workers play a vital role in lean production. TPS favours workers being directly involved in shop floor activities. This allows them to increase labour productivity and to effectively manage their areas in conjunction with other workers leading to the creation of work teams on the shop floor (Barnes, 2001: 20). Given the merits of the TPS as outlined above, lean production facilitates economies of scale and efficiency, further improvements in productivity and better quality leading to improvements in competitiveness.

Table 1 below highlights fifteen key differences between mass and lean production techniques. Mass production appears uncompetitive compared to lean production, however the two are not completely polarised systems (Barnes, 2001: 27). The TPS identifies shortfalls in mass production related to intra-firm organisation and inter-firm relations involving customers and suppliers. Mass production often compromised quality standards and customers were met with uncompetitive pricing and marketing. In lean production, TMC delivered better quality, differentiated and more economic models at an affordable price.

Fundamental differences exist between supplier relations in mass and lean production systems. Suppliers in mass production operate on large inefficiencies due to low profits, information asymmetries and large inventories. OEMs under mass production source components from over 2000 suppliers competing against each other on price, quality, delivery and reliability (Womack *et al.*, 1990: 36). Moreover, in mass production OEMs rarely interfere in the operations of suppliers and suppliers are given a limit of accepted defects which results in high inefficiencies and increased wastage. In contrast, lean producers source components from first and second tier suppliers therefore cutting suppliers down to approximately 200 with the selection of suppliers based on trust, long term relationships and profit sharing (Barnes, 2001: 38).

Furthermore, TMC developed a Supply Chain Management (SCM) system for suppliers as it saw the importance of integrating suppliers into the global automotive value chain. OEMs established close relationships with their suppliers by maintaining equity stakes and by assisting with implementations of lean processes, especially in JIT to promote flexibility along the value chain. Suppliers are also involved in product development and in the design of component parts (Mashilo, 2010: 41).

Table 1: Key differences between mass production and lean production

Mass Production	Lean Production
Standardisation of products	Differentiated products
Maximum machine utilisation	Machines operate on a demand basis only
Functional factory layout and production are organised according to processes	Cellular factory layout and production are organised according to products
Long production runs	Short production runs
Large production batches	Small production batches, and single units where possible
Production pushing based on sales forecasts (supplier driven)	Production pulling based on customer orders (customer driven)
Quality rectification at end of production process undertaken by skilled personnel	Quality built into the production system and controlled by production workers at each work station
Long manufacturing throughput times	Short manufacturing throughput times
High levels of stocks 'Just in Case' problems occur in production	Minimal stocks to ensure 'Just in Time' production
Complex managerial and production controls	Simple managerial and production controls
Large number of indirect labourers supporting workers	Small number of indirect labourers supporting workers
Single skilled and single tasked workers operating in isolation from other workers	Multi-skilled and multi-tasked workers working in teams
Improvements at company solely the responsibility of management	Improvements at company responsibility of workers and management
Arm's length relationship with suppliers and customers	Obligational long-term commitment to suppliers and customers

Source: Barnes, 2001:19

2.6. The transferability of lean production to firms outside of Japan

Lean production is a dynamic learning cycle, one that has undergone several changes since its development by TMC. OEMs based in North America and the EU widely implemented principles of lean production into a more adaptable and sustainable production process. This advancement of lean techniques into best operating practices led to the development of world class manufacturing (WCM). According to Leoni (2013: 8) and Kearney (1997:74), WCM refers to the institutionalised point of reference to lean production underpinned by sophisticated organisational elements of production pursuing production excellence and effectively combining people, materials and system tools. WCM sets to boost competitiveness and develop top leaders in the industry.

The greatest benefits of lean production emerge when applied systematically. Barnes (2001: 34) writes that even a partial adoption of lean practices by mass producers leads to improvements in efficiency. Ultimately, the transfer and adoption of leanness should not be a goal or desire, but rather seen as integral to a firm's survival in the highly competitive global industry. Lean production is easily transferable and adaptable given that continuous and sustainable improvements - *kaizen*, remains at the core of the system. Many OEMs operating outside Japan achieved great success after adapting to lean practices. The success of lean production adapted by US based OEM - New United Motor Manufacturing Inc. (NUMMI) as a result of a joint venture between TMC and GM, demonstrated that lean production is not culturally bound to Japan, and thus transferable to other countries, industries and organisations (Mashilo, 2010: 42).

Before the transition to lean production, OEMs and component suppliers based in developing economies produced under 'weak' mass production due to low capital intensity and limited technological capacity. These firms could transition towards leanness because its key advantages are organisationally driven rather than technologically driven (Barnes, 2001: 30). Firms operating in developing economies have the potential to benefit from gains in productivity, economies of scale and penetration into export markets and improvements in customer relations without heavy capital investments and foreign capital. Developing economies can successfully make the transition to becoming lean producers. Success in the transition of leanness has been recorded in India, China, South Africa and Thailand among many other auto-producing economies (Barnes, 2001: 35; Mashilo, 2010: 43). However, a potential threat for developing economies is the low levels of human resource development, consequently limiting the base of skilled workers and the understanding of management in implementing steps which are key to the firm's success.

2.7. Global value chains in the automotive industry

Transformation towards leanness changed the structure of global value chains (GVCs). The reduction in component suppliers per assembly plant, outsourcing of labour activities and value added services, and the global sourcing of component parts mediated value chains into a coordinated globalised integrated system. Lean techniques became important in the coordination and integration of the global value chain, as firms increasingly focus on improving their responsiveness and flexibility to customer deliveries. Realising the importance of increased participation and integration in the stages of production, industries and organisations enables connectedness in the value chain therefore ensuring not only cost minimisation, but also efficiency and better linkages across the supply chain of firms operating in the automotive industry (Kaplinsky and Morris, 2001:3).

As previously highlighted, this era of globalisation saw a rise in competitiveness between developing and developed economies which shifted global production, end markets and supply chain operations as well as altering organisational structures within industries. Kaplinsky and Morris (2001:5) note that active participation by economies and firms in the global economy is crucial because of the strengths and opportunities offered by integrated global network operations. This consequently led to the rise and significance of GVCs in economic sectors, particularly in the automotive industry.

As Kaplinsky and Morris (2001:4) state, the value chain illustrates a full range of activities required to develop a product through various stages including the phases of production to deliveries, to end customers and the independent aftermarket. GVCs create an opportunity for developing economies to participate effectively in the global economy. The framework focuses on globally expanding supply chains and creating and capturing value within the system. New production opportunities in the automotive value chain are concentrated in large developing economies characterised by low cost labour and raw materials, large domestic markets and capable manufacturers (Gereffi, 2013: 8).

Core activities, being design, research and development (R&D) and branding are concentrated in developed economies. All non-core activities are outsourced to developing regions on the basis of selecting low cost suppliers who meet quality standards, are reliable and can deliver on time (Morris *et al.*, 2012: 410). The imperatives of lean production play an important role in selecting the location for outsourcing and the development of linkages in GVCs (Morris *et al.,* 2012: 409). The proximity of suppliers to both OEMs and consumers plays a key role in the development of domestic linkages of SCM. This is because proximity promotes near sourcing. It facilitates flexibility from suppliers in responding to JIT, TQM and changing production demands from OEMs. In the automotive value chain, due to extra parts being required, there are component parts sourced from a single supplier, thus proximity would increase costs for this supplier if it served multiple OEMs. Interaction and communication through long term relationships enhanced by trust and commitment are crucial between OEMs and suppliers. Similarly, to lean manufacturing, OEMs in GVCs deal with fewer suppliers in order to manage them effectively while also ensuring that there is a focus on strategic competences. Gastrow (2012: 5901) writes that Swedish based OEM Volvo provides its domestic suppliers with technological assistance therefore helping them in advancing their capabilities and improving operations.

OEMs, the government and civil society set standards within a GVC framework that do not only advance efficiencies and competitiveness of firms, but also protect workers, consumers and the environment. OEMs and lead supplier firms set standards and specifications affecting quality, delivery and costs, however research shows that many second, third and fourth tier suppliers face difficulties trying to meet these standards (Gastrow, 2012: 5896). For that reason, this limits their prospects of upgrading and reduces both their economies of scale in production and economies of scope in design. The value chain becomes weakened as it then fails to create and capture value in the innovation and upgrading of lower tier suppliers. Connectedness and integration into the global value chain is important for lower tier suppliers as failure to increase linkages can cause firms to lose their position in the components industry (Leppelt, 2010: 58). For example, the South African automotive industry is characterised by weak GVC linkages because locally based OEMs are often not effective in connecting domestic based suppliers to global markets.

Although increased competitiveness is achieved through GVCs, the mode of connectedness into the global economy requires policy intervention and strong institutional linkages to promote the success of linkage development. Governance in GVCs ensures that interactions and linkages along the value chain reflect an effective organisation, instead of randomness (Morris and Kaplinsky, 2001: 41).

PART TWO: MEASURING PRODUCTIVITY AND BENCHMARKING ANALYSIS

2.8. Performance evaluation of firms using productivity measures

In efficiency and productivity measurement, it is in the best interest of a firm to attain an optimum outcome by making the best possible use of its resources (Karaduman, 2006:7). Sheman and Zhu (2006:18) define efficiency as achieving the greatest possible output with fixed amount of inputs. In defining productivity, Coelli *et al.,* (2005:3) note that productivity measures the ratio of output that a firm produces to the inputs that it uses in its production process, where more output per unit of inputs reflect higher productivity. A higher level of productivity is influenced by inputs including the use of machinery and technology in addition to the efforts or efficiency of labour input. A firm can generate large profits, however this does not prove that it is efficient in using its resources, hence a highly profitable firm is not exempt from low or inadequate capacity utilisation (Fried *et al.,* 2008:16). Coelli *et al.,* (2005:7) and Comin (2006:4) highlight that when a firm's productivity increases from one year to the next, the improvement in productivity levels may not solely be due to improving efficiency, but also takes into account technical change or the exploitation of economies of scale. Additionally, the appropriate adoption of lean and WCM production techniques can help firms in different manufacturing sectors improve productivity.

2.9. Objectives of productivity measurements

A look at the productivity literature shows that there is neither a unique purpose nor a single measure of productivity. Productivity measurement has a range of objectives and these are to measure; i) technology, ii) efficiency, iii) benchmarking processes, iv) real cost savings and v) living standards (OECD, 2001:12).

i. Technology: Productivity is measured to assess shifts in the production frontier or the development of technology and innovation, and the catching up to a production frontier.

ii. Efficiency: In moving towards optimality, firms aim to achieve best practices and to eliminate technical and organisational inefficiencies.

iii. Benchmarking processes: Comparisons of productivity levels for production techniques in manufacturing production can help firms identify inefficiencies.

iv. Real cost saving: Measuring productivity helps firms identify real cost savings in production processes.

v. Living standards: Productivity is directly linked to the development of living standards. For example, adjusting for changing working hours, unemployment and labour force participation impacts on an economy's underlying productive capacity. From a policy perspective, value added based labour productivity is important as an economic and statistical reference in wage bargaining.

2.10. Single factor productivity

2.10.1. Labour productivity

Labour productivity measures the efficiency of labour combined with other factors of production. The changes in labour productivity reflect the joint influence of changes in intermediate inputs as well as technical organisation and efficiency changes within firms in an industry. It is measured as gross output or value added (Cobbold, 2003:2).

Labour productivity based on value added equals sales in a given period of time, less intermediate inputs, including purchased materials, energy and services. Labour productivity based on gross output includes the use of labour inputs and other intermediate inputs involved in the production process. Cobbold (2003: 5) emphasises that the difference between the two basic concepts of labour productivity is less pronounced at an aggregate level than it is at an industry level.

Labour productivity is calculated as follows:

$$\frac{\text{Quantity index of gross output or value added}}{\text{Quantity index of labour input}}$$

2.10.2. Capital productivity

Capital productivity measures the output per unit of fixed capital (OECD, 2001: 9). Similar to labour productivity, capital productivity is based on gross output or value added.

Capital productivity is calculated as follows:

$$\frac{\text{Quantity index of gross output or value added}}{\text{Quantity index of capital input}}$$

According to the OECD (2001: 11) and Cobbold (2003: 7), labour productivity is a simple and useful measure of productivity, whereas even though useful, capital productivity is difficult to compute and more of a subjective measure since it involves procedures for evaluating the magnitude of capital input. Labour and capital productivity are only partial indices and can often lead to biased results.

2.11. Total factor productivity (TFP)

TFP is key in understanding efficiency and technological processes. The measure assumes that firms produce along a production frontier with full technical efficiency and no inefficiencies (OECD, 2001: 15). TFP is the weighted average of capital and labour productivity where the weights are determined by relative amounts of labour and capital employed in the production process. For TFP estimates, most studies use TFP in the form of capital-labour TFP based on value add, or capital-labour TFP based on gross output.

2.12. Benchmarking processes

This dissertation examines productivity measures using single productivity and the application of productivity measures using benchmarking processes. Benchmarking is perceived as a continuous and systematic process. The purpose of benchmarking is to compare similar production activities by identifying and adopting best practices useful in improving productivity and thereafter implementing the results (Kelessidis, 2000: 11). Measuring best practice allows firms to have the best opportunity at gaining strategic and profitability advantages. An effective benchmarking methodology rests on the selection of appropriate quantitative measures for measuring comparative performance using a set of measurable parameters of strategic importance.

Benchmarking is a useful tool for measuring productivity, competitiveness and quality. It identifies strengths and weaknesses and allows firms to gain the best results by learning from others. The process is driven internally, and by external pressures in the form of competitors and customer needs. According to Benson *et al.*, (2005: 851) and Nazarko *et al.*, (2009:499), a comparative study of performance measurement defines performance using indicators such as operating efficiency, waste reduction, timely delivery, motivated employees, customer satisfaction and quality standards. In moving towards WCM and building competitive advantages around performance, firms in the automotive industry need to commit to quality improvement, reduction of lead times, involvement of employees, increased flexibility to allow for production in small batches and higher capacity utilisation and an integrated supply chain comprising of both suppliers and customers. Benchmarking therefore becomes a search for the most effective methods for an organisation to gain competitive advantage over its competitors (Benson *et al.,* 2005: 856).

Nazarko *et al.,* (2009:500) further state that benchmarking enables the identification of the gap between the productivity of one firm over the productivity of similar firms in the same industry. The aim then becomes to reduce this gap by increasing productivity through the implementation of practices indicated by the benchmarking process as solutions to the firm in achieving excellence and world class competitiveness.

However, benchmarking processes overlook whether the improvement in efforts justify the costs and time devoted to them. The real potential of the firm should be estimated and an analysis made of whether the desired effects are possible and within the budget at the disposal of the firm. Benson *et al.,* (1995:858) note that performance evaluations focusing on sustained achievements without accounting for the corresponding efforts or resources committed usually undermine the true competitiveness of a firm. Performance is reported for each indicator rather than in a consolidated manner through an aggregate index of performance (Nazarko *et al.,* 2009:502). As a result, performances are evaluated and compared for individual indicators respectively, but there is no report on aggregate performance through a composite index of performance which consequently poses a major drawback to its application.

SECTION 3: BACKGROUND ON THE AUTOMOTIVE INDUSTRY

3.1. Introduction

Section three's analysis focuses on the main trends in automotive production and sales, and the rise of developing countries within the industry. A comparative study of the performance and development of the automotive industry in South Africa, India and Hungary is assessed. While these three countries have a varying degree of technological capabilities, policy interventions, proximity to markets and FDI, they have all managed to develop mature and globally competitive automotive industries. The Hungarian industry is shown to have an advantage of low labour costs and a well-positioned supply base, while the Indian industry has the advantage of low production costs and a large domestic market.

3.2. Overview of the global automotive industry

The automotive value chain consists of three divisions; 1) original equipment manufacturers (OEMs) or vehicle assemblers, 2) original equipment suppliers (OES) of automotive component parts and accessories supplied to OEMs and 3) the independent aftermarket which consists of replacement parts and accessories supplied via dealers and repair shops (Barnes and Morris, 2008:38). The production and assembly of vehicles incorporates approximately 5000 component parts and makes use of a range of technological processes, production techniques and materials. The value chain is characterised by producer driven leading OEMs and large first tier suppliers. These firms have strong coordination capabilities additional to huge buying power over production in global supply chains. Leading OEMs take on the bulk of activities with high economic rents including innovation activity, branding and marketing, design and almost all vehicle assembly functions (Gastrow, 2012: 5898). OEMs produce relatively few of their parts in-house, instead most parts are outsourced to first and second tier suppliers as this proves to be a more cost competitive option for OEMs.

Automotive industries in developing economies operated under an import substitution industrialisation (ISI) strategy grounded in support for local content programmes and heavy government protection based on high tariffs and import quotas. The ISI strategy resulted in a lack of competition and limited access to foreign markets for domestic firms, consequently promoting inefficient use of resources that led to low levels of productivity and failure to achieve economies of scale. The move towards trade liberalisation post the 1990 Washington Consensus resulted in a change in the organisation of the automotive industry with large shifts in trade flows, FDI, bargaining power and end markets from developed economies to the developing world (Gereffi, 2013: 5).

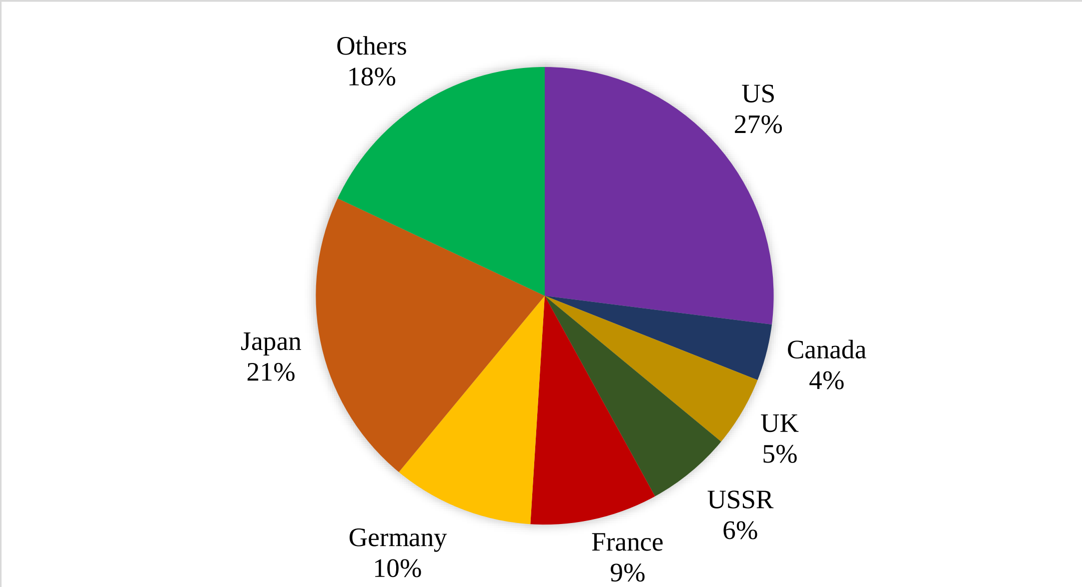
Intensified competition for new markets, overcapacity and cost pressures in the Triad regions; North America, Japan and Europe, created opportunities for developing countries to add value to the global strategies of OEMs, improve cost saving measures and provide a large profit potential for OEMs. The expansion of OEMs and component suppliers into the developing world was enhanced through mergers and acquisitions and equity based alliances. This influenced the buying power and capabilities of OEMs across supply chains into a more integrated global industry (Sturgeon *et al.,* 2009:11). Furthermore, many governments in developing countries adopted market friendly policy instruments looking to attract FDI, promote exports and ensure growth in the industry. However, despite growth in the industry, Barnes *et al.,* (2017a:19) in the South African Automotive Masterplan (SAAM) report describe the demand for vehicles as fragile owing to structural changes in the global industry, such as increasing demand for fuel efficient vehicles, advanced safety standards and the rising demand for vehicle infotainment systems, all of which put pressure on product development and production costs.

3.3. Global vehicle production and sales

The automotive industry in the Triad economies has reached stagnation in its production and sales in comparison to the growth of the industry in developing countries and the rest of the world. According to Humphrey and Memedovic (2003: 5); Sturgeon *et al.,* (2012: 10) and OICA (2016), the spread of vehicle production in developing countries more than doubled in the boom years of rapid expansion from 33 million units in 1975 to 61 million units by 2015. Figure 1 shows that in 1975, seven countries in the Triad economies accounted for 80% of the world's total vehicle production, but by 2015, eleven countries accounted for the same share comprising of China, India and Brazil and South Korea emerging as competitive players in the industry. However, the US remains a dominant producer in automotive vehicles. China and India emerged as highly competitive markets because of growing FDI, cheaper labour costs and affordable vehicle prices therefore contributing to driving growth, increasing productivity and efficiencies in their local automotive industries.

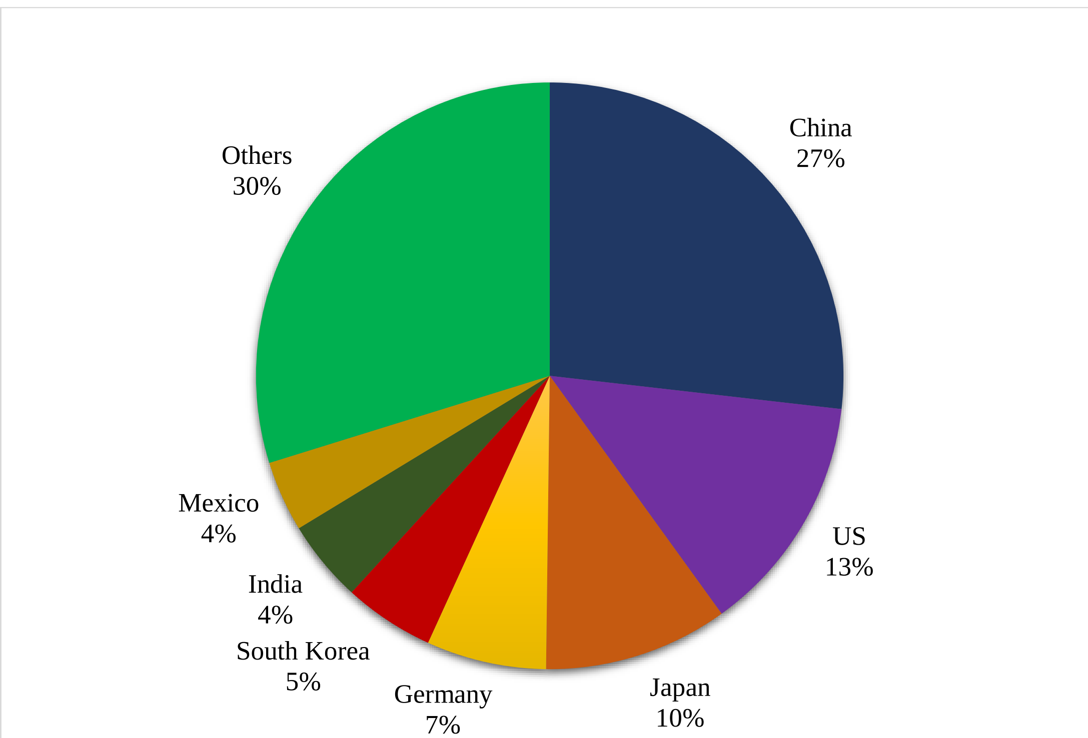
The share of vehicle production by the major producer countries in 1975 and 2015 is illustrated in Figure 1 and 2. The most striking development has been the rise of China as the world's largest producer accounting for 27% of global vehicle output by 2015. This has been accompanied by a concomitant decline in the output share of the Triad economies (Japan, North America and Europe).

Figure 1: The geographic distribution of total vehicle production in 1975



Source: Sturgeon *et al.*, 2012

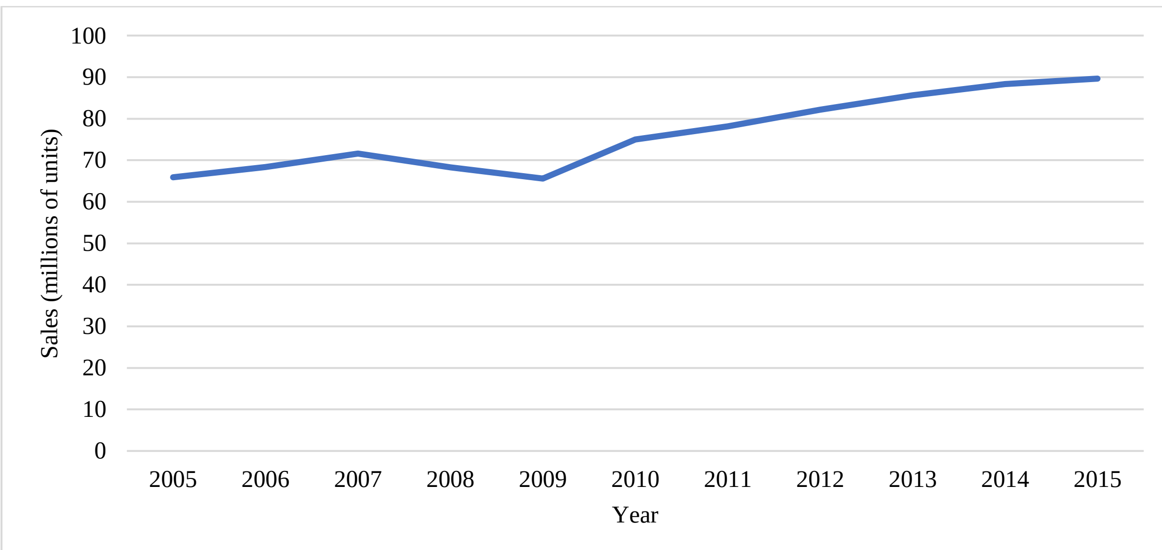
Figure 2: The geographic distribution of total vehicle production in 2015



Data Source: OICA, 2015

Emerging regions and countries including South America, Eastern Europe, Mexico, China, India and the Association of Southeast Asian Nations (ASEAN), accounted for a larger share of new vehicle sales compared to the Triad economies. Between 2008 and 2015, sales rose by 17.4% in the Triad regions and by 106.7% in emerging countries. Figure 3 shows the rising trend in automotive sales. In 2007, automotive sales reached 71.6 million units, however in 2009, owing to the financial crisis unit sales fell by 5.9 million units. Following this, the global industry experienced positive trends in sales growth from 47.8 million units in 1990 to 89.7 million units in 2015 (Figure 3). When looking at the sales profile of vehicles across different regions, Barnes *et al*., (2017a:19) report that developed countries accounted for the majority of sales of Sport Utility Vehicles (SUVs) as well as higher value and lifestyle oriented vehicles, whereas consumers in developing countries demanded small, less sophisticated, and more standardised vehicles.

Figure 3: Total automotive global sales for new vehicles 2005-2015



Note: New vehicle sales for both light commercial vehicles and passenger cars

Data Source: OICA, 2016

3.4. The Hungarian and Indian automotive industries

In Section eight, comparative benchmarking data for India and Hungary are presented. We therefore provide additional background on these two countries below. Like South Africa, automotive industries in Hungary and India developed rapidly over the past two decades, with the value of automotive exports almost doubling from the 1990s to 2005. In 2015, South Africa and Hungary’s total vehicle production accounted for 0.6% and 0.5% of global production, respectively. India accounted for 4% of global production, this therefore shows that the Indian automotive industry enjoys a significantly larger share of global output compared to Hungary and South Africa.

3.4.1. Hungarian automotive industry

The automotive industry is one of the driving forces in Hungary's export growth. The government identifies the automotive industry, particularly first and second tier component suppliers as a catalyst to attracting new FDI and creating new jobs (Canadian Trade Commissioner Service, 2014). Hungary is a low cost and high value components producer that benefits from geographic proximity to parent company supplier networks in Western Europe. Hungary's slow economic growth and the geopolitical vulnerability of Eastern Europe prompted the Hungarian government to offer foreign investors unusually generous tax holidays and profit repatriation allowances (Barlett and Seleny, 1998: 335). The cost advantage subsequently led to heavy FDI in the local components industry by leading MNC subsidiaries and large first tier suppliers such as Bosch, Bridgestone and Delphi Calsonic. The Hungarian government had planned to transform Hungary into one of Europe's leading manufacturers of advanced automotive engines, transmissions and power steering equipment. The government imposed strict requirements whereby MNCs had to invest in local content to promote the domestic industry.

After the collapse of the Soviet Union, Hungarian component firms had to adjust to a radically altered international and domestic environment owing to trade liberalisation, intense competition and the loss of former markets. This forced component firms in the domestic industry to shift their focus to improving competitiveness through adapting new production techniques and introducing new management techniques (Canadian Trade Commissioner Service, 2014). Notable interventions by component firms were quality management, cost saving measures and human resource development. MNC subsidiaries intervened to provide technical assistance and training courses to facilitate the introduction of these techniques. Hungarian component firms saw improvements in management, quality assurance systems and labour productivity reaching similar levels to the Western European average. Quality, price and supplier capacity were highlighted as important factors in achieving high levels of competitiveness in the Hungarian domestic industry.

3.4.2. Indian automotive industry

India is the fourth largest automotive market in Asia and offers a cost saving of up to 36% in labour costs compared to the Triad economies (Just Auto, 2010). The Indian components industry is highly competitive with a presence of foreign and domestic Indian firms. The industry has developed the capability of manufacturing all component parts required to assemble a vehicle, which is evident from the high levels of localisation achieved in the domestic assembly industry as well as the components developed for the 100% Indian made vehicles such as the Tata Indigo, Tata Indica and Mahindra Scorpio (Mukhopadhyaya, 2011: 6). After trade liberalisation in the 1990s, new MNCs worked closely with local suppliers to achieve high standards of productivity, efficiency and quality. Sutton (2005:8) notes that Suzuki's partnership with India's Maruti did not only develop a network of component suppliers, but it also ensured high quality and delivery standards through the implementation of Japanese management practices and long term supplier relationships. A growing number of component firms in the industry are focusing on lean and WCM techniques, which has resulted in firms improving their productivity, efficiency and quality standards.

Mukhopadhyaya (2011: 2) reports that Indian firms account for 60% of the revenue of the components industry, while MNCs only contribute 12% and the unorganised segment, largely made up of small and medium enterprises (SMEs) contribute the remaining 28%. Domestic and foreign component suppliers in India face increasingly intense competition for market share, and their response to this was to upgrade their productivity and quality levels (Sutton, 2005:8). Quality and efficiency of domestic component firms plays a crucial role in determining the future of the Indian automotive industry. Barnes *et al.,* (2017d: 61) reports that total production volumes in India are higher than domestic sales indicating that India's industry has a strong export base.

SECTION 4: POLICY INTERVENTIONS IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY

4.1. Introduction

South Africa's automotive industry has a long history which began in in the mid-1920s. The operating environment was transformed from completely knocked down (CKD) production to full manufacturing enabled by increasing capabilities, improved technological processes and a shift towards global integration. Additionally, given its perceived economic importance to national development, the industry is supported by various industrial policy frameworks and government backing. This section aims to provide a comprehensive view of the history of South Africa's automotive industry, whilst also assessing the impact of several policy interventions implemented since 1995.

4.2. The role of the automotive industry in the South African economy

South Africa's automotive industry is the country's leading manufacturing sub-sector accounting for 6.7% of manufacturing output in 2014 (Black *et al.*, 2017:32). The industry is underpinned by an export-led growth model with a strong focus on growing productive capacity through exposing domestic firms to foreign markets, adopting best practices and capturing economic gains from trade liberalisation and global integration. The industry contributes to employment opportunities, acts as a pioneer to technological development and presents large industry linkage effects. South African based OEMs and component suppliers are well integrated into strong forward and backward linkages with other sub-sectors of the economy including machinery and equipment, glass and non-metallic products and metals and petrochemicals (Seda, 2012:84).

In 2015, South Africa ranked 21st among the world's vehicle producing countries with a 0.8% share of global vehicle production. In the same period, South Africa ranked 22nd with a market share of 0.7% in global vehicle sales (AIEC,2016:5). Although the South African automotive industry appears relatively insignificant in global terms, the industry plays a crucial role in the national economy and is considered a mainstay of the national industrial base.

Vehicles and components amount to 14.6% of all South African exports (AIEC, 2016: 5). In 2015, the automotive industry reported export earnings of R151.1 billion, up by 30.6% from R115.7 billion in 2014 and 47.2% from R102.7 billion in 2013 (AIEC, 2016:7; AIEC, 2014:4). Moreover, the industry has a large employment multiplier and employs 113 000 workers in vehicle and components production. Inclusive of automotive repairs and trade, wholesale and maintenance, the industry employs a total of approximately 322 220 employees (Cokayne, 2016; Chinembiri and Kapuya, 2013; Barnes *et al.*, (2017b: 25). Despite the rapid progress of the industry, the growth outlook across the value chain has deteriorated as the industry faces significant and dynamic challenges at both the micro inter and intra firm-level, and macro national and global level. On average, South Africa's GDP growth has been slowing, signalling low economic growth that is failing to stimulate demand in the domestic market.

4.3. Early developments

In 1924 and 1926, GM and Ford respectively, became the first OEMs to set up production activities in the country (Barnes, 2000:38; Black, 2009:21). GM and Ford imported all their component parts from foreign markets. During this time, there were a few local component suppliers in the local industry specialising in the production of glassware, batteries and rubber tyres. Because of increasing vehicle activities in the industry, the government implemented an inwardly-oriented growth strategy underpinned by infant industry protection, an ISI strategy and local content programmes (LCPs) aimed at supporting, protecting and growing the local industry. The small and limited domestic industry experienced low productivity levels and scale inefficiencies resulting in high unit costs as well as a rise in import content. The high import content was a result of rising demand for technology intensive component parts.

OEMs produced a wide range of models at low volumes, the market was heavily fragmented, there was non-specialisation in production and, domestic component suppliers were unable to upgrade their production capacity (Black, 2011: 6; Barnes, 2000:32). This led to the introduction of the six phases of local content programmes from 1961 to 1989. A set of local content requirements were put in place and the government continued with high tariffs aimed at reducing the industry's dependence on imported component parts. Even though LCPs still operated within an ISI framework, they were a much more focused and specific strategy intervention by the government in the automotive industry (Nkunzi, 2014: 38).

4.4. Local Content Programmes (1961 to 1995)

Through the 1920s until the late 1940s, local content levels remained very low in the domestic industry. OEMs were dependent on imported components and this was of concern as not only was the potential growth of local firms undermined, but it negatively affected South Africa's trade balance.

The most widely used definition of local content is based on local component purchases less all import content as percentage of all component purchases (Black, 2009:10). Binza (2014:41) and Barnes (2000: 38) state that increasing local content aimed to serve two purposes. Firstly, increased local content aimed to reduce the country's trade deficit, this is because the automotive industry accounted for 15% of all total imports by 1960. Secondly, increased local content was to increase the scale and efficiency of production as well as to create jobs.

During Phase I of the LCP (1961-64), model proliferation increased and OEMs significantly increased local content in their production, thus further encouraging localisation and the development of the components industry (Barnes, 2000: 3). A negative characteristic of Phase I was that it failed to increase economies of scale in the components industry and as a result the market was further fragmented. Phase II (196470) was a critical phase in shaping the domestic industry. There was a growth momentum maintained from the first LCP and major component investments took place independently of OEMs. In terms of Phases III and IV (1971-79), local content was set to increase from 52% to 66% (Black, 2007:75). Following this, there were large capital investments in the components industry leading to increased input costs for OEMs. The proliferation of vehicle models being locally assembled was a growing concern, however the government did not intervene to address the issue. Inevitably, the domestic industry experienced low levels of real growth. Phase V was introduced in 1980 at a time when sanctions were impacting the economy leading to a fall in demand and disinvestment by some OEMs. Moreover, the mass based local content system had severely distorted the structure of the domestic components industry (Meyn, 2004: 16).

The first five Phases of the LCPs were heavily flawed with many challenges. Firms operated in an industry characterised by low cost and low technology production, hence maintaining South Africa's uncompetitive and high cost production structure.

4.4.1. Phase VI (1989 to 1995)

Phase VI marked the start of partial liberalisation of the industry. The local content definition previously used in the last five LCPs changed from mass based to value based and exports were included as local content. Therefore, local OEMs and component suppliers could meet local content requirements by exporting (Black, 2007: 75). Under Phase VI there was rapid growth in component exports, particularly in non-traditional automotive components such as catalytic converters and leather seats. Black (2007:78) notes that export increases were incentivised by the weak demand in the domestic market and the desire to improve domestic production. At the same time, OEMs increased their model platforms leading to a rapid increase in model proliferation (Tomlay, 2012: 34). This exposed many component suppliers' weaknesses as they were unable to improve their technology and upgrading capabilities to assist the development of OEM production activities.

Phase VI improved on the shortfalls experienced by previous LCPs. However, because it still operated within an ISI framework, inefficiencies in resource allocation, a lack of innovation and capacity underutilisation caught up with the industry as demand stagnated, sales declined and the market became more fragmented than before (Black, 2011).

The government failed to intervene in limiting model proliferation in the small domestic market, and thus component suppliers were locked into a low volume environment that prevented them from using the domestic market as a base for significant export expansion (Barnes, 200: 28). The LCP undermined rationalisation. Even though the LCPs were unsuccessful in improving competitiveness in the components industry, they managed to increase the number of domestic component suppliers in the local industry and attract new FDI.

4.5 Post-apartheid industrialisation

4.5.1. The Motor Industry Development Programme (MIDP)

The role of industrial policy became important in shaping a national industry's integration into GVCs, as well as in promoting the upgrading and adoption of WCM standards which are emphasised as critical to maximising gains in competitiveness (Barnes and Morris, 2008: 19). In 1994, South Africa signed the General Agreement on Tariffs and Trade (GATT) moving in the direction of trade liberalisation. The government reduced tariffs more substantially than the World Trade Organisation (WTO) had required. South Africa's industrial policy set out to transform the economy and set it on a growth path supported by labour intensive and higher value adding industries to aid in reducing inequality, poverty and unemployment (dti, 2014:13). Apart from the support by national industrial policy, the automotive industry had its own industry specific policy; the MIDP. The MIDP was implemented in 1995 and initially planned to last until 2002, but it was extended twice to 2007 and then again to 2012. The MIDP occurred in a context of rapid liberalisation, a major shift in government policy and a change in South Africa's trade regime (Barnes, 2000: 31). The government shifted from a focus on demand-side interventions in the form of high tariffs and quotas to protect the domestic industry towards supply-side interventions aimed at promoting exports and global integration (Barnes, 2000: 31; Binza, 2014: 21).

The MIDP's key objectives were to improve the competitiveness of the industry thereby encouraging growth, exports and the stabilisation of employment (Black, 2009:20; Barnes, 2000: 13, AIEC, 2014):

The following instruments were implemented under the MIDP (Black, 2009:20; Barnes, 2000: 13; Mashilo, 2010:51 and Meyne, 2004: 13):

i. The import duty tariff phase down involving the reduction of nominal tariff rates from 115% under Phase VI to 40% for CBUs and 30% for CKD components by 2003, and by 2012, the tariff rate was 25% for CBU vehicles and 20% for CKD components (Nkunzi, 2014:22 and Barnes, 2000:38).

ii. Duty free allowance for imported components up the value of 27% of the value of vehicles produced for the domestic market.

iii. The Small Vehicle Incentive (SVI) provided subsidies to OEMs of more affordable vehicles. This was abolished in 2007.

iv. The Import-Export Complementation (IEC) scheme was aimed at increasing production and expanding exports into foreign markets (Nkunzi, 2014:24). OEMs could earn duty credits from the Import Rebate Credit Certificates (IRCCs) by exporting. Meadows (2000:18) and Barnes (2000:40) highlight that duty credits were tradable and could be used to offset import duties on vehicles, materials or components.

v. The Productive Asset Allowance *(*PAA*)* was introduced in 2000 as a fiscal incentive to support investments in productive assets including land, material, machinery or capitalised R&D. If OEMs wanted to benefit significantly from the PAA scheme, then they had to effectively reduce the number of models they produced domestically.

4.5.2. The contribution and implications of the MIDP in the South African automotive industry

The MIDP led to rapid productivity improvements along with FDI inflows and the introduction of new technology. There was an improved degree of rationalisation and greater economies of scale were achieved owing to the increase in exports, specialisation and competitiveness (Black, 2009: 18; Barnes and Black, 2013:4). In addition to policy support, the development of South Africa's industry was assisted by various exogenous factors including relatively cheap raw materials and an experienced components industry as well as relatively cheap labour compared to developed countries. The domestic automotive industry became a leading export industry and one of the best performing industries in the manufacturing sector.

OEMs and large first tier suppliers significantly benefitted from the MIDP, while lower tier component suppliers faced a challenging environment. Many local component suppliers struggled in the new environment due to having to cope with increasing competition, especially given that firms were operating in a fragmented and limited domestic market. Additionally, the transformation from broad to highly specialised suppliers was a difficult challenge for component suppliers and consequently not all survived the restructuring process (Barnes and Morris, 2008:26). Several large domestic suppliers including Murray and Roberts, Metair and Dorbyl moved from being first tier suppliers to becoming second tier suppliers because of difficulties in upgrading production, design and technological capabilities (Black, 2011: 21). Exporting became a key imperative for many firms partly to replace loss of domestic market share but also to achieve the benefits of specialisation through higher volumes.

In their attempt to adjust to a new environment, firms pursued a range of strategies including the introduction of licensed technology, undertaking new investments, incremental adaptations of processes and products, shifting to new products and markets, upgrading the network of suppliers, reducing domestic sourcing and to obtaining foreign equity partners or owners (Black, 2011:9). Furthermore, Black (2011: 11) notes that foreign partnerships and equity agreements between foreign and local suppliers enabled local suppliers to obtain up-to-date technology and become better integrated into the GVC. OEMs and suppliers deeply entrenched into the GVC were able to use their strategic positioning to increase their import propensity.

The MIDP removed local content requirements however, it provided incentives for locally based firms in the form of export credit. A major weakness of the MIDP lies in the way the IRCC policy was used, and not in the instrument itself. The rebate mechanism allowed for low levels of local content and OEMs could maintain a wide range of different models for the domestic market. The IRCCs allowed firms importing CBU vehicles easy access to the domestic market (Barnes, 2000:43; Black, 2009:18; Nkunzi, 2014:33). OEMs could bring in duty free components through the IEC therefore offsetting import duties against exports. OEMs put effort into identifying competitive component parts manufactured in the South African industry as component exports meant firms could earn credits from importing CBU vehicles. The government later decided to include raw materials as local content. OEMs took advantage of this, and they seized the opportunity to export low value added automotive products with high levels of local raw materials, which allowed them to import high value added components or CBU vehicles. This had the effect of displacing some local suppliers and potentially undermining the domestic components industry. The components industry was left widely exposed and unprotected.

Competitiveness improved from the previous industrialisation phase, but the domestic industry still compared relatively poorly to international benchmarking standards. South Africa incurred high inbound and outbound logistics costs because of the long distance to end markets. Barnes (2000: 32) maintains that the MIDP led to quick exposure of the domestic industry to global competition. Another objective of the MIDP was to improve the industry's trade balance. However, this was not achieved because as exports increased, imports also increased. According to Flatters and Stern (2008:33) and the AIEC (2012), imports grew from 20 000 units per year in 1995 to 120 000 by 2004, and over 200 000 units in 2012, with the top importers being Germany and Japan. Roberts (2005) and Flatters and Stern (2008:39) argue that under the MIDP, import duties in excess of 30% and a ban on used vehicle imports meant that consumers incur high vehicle prices. Moreover, the development of labour intensive downstream industries was repressed which consequently led to declining jobs in the automotive industry.

Overall, in theory, trade liberalisation is good for competitiveness, however the results depend on strategies undertaken by OEMs and component suppliers. Despite its limitations, the MIDP was generally seen to be quite successful in integrating the industry into the global industry (Barnes and Morris, 2008: 103; Black, 2011: 37).

4.6. The Automotive Production Development Programme (APDP)

In 2013, the APDP replaced the MIDP. The APDP followed a similar trajectory to the MIDP. The government supported it through supply side interventions and anticipated that OEMs would create the necessary demand to develop the local components industry (Binza, 2014: 41). The APDP reinforced policy certainty, which in the automotive industry is critical for investors to make long term investment decisions (Barnes and Black, 2013: 9). The APDP had the objectives of increasing vehicle production to 1.2 million units by 2020, increasing total Value Addition (VA) and local content and achieving a better balance between domestic and export sales (AIEC, 2015:32 and NAACAM, 2013:2).

The APDP comprises of four pillars (AIEC, 2015:33; NAAMSA, 2010:36):

1. Import duty applied at 25% for CBU vehicles, 20% for CKD components used by OEMs, and 18% for CBU vehicles out of Europe.

2. The Volume Assembly Allowance (VAA) in the form of duty-free imports credits, issued to vehicle manufacturers with a plant volume of at least 50 000 units per annum to import a percentage of their components duty free based on the ex-factory vehicle price in 2013.

3. A Production Incentive (PI) in the form of a duty credit aimed at raising value addition in production.

4. The Automotive Investment Scheme (AIS) is a direct cash grant with the objective of increasing production volumes, sustaining employment and strengthening the automotive value chain. The AIS replaced the PAA and provided a taxable cash grant of 20% of value qualifying investment in productive assets.

One of the biggest criticisms of the APDP is that there is no specific target addressing the behaviour of OEMs. OEMs managed to capture large gains acquiring far more control over the production, quality and pricing of component manufacturers (Nkunzi,2014: 39). Additionally, the valuable lessons and criticism from the MIDP were not acted on when the APDP was implemented. Both the MIDP and the APDP are criticised for their failed attempts in reducing manufacturing complexities by increasing output while producing fewer platform models. In a BizCommunity interview (2015), Maxwell and Brooks write that the Director of NAAMSA mentioned that there are doubts that the APDP can significantly increase local content. Furthermore, he said there is currently no roadmap in place among relevant stakeholders on how to facilitate and execute the objective set to achieve 1.2 million vehicles by 2020.

SECTION 5: THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY

5.1. Introduction: The status of South Africa's automotive industry

Under industrialisation during apartheid, the automotive industry was protected by an ISI-led strategy dependent on high tariffs and local content requirements. Following trade liberalisation and the inception of the MIDP in 1995, Gastrow (2012:5900) outlines a list of factors that contributed to South Africa's success in the late 1990s as an attractive emerging market for new OEMs, large suppliers and FDI; 1) existing opportunities presented for entry and growth in large foreign markets, 2) a comparative advantage in relatively low labour costs, 3) the gains in productivity from innovative and technical processes and techniques, 4) adoption of lean production techniques, 5) flexible production capabilities, and 6) a commitment to industrial policy promoting the automotive industry through various programmes and incentive schemes targeted at enhancing potential gains related to the industry's growth and success. Seda (2012: 88) highlights that this led to the development of a mature industry, particularly in CBU vehicle assembly evolving capabilities from the basic assembly of fully imported CKD through to regional supply and global exports, as well as a globally competitive components industry exporting catalytic converters, leather seats, exhausts and engine parts.

The South African automotive industry currently faces a number of problems. South Africa is a net importer of automotive products, despite the rapid increase in exports. The industry operates in a small domestic market which potentially leads to firms operating below efficient scale (Black and McLennan, 2016:202). At a firm level, the industry is constrained by the following; 1) OEMs and component suppliers need to correct for scale inefficiencies, 2) low tier component suppliers need to be better integrated into the supply chain, and 3) wage and cost increases need to be matched with improvements in productivity (NAAMSA, 2016). As a result, the industry faces strong competition from emerging economies such as China, India, Brazil and Thailand (Nitschke, 2011: 26). Additionally, in an attempt to meet increasing global demand in passenger safety and environmental standards, South African manufacturers are required to develop technology and infrastructure associated with advancing production to assist with product development and production processes (Barnes *et al.,* 2017b:42).

The African market is presented as an opportunity to expand South Africa's automotive industry. In a recent study, Black and McLennan (2016:194) find that there is growing demand for vehicles in Africa, however, this is largely met by imports of used vehicles from Europe and low cost producing Asian countries. Africa is South Africa's second largest export market after the EU for automotive products (AIEC, 2016:36; Black and McLennan, 2016:204). South Africa could expand its value chain in the short to medium term, or act as a support system for emerging countries in the region looking to establish a domestic automotive industry (dti, 2015). Regional integration therefore needs to be fast-tracked to allow for an environment where firms can achieve efficiency gains, and competitive pricing as well as technology spill overs and transfers (Black and

McLennan, 2016:202). That said however, there is growth in the new vehicle market in Africa and South Africa's proximity and its understanding of business conditions and practices in other African economies place it in a favourable position to meet this growing demand. Yet, the lack of a solid automotive industrial base across the continent, limited capabilities, inadequate infrastructure and corruption could impede the prospects of an integrated regional value chain in Southern Africa (Black and McLennan, 2016: 194; AEIC, 2016:39).

5.2. Ownership and market share of South African based OEMs

The organisation of ownership structure in South Africa's automotive industry has undergone striking changes.

Table 2: Changes in ownership in South Africa's automotive industry 1990-2015

South African based OEM	Ownership: 1990	Ownership:1998	Ownership: 2007	Ownership: 2014
Toyota	100% local	72% local and 28% foreign	25% local and 75% foreign	100% foreign
Volkswagen	100% foreign	100% foreign	100% foreign	100% foreign
BMW	100% foreign	100% foreign	100% foreign	100% foreign
Mercedes Benz	50% local and 50% foreign	100% foreign	100% foreign	100% foreign
Ford	100% local	45% local and 55% foreign	100% foreign	100% foreign
Nissan	87% local and 13% foreign	37% local and 63% foreign	100% foreign	100% foreign
GM	100% local	51% local and 49% foreign	100% foreign	100% foreign

Source: Barnes and Meadows, 2008: 18; dti, 2015

Table 2 above shows that prior to 1990, only German based firms; Volkswagen, BMW and Mercedes Benz had large shares in foreign ownership, and the rest had their operations licensed in the South African industry. By 2014, all seven South African based OEMs were 100% controlled subsidiaries by their respective automotive MNCs. The dti (2008: 18) states that 75% of first tier component suppliers are foreign owned with these firms contributing to approximately 80% of the components industry's total domestic and export sales. Functional integration and increased MNC ownership led to the standardisation of production facilities and management strategies. This sees cost saving measures and improvements in productivity and competitiveness that contribute to the rationalisation by OEMs and component suppliers (Mashilo, 2010:12). Furthermore, Black (2007:77) writes that wholly-owned subsidiaries are better integrated into global networks.

5.3. Market share

Seven OEMs; Toyota, GM and Ford, Volkswagen, Nissan, BMW and Mercedes Benz make up South Africa's automotive industry with approximately 120 first tier suppliers and over 200 second and third tier suppliers, mostly owned by South African firms (dti, 2015). South African-based OEMs are located in automotive clusters across three provinces in the country; Gauteng, KwaZulu-Natal and the Eastern Cape. Toyota remains a top OEM in the South African market accounting for a 19.9% market share, while Mercedes Benz tops the premium market with a share of 5.3% (AIEC, 2016:9).

5.4. Components industry

Barnes (1999:402) highlights that the component industry plays a crucial role in the automotive industry, however it receives far less government support and protection compared to OEMs hence it faces heavy international competition. In 2002, the components industry accounted for 60% of total exports in the automotive industry (Meyn, 2004:26). The industry performed relatively well in exports before the MIDP, however following the implementation of the MIDP, the industry rapidly expanded its exports and competitiveness. In 1995, component exports increased from R3.3 million to R23.0 billion by 2005 (Table 3). Following the financial crisis, the components industry showed a quick recovery that by 2011 exports peaked at R42.5 billion, showing a growth of 84.9% between 2005 and 2011. The growth of exports in components resulted in job creation, increased government revenue and the stimulation of product expansion in raw materials like steel, textiles and plastics (Meyn, 2004: 25). Barnes *et al.,* (2016:22) raise concerns regarding the long term sustainability of the rapid expansion of component exports. The growth and exports of component parts are mainly limited to a small group of products, as shown in Table 3.

Table 3: Top 10 exports in the components industry 1995-2014

	1995	2008	2009	2010	2011	2012	2013	2014	2015	Percentage (%) of the total 2015 export value
Total (million R)	3316	44055	27853	30802	42534	39883	42176	45682	49641	
Catalytic converters	389	24267	12280	14761	19639	16347	17641	19493	20326	40.9
Engine parts	102	1853	1554	1505	2058	2875	3189	3732	3941	7.9
Tyres	213	1676	1355	1133	1675	1522	1842	2206	2193	4.4
Automotive tooling	153	518	464	447	438	782	777	936	1459	2.9
Engines	9	1045	605	965	819	559	263	364	1448	2.9
Radiators and parts	66	1026	824	951	1118	945	1117	1172	1190	2.4
Transmission shafts	55	782	503	415	596	771	926	1102	1060	2.1
Stitched leather seat parts	1019	3084	2357	2898	2190	1719	1530	1286	993	2.0
Silencers/exhaust	76	1913	1283	1696	2139	1730	1225	504	535	1.1
Other parts	727	3804	3188	2817	4447	5722	8809	9315	10816	21.8

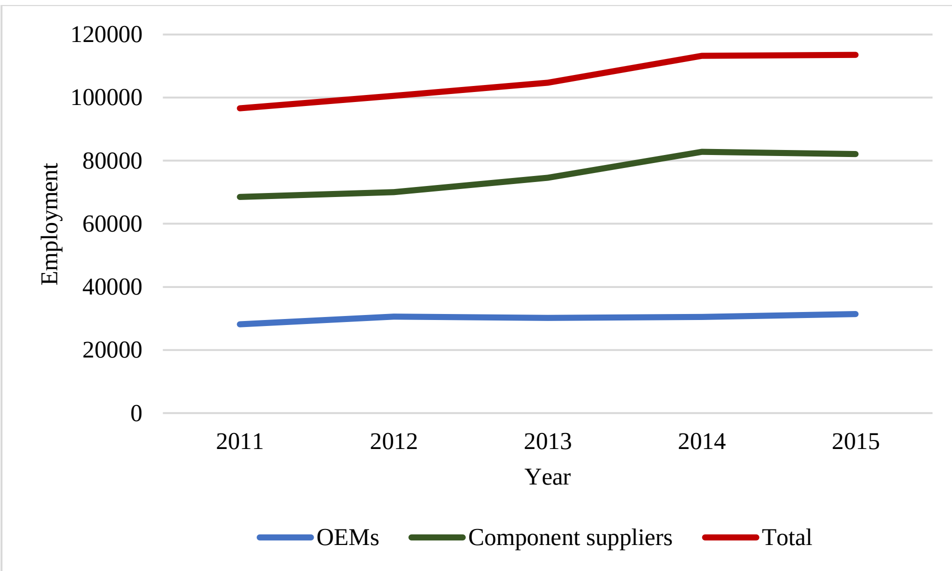
Note: Other parts include parts of component parts, which according to Barnes *et al.,* (2016:23) are not specific to a particular component. Export figures are in nominal Rand values.

Source: Barnes *et al.*, 2016:23; AIEC, 2012:29 and AIEC, 2016:37

5.5. Employment

A study by Barnes *et al.,* (2017) reveals that semi-skilled and skilled labour in the South African automotive industry earned much higher wages than in Thailand and Poland. Thailand's labour market is a lot more flexible relative to South Africa, this flexibility has facilitated cost advantages for Thai auto-producing firms (Barnes *et al.,* 2017:44). Barnes *et al.,* (2017:46) note that wages in both Thailand and South Africa are on the rise, however South African firms pay a high premium for skilled and educated workers as a result of the poor education quality and skills shortages in the South African labour market. South Africa's automotive industry is an intermediate capital-intensive industry (Black *et al.,* 2017:15). Employment in the automotive industry follows a positive growth trajectory, however because of different operating conditions and activities, among other factors, OEMs and component suppliers have experienced contrasting employment trends. BCS Africa (2014:120) reports that component suppliers experienced employment gains, however with greater volatility. OEMs experienced declining employment, and for the period 1995 to 2005, job gains in the components industry were less than the job losses by OEMs. Job losses in the vehicle assembly, especially between 1995 to 1998 industry were due to a degree of rationalisation and the outsourcing of jobs previously performed in-house (MPL Consulting, 2005:21). Foreign ownership and control increasingly result in operational strategies including employment strategies decided upon in MNC home countries and within the global industry. MNCs are highly sensitive to production costs and they operate in an environment where reducing costs is a key to strategic decision making.

Figure 4: Employment in South Africa's automotive industry 2011-2015



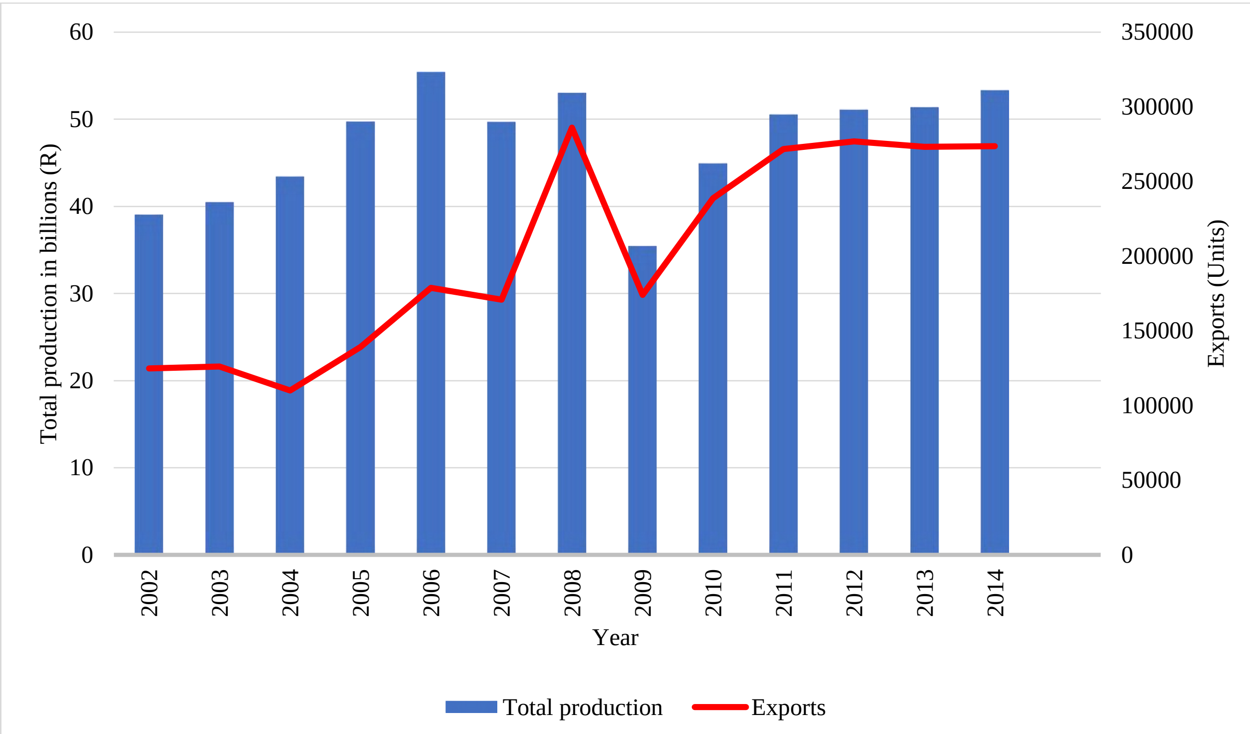
Data source: Barnes *et al.*, 2017b: 25

According to Barnes *et al.*, (2017b:25), the AIEC, NAAMSA and Statistics South Africa (StatsSA) report different aggregates and trends for employment in the automotive industry. Figure 4 presents employment data reported by the AIEC and NAAMSA. In Figure 4, employment in the components industry increased by 27.3% since 2011 showing a positive growth trend. However, Barnes *et al.*, (2016:13) reveal that a StatsSA report recorded declining employment figures for components. Employment in vehicle assembly increased slightly from 2011 to 2015. Job gains in the components industry contributed significantly more to total employment in the automotive sector. Employment in the South African automotive industry is driven by demand, export expansion and efficiency improvements. Improvements in efficiency lead to low costs in overall production which then allows firms to reduce pricing making products affordable which would then increase demand, and therefore increase production activities leading to increased jobs (BCS Africa, 2014: 109). On the other hand, increased automation and improvements in efficiency could lead to job losses. Regardless of job gains in the industry, Black *et al.*, (2017:29) argue that despite

South Africa's comparative advantage in abundant labour, employment in the automotive industry is unimpressive and less labour-intensive.

5.6. Production and exports

Figure 5: Total production and exports 2002-2014



Data source: Barnes *et al.*, 2016: 17

Reduced protectionism and the liberalisation of markets during LCP Phase VI and the MIDP contributed mostly to the growth in total automotive volume production and exports, particularly under IEC arrangements aimed at stimulating increased volumes to create a competitive domestic market against imports (Barnes *et al.*,2016:15). South Africa's production growth has been driven by exports. Total production in the automotive industry experienced a rapid rise between 2002 and 2006 from R39.0 billion in 2002 to R55.4 billion by 2006 resulting in a 42.0% growth (Figure 5). In the same period, total exports rose by 43.2%. Economic activity in the automotive industry is strongly correlated with economic business cycles hence the 2008/9 financial crisis coincided with the dramatic fall in production, exports and sales in the global industry. Total production volumes fell by 33.2% and total exports declined from 285 999 units to 174 116 units in 2008 and 2009 respectively, as shown in Figure 5. Growth in total production was on a slow recovery, total exports as well as exports as a share of total production increased steadily by 2010. Barnes *et al.*, (2016: 18) relate the success of increased exports during this period to increased volumes, the weakening of the Rand, strong integration within GVCs, specialisation allowing firms to earn rebates on import duties, as well as improvements in non-price competitive factors including improved economies of scale and cost competitive measures. Export growth, mostly by the components industry contributed to improvements in narrowing the industry's trade balance between 1995 (- R12.2 billion) to 2003 (-R9.1billion), however from 2004 (-R18.8 billion) to 2015 (-45.2 billion) trade deficit continues to widen due to increased imports, especially those of component parts (AIEC, 2012:33; AIEC, 2016:81).

Over the past several years, a slowdown in economic growth, falling domestic demand, labour unrest, high infrastructure and logistics costs, failure to fully integrate South Africa's OEMs into GVCs and weaker performance relative to competitors has exposed the vulnerability of the domestic industry. This has hindered the industry's ability to compete resulting in declining growth.

SECTION 6: EMPIRICAL FRAMEWORK

6.1. Introduction

The empirical section discusses in detail three key benchmarking studies underpinning this research; Womack *et al.*, (1990), Barnes (2001) and (Delbridge *et al.*, 1995). This section looks at previous research on benchmarking processes and the findings from each study.

6.2. Empirical framework

There are several studies and surveys that deal with the benchmarking of organisation processes. The case study on Xerox by Camp (1981) cited in Dragolea and Cotirlea (2009), one of the world's top copier companies, became one of the best examples of the successful implementation of benchmarking, bringing widespread attention to benchmarking. Xerox's study explores the positive impacts of benchmarking processes on the company in the early 1980s. Benchmarking encouraged Xerox to find ways to improve quality and reduce their manufacturing costs, which was integral to the company achieving excellence and becoming a leader in the copier industry.

Most benchmarking studies in the automotive industry focus their attention on the level of the firm. In doing so, such studies implicitly emphasise management practices as the explanation of performance and hence as a primary route to improvement. Other factors relevant to competitiveness, such as national economic policies, are therefore often ignored. The main emphasis of benchmarking is on improving organisation processes or operations by exploiting 'best practices' rather than 'best performance'.

The applications of benchmarking processes in the automotive industry have been widely studied by the IMVP based at the Massachusetts Institute of Technology (MIT). In 1990, Womack *et al.*, (1990: 90) conducted one of the largest benchmarking studies in the world. The study compared the performance of automotive firms in North America, Japan and Europe[1]. The focus was on changes in productivity[2] and quality measures in response to production processes using an IMVP benchmarking survey. Indicators implemented by the survey related to the differences in production techniques, organisation structures and human resource development. The results from the survey showed that Japanese 'lean' producers performed better than 'mass' producers in Europe and North America due to differences in quality performance, productivity gains, employee satisfaction and continuous improvements in the production process (Table 4).

Japanese firms in Japan achieved the highest productivity levels reported at 16.8 worker hours per vehicle compared to EU firms that reported 36.2 hours per vehicle. Table 4 shows that quality defects per 100 vehicles were lower in Japanese firms in Japan at an average of 60, compared to

[1] The study was conducted across 90 automobile assembly plants in 17 countries; this represented half of the assembling capacity in the world (Graves and Madigan, 1:1997).
[2] Productivity was measured as total hours of all employees divided by the total number of motor vehicles produced (Graves and Madigan, 1:1997).

Japanese firms in North America at 65, American firms in North America at 82.3 and EU firms at 97. Furthermore, Japanese firms in Japan received 61.6 suggestions per employee compared to 1.4, 0.4 and 0.4 in Japanese firms in North America, American firms in North America and EU firms, respectively. EU based OEM Renault used the IMVP method to benchmark its plant against competitors and in response this led to improvements in performance and plant efficiency (Holweg, 2007:430). Following the IMVP benchmarking survey, Womack *et al.*, (1990: 93) suggested that firms should focus on the implementation of lean techniques in their assembly plants, rather than on using comparison measurements based on financial performance and pricing factors.

Table 4: IMVP survey showing the average performance of vehicle assemblers 1989

	Japanese in Japan	Japanese in North America	American in North America	All Europe
Productivity (hours per vehicle)	16.8	21.2	25.1	36.2
Quality (assembly defects per 100 vehicle)	60.0	65.0	82.3	97.0
Inventories (days for 8 sample parts)	0.2	1.6	2.9	2.0
Suggestions per employee	61.6	1.4	0.4	0.4
Training of new production workers (hours)	380.3	370.0	46.4	173.3
Absenteeism levels	5.0	4.8	11.7	12.1

Source: Womack *et al.*,1990: 92

In his PhD research, Barnes (2001) conducted a benchmarking assessment in South Africa's components industry using firm-level data. The aim of the study was to assess the link between component competitiveness in the South African industry, macroeconomic challenges faced by the industry and economic trajectories bridging a theoretical gap in the growing discourse surrounding lean production and WCM. Moreover, the study explored findings within the South African components industry and how the industry compares to its international peers.

In the study, 16 domestic firms were profiled using operating parameters for a three-year period from 1996/7 to 1999. The average of the total domestic firms was analysed in comparison with a total average of 17 international firms for the same period. The methodology used detailed economic performance and operational competitiveness. Market drivers in economic performance included measuring (i) average turnover, (ii) the average number of employees, (iii) geographical location, (iv) ownership and (v) quality accreditation. Overall, the results showed that South African firms on average, given their small size had low turnover and employment having average turnover of R97 million, compared to R490 million by international firms. Using the same methodology detailing operational competitiveness included (i) cost control, (ii) quality, (iii) external flexibility, (iv) internal flexibility and (v) capacity to change and (vi) innovation capacity.

The results from this methodology showed that South African firms achieved much more rapid improvements than international firms. Improvements in operational competitiveness in the South African industry averaged at 82.8% relative to sampled international firms averaging only at 35.7%. To add, in assessing quality standards many South African firms were moving towards WCM which improved internal scrap rates and flexibility relating to batch sizes.

A study by Delbridge *et al.*, (1995) on the benchmarking practices of 18 motor vehicle suppliers looked at 9 Japanese and 9 UK firms to identify the key elements for successful benchmarking. The results demonstrate that good benchmarking practices are based on a high level of communications, qualitative research methods, attention to detail and consistency, a 'well-bounded comparison process', performance measures and participants' knowledge of the process. The study focuses on measuring productivity and quality using the IMVPs methodology. Financial measures were largely avoided because of the difficulty in interpreting this data, as factors such as transfer pricing and currency exchange rates can give misleading impressions. The measures of internal management practices were developed from the assembly plant questionnaire used by the IMVP. The questionnaire contained sections specifically designed to provide objective, quantitative indicators of the management practices utilised at the plant (factory practice, work systems and human resource management). Other factors which may influence productivity such as capacity utilisation and the level of automation were also measured and compared across the sample, but adjustments were not made to the performance data to attempt to standardise the plants. Rather, these were held as potential explanations of variations in that performance. This meant the research was able to minimise the adjustments made to the raw data but still able to infer the relative impact of these variables.

An inspection of the literature on benchmarking in automotive industry shows that although various papers examine a selection of different productivity measures, two of the most fundamental aims highlighted in the studies were concerned with the improving operational competitiveness of firms and the effect of policy reform and changes in the sector and subsectors studied.

SECTION 7: DATA AND METHODOLOGY

7.1. Introduction

This section describes the methodology applied to establish benchmarking in the components industry in South Africa. The comparative analysis of benchmarking establishes a common ground identified by market driver indicators as a basis for comparison. The selected functional areas are compared with agreed indicators derived from recognised sources of best practices. The methodology used in this paper is adapted from Barnes (2001).

As indicated in Barnes (2001), performance standards in the automotive industry are explored covering six operational areas of competitiveness. These are highlighted in Table 5 (1) cost control, (2) quality, (3) value chain flexibility, (4) operational flexibility, (5) capacity to change (human resource development), and (6) innovation capacity.

The analysis uses quantitative data across the South African automotive and component industries in an attempt to explain key trends observed in the industry.

Table 5: Key market drivers in the automotive components industry and related operational performance measures and practice indicators

Key market demands	Operational performance measures	Related organisational practices
1. Cost control	• Raw material stock holding (days) • Work in progress levels (days) • Finished goods stock holding (days) • Total stock holding (days)	• Single unit flow lines • Quality at source • Cellular production systems • Production pulling/use of kanban • Supply chain management
2. Quality	• Customer return rates (parts per million) • Internal quality performance: Reject rates (%), scrap rates (%), rework rates (%) • Supplier quality performance (ppm)	• Statistical process control • Quality circles/Green Areas • Team working • Mistake proofing • Corrective action processes
3. Value chain flexibility	• Time from customer order to delivery (lead time – days) • Delivery frequency of suppliers • Delivery reliability of suppliers (%) • Delivery frequency to customers • Delivery reliability to customers (%)	• Process engineering • Supply chain management • Information sharing: customers/suppliers
4. Operational flexibility	• Manufacturing batch sizes (units) • Manufacturing lot sizes (units) • Machine changeover times • Throughput time through factory (hours) • Production flow measures (metres)	• Value chain relationships • JIT manufacturing principles • Single minute exchange of dies • Multi-tasking/multi skilling of workers • Cellular manufacturing
5. Capacity to change (Human resource development)	• Education levels: numeracy, literacy (%) • Training spend as % of remuneration • Types of training (formal/informal) and focus according to employment categories • Suggestion schemes • Labour/management turnover (%) • Absenteeism levels (%) • Output per employee levels (R)	• Continuous improvement (kaizen) • Worker and management development • Worker and management commitment to companies • Organisational hierarchies • Communication flows • Team working • Multi skilling and multi-tasking
6. Innovation capacity	• Product development, product reengineering and process innovation expenditure (% of turnover) • New products released: % of sales	• Concurrent engineering • R&D structures • Continuous improvement programmes

Source: Barnes, 2001: 66

7.2. Data

The study uses firm level panel data comprising of local and foreign component manufacturers based in South Africa, Hungary and India. The firm level data was constructed from questionnaires, financial and production statements obtained from automotive component firms. The questionnaire used by B&M Analysts focuses on firm level research profiling firm ownership, geographical location and size, as well as measuring performance standards in the industry. Data used was sourced from B&M Analysts, a South African firm specialising in providing competitiveness benchmarking, industrial support and development to local and international enterprises in various industries including clothing and textiles, chemicals and automotive. Additionally, with respect to the management of the APDP Administration System (AAS), B&M Analysts is responsible for conducting a national analysis of production data in the automotive industry using over 50 key performance indicators.

7.3. Sample size

The sample size used in this paper contains an average of 21 component firms comprising of firms in the B&M Analysts Benchmarking Club. The same 21 firms were used in each period. Initially, the sample size was comprised of 174 component firms, however most of the data was unavailable therefore limiting the scope of analysis of the study. Given the nature of the industry in South Africa, the missing data for most firms could be explained by the different years in which different firms began or ended production, the entrance and exit of firms in the benchmarking club, or by the lack of compliance by firms in reporting and returning data and questionnaires to B&M Analysts.

7.4. Limitations

The relatively small sample size of 21 component firms (for the South African part of the study) is regarded as the most significant limitation and generalisations cannot be made for the entire domestic industry. With a small sample size, uncertainty increases. Therefore, the findings in the study are not conclusive owing to the fact that the sample size only represents 12% of the industry total population. Consequently, any conclusions drawn in this study may not reflect an accurate picture of the component suppliers operating in the domestic industry. Nevertheless, useful information can be obtained by tracking performance of these 21 firms over time. The results from the study are meant to provide insights for automotive associations and policymakers, rather than to recommend specific interventions for the local industry. Another limitation to the study is the heavy reliance on secondary data and research. Interviews with component manufacturers and key stakeholders in the industry would have complemented the data but were not possible due to resource constraints.

SECTION 8: RESEARCH FINDINGS AND ANALYSED BENCHMARKING DATA

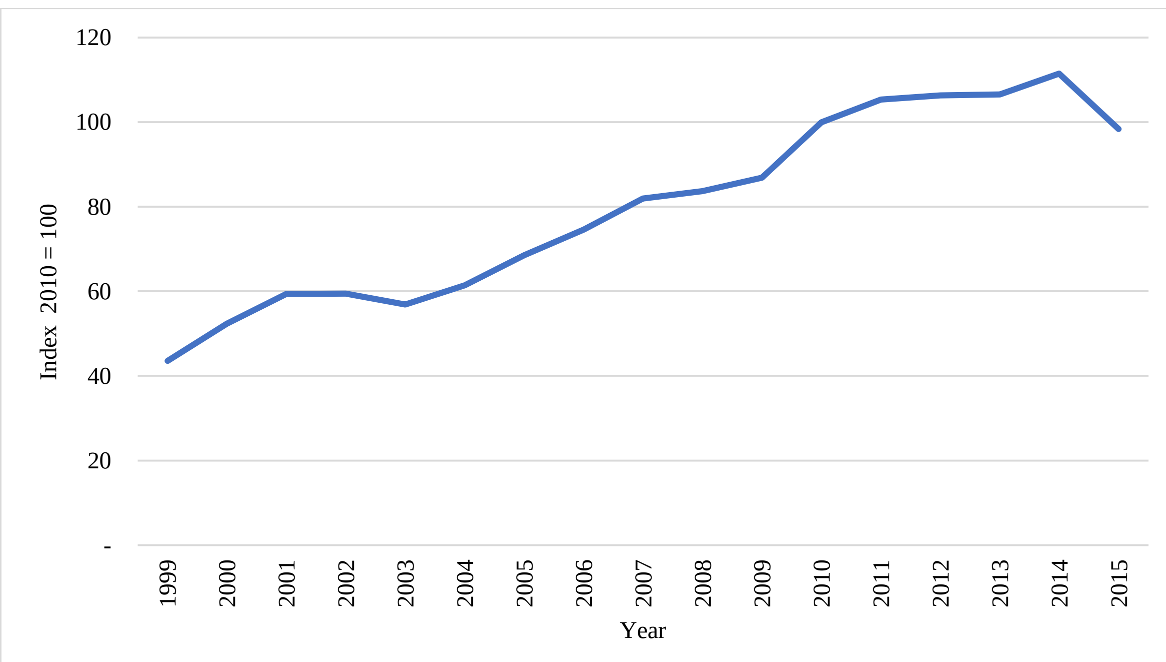
8.1. Introduction

This section presents the performance trends in South Africa's automotive industry, with a focus on labour productivity, unit labour costs and capital expenditure. The section further discusses the results and findings of operational competitiveness in the local industry using the benchmarking methodology outlined in Section seven. To add, the section provides a comparative analysis of benchmarking data of component industries in Hungary, India and South Africa with the aim of assessing existing competitiveness gaps that exist between South Africa and its international peers.

8.2. Labour productivity

In this paper, labour productivity is defined as gross output per worker indexed using 2010 as a base period. As shown in Figure 6, the overall trend in labour productivity is positive. Labour productivity in the industry grew by 112.5% in absolute terms from 1999 to 2015. Over the seventeen-year period, labour productivity increased at an average annual rate of 5.5%.

Figure 6: Labour productivity in the South African automotive industry 1999-2015



Data Source: Quantec easy data, 2015

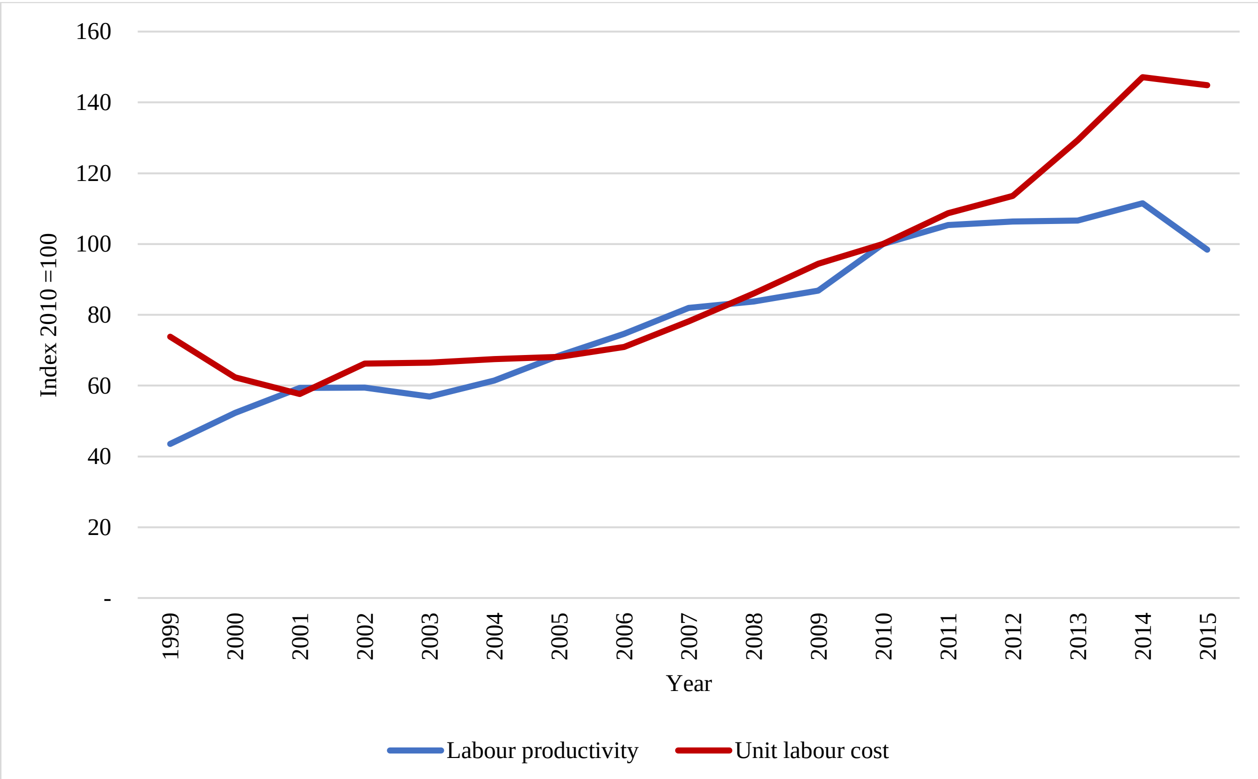
Growth was assisted by heavy capital expenditure aided by the AIS, FDI and technological transfers leading to increased levels of automation which improved labour productivity. More flexible working methods were also reflected in falling unit costs, improved efficiencies and gains in labour productivity. In 1999, labour productivity was at its lowest at 43.5 index points, however it has since improved significantly that by 2003 it reached 56.9 index points. Following the recession of 2009, automotive firms were forced to increase output using their existing capacity through encouraging workers to work overtime resulting in increased labour productivity by 2010 and in subsequent years. Uncertainties in political and economic policies relating to the automotive operating environment saw firms becoming more cautious hence adopting a conservative approach to strategy relating to pricing, capital expenditure, wages and employment.

Barnes (2002: 14) reports that inadequate management in the components industry is partially to blame for low labour productivity. Furthermore, industrial strikes, capacity underutilisation and the high prevalence of HIV/AIDS are identified as key drawbacks facing the country's workforce therefore hampering firms labour productivity gains (Meyn, 2004:17). Microeconomic theory presents a strong relationship between gains in labour productivity and wages in the short run. The assumption of economic theory, all things equal, is that wages adjust to changes in labour productivity i.e. an increase in labour productivity will result in increasing wages. Productivity changes can, therefore, be used to justify wage increases. In the South African example, however, wages increased more rapidly than productivity hence raising concerns over long term profitability for firms in the industry. At least four automotive component suppliers disinvested in South Africa and relocated to Lesotho, Botswana and Eastern Europe where they would be able to enjoy low production and energy costs and relatively lower wages leading to lower unit costs in labour intensive component products (Cokayne, 2014).

8.3. Labour unit cost and labour productivity

Unit labour cost is defined as the total labour cost per unit of output (Lawana, 2015: 36). Unit labour costs, therefore provide a clear indication of cost competitiveness and firms need to maintain low unit labour costs relative to competitors.

Figure 7: Index of labour productivity and unit labour costs in the South African automotive industry 1999-2015



Note: Values are in real terms

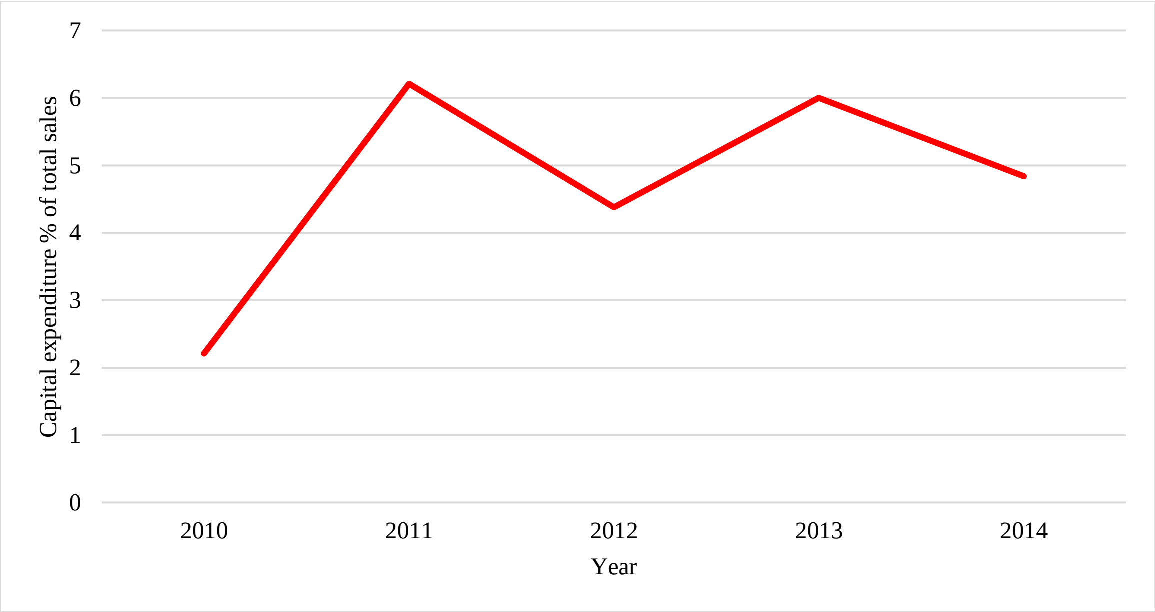
Data Source: Quantec easy data (2015)

Figure 7 shows an upward trend in unit labour cost. From 1999, unit labour cost steadily fell to from 64 index points to 58 index points in 2001. A fall in unit labour cost is viewed with optimism as it improves competitiveness. Unit labour costs remain relatively high in South Africa's automotive industry. In Figure 7, unit labour costs rise considerably potentially restraining the industry's cost competitiveness, profits and employment, if other costs are not adjusted to compensate for the increase (Meager and Speckesser, 2011: 7). In a study by BCS Africa (2014: 112), wages increased by 50% above inflation (Consumer Price Index) over an eight-year period from 1995 to 2013. A significant reduction in wage levels in the industry is needed to boost competitiveness and reduce unit labour cost, all things equal, however this alone is not sufficient, and it could negatively impact on the standard of living for workers. Meager and Speckesser (2011: 7) note that a relatively moderate increase in wages can lead to constant or decreasing unit labour cost if labour productivity increases at the same or higher rate than wages.

8.4. Capital expenditure

Capital expenditure is defined as expenditure that results in the acquisition or maintenance of fixed assets including land, buildings and equipment (Saffarizadeh, 2014:3). Capital expenditure as a percentage of sales measures how firms reinvest their profits back into productive assets over the long term.

Figure 8: Capital expenditure in the components industry 2010-2014



Data Source: B&M Analysts

Capital expenditure as a percentage of sales appears highly volatile. On average, the sampled firms spend 4.7% of their sales on capital expenditure. Only a limited number of firms could consistently report their capital expenditure and sales leading to low levels of confidence because the average is from the 21 firms. South African Automotive Benchmarking Club (SAABC) data for the automotive components industry shows that average capital expenditure in the South African industry consistently lagged behind investment levels of international competitors. Political and policy uncertainty along with weak domestic economic growth led to a fall in capital expenditure in 2012 and 2014.

8.5. Benchmarking performance in South Africa's component industry

Table 6: Benchmarking KPIs in South Africa's components industry 2002-2014

Market driver	Operational performance measures	Sample size	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Percentage (%) change in performance
Cost control	Inventory holding (days)	*n* =23	45.6	38.8	30.6	33.3	33.1	37.0	31.2	24.6	25.6	30.7	28.7	25.3	32.2	32.1	29.4%
External quality	Customer return rate (ppm)	*n*=20	1376	628	684	428	313	260	156	125	182	140	119	139	64	355	95.3%
	Supplier return rate (ppm)	*n*=20	17901	15782	14393	19129	7607	11208	4441	5308	3386	6009	4496	9206	8973	9834	49.9%
Internal quality	Reject rates (%)	*n*=20	3.0	2.3	2.2	1.7	1.6	1.7	1.8	1.5	1.7	1.6	1.3	1.0	1.1	1.7	62.9%
	Scrap rates (%)	*n*=20	1.3	1.9	1.2	2.2	1.1	1.5	1.6	1.2	1.0	2.1	1.8	1.1	1.3	1.5	3.5%
	Rework rates (%)	*n*=21	1.2	2.2	3.9	1.5	2.1	2.3	2.4	3.8	3.3	1.7	1.7	2.1	1.3	2.3	4.6%
Value Chain Reliability	OTIF delivery reliability to customers (%)	*n*=24	90.7	90.3	91.8	90.9	91.7	89.8	87.2	89.0	93.0	92.1	94.7	94.3	96.3	91.7	6.2%
	OTIF delivery reliability from suppliers (%)	*n*=20	84.8	89.0	87.9	88.6	88.4	90.7	89.4	90.3	89.4	86.5	88.5	88.5	86.7	88.4	2.1%
Operational Flexibility	Throughput time through factory (hours)	*n*=22	34.9	43.1	39.0	18.9	22.0	35.3	56.8	56.9	39.8	53.4	45.5	50.5	48.8	41.9	39.8%
Human Resource Development	Absenteeism (%)	*n*=24	3.9	3.5	3.9	3.3	4.5	3.5	3.7	3.0	3.4	3.5	3.4	3.9	4.6	3.7	17.9%
Innovation capacity	R&D	*n*=14									1.7	1.1	1.2	3.9	7.1	3.0	125.2%

Source: Compiled by author from B&M Analysts' data

Operational competitiveness is built on the concepts and philosophy of lean and WCM practices. Each operational performance indicator relates directly to a particular organisational practice helping firms achieve better management and reduce costs in non-price competitive factors (Barnes, 2000:18).

8.5.1. Cost control through reduced inventory

A key cost control measure is the reduction of inventory. Inventory holdings show the extent to which firms adhere to lean and WCM practices by combining demand pulling, single unit flow and cellular production systems (Barnes and Black, 2006:26). Lean management favours reduced inventories. Economic theory states that effective lean management ensures reduced overhead costs while meeting customer expectations of product availability as well as improvements in a firm's profitability (Table 6). As component firms moved towards adopting WCM practices, their total inventory holdings improved. Between 2002 and 2014, the average inventory holding went from 45.6 days to 32.2 days. Raw materials, work in progress (WIP) and finished goods stock holding levels all show positive improvements between 2009 and 2013. Significant improvements were evident between 2002 and 2013, raw materials and finished goods stock holding days improved by 51.1% and 39.4% in 2013[3] respectively. According to the NAACAM Automotive report (2018:6), the adoption of SCM best practices assisted in strengthening and developing relationships with suppliers, resulting in improved raw materials stock holding days. Although the components industry's inventory levels improved, firms still hold relatively high levels of inventory and opportunities to reduce raw material stock holding days must be pursued. This includes investigating opportunities to increase local content in the industry.

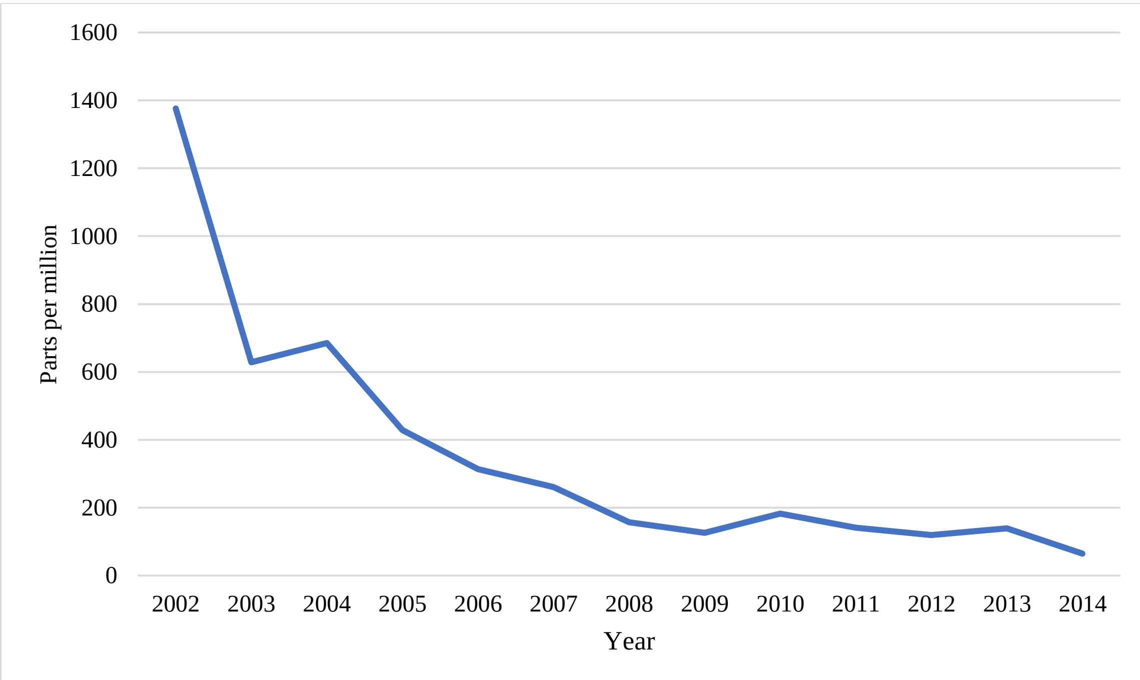
8.5.2. Customer and supplier return rates

Customer and supplier return rates measure the external quality performance of firms. Customer return rates measure the ability of firms to meet the quality requirements as desired by customers. Component firms improved customer return rates to targets of 20 to 30 parts per million (ppm) from 1000 to 2000 in the 1990s (Barnes, 2001:32). Customer return rates improved significantly over the period 2002-2012 (Figure 9). The average customer return rate of the sampled firms was 355 ppm (Table 6), this follows a big improvement of 95.3% over the period. From Table 6, customer return rates improved by over 50% in 2003, this improvement in customer return rates is also shown in Figure 9 by the steep decline from 1376 ppm to 628 ppm. The massive improvement in customer return rates could be linked to improvements in quality, functionality, JIT links and improved technical and assembly capabilities that meet customers' needs. At the same time, this could be an anomaly given that the customer return rate in the base year is very high and there is no data available before 2002. From 2004, customer return rate was on a continuous decline until 2009, where there was a very small increase from 2009 (125ppm) to 2010 (182 ppm). External quality improvements allow firms to improve competitiveness in the highly

[3] This was calculated from the data received from B&M Analysts (2014).

competitive global industry. Firms are required to attain quality performance standards by adhering to certified quality management systems ISO/TS 16949 (Barnes, 2001:81; Barnes and Morris, 2008:40). Additionally, the improvements were also due to the increase in standards of customer quality by OEMs. Supplier quality rates also improved, however the improvement was not as impressive as customer return rates. Supplier return rate improved between 2002 and 2014. In 2002, supplier return rate was 17901 ppm, an improvement of 45.1% ppm from 9834 ppm in 2014.

Figure 9: Average customer return rates in parts per million (ppm) 2002-2014



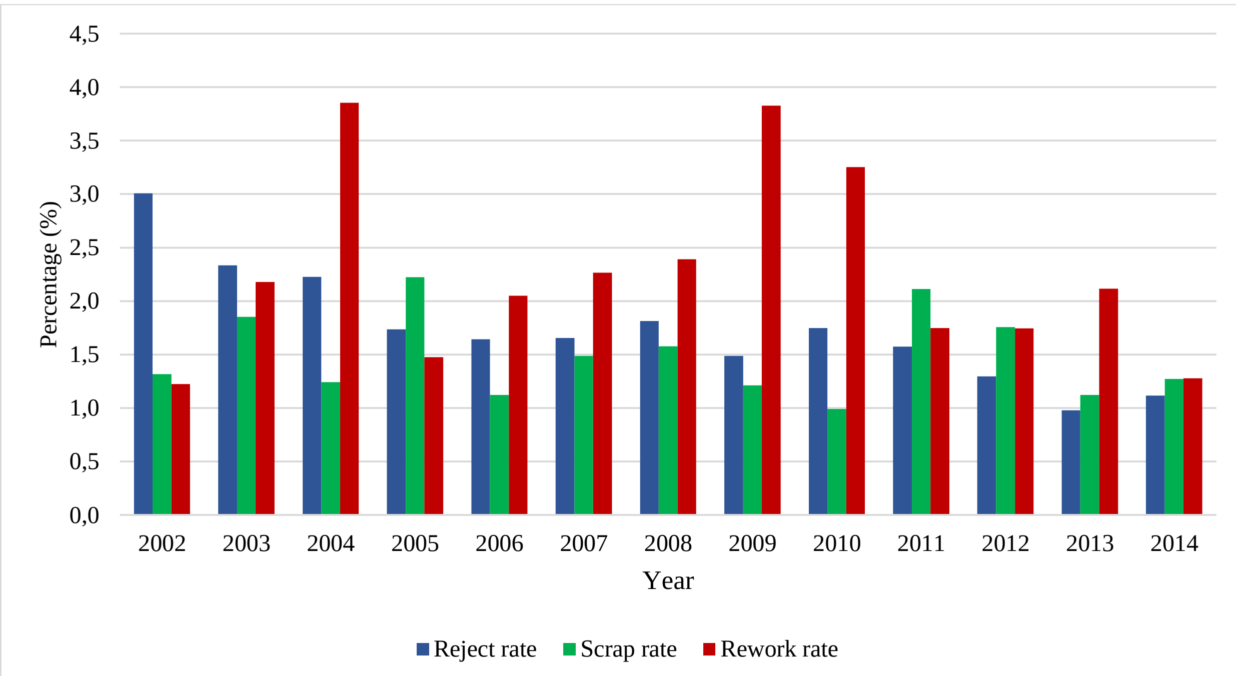
Data source: B&M Analysts

Barnes (2000:26) highlights that maintaining external quality results in high costs, therefore maintaining internal quality is of great importance as it accounts for the extent to which quality is monitored during the production process.

8.5.3. Quality

Rework and scrap rates capture scrap losses as a percentage of a firm’s material costs. Between 2002 and 2013 scrap rates remained unchanged. Table 6 shows that in 2002 the average scrap rate for component firms was 1.3%, this increased to 2.1% in 2011 but later fell to 1.1% in 2013. During the period from 2006 to 2010, rework rates and reject rates deteriorated in performance, however between 2003 and 2014, reject rates improved massively by 52.1% and rework rates by 41.2% (Figure 10). Improvements in scrap and rework rates help reduce the amount added to a defective product therefore improving internal quality performance. Defects need to be completely avoided in lean production processes therefore continuous improvements should aim to have zero defects. Volkswagen South Africa struggled with high defects in the domestic market. Flatters and Stern (2007:13) reported that a survey of South African automotive buyers revealed that buyers preferred imported vehicles and component parts as they are of superior quality to domestically produced vehicles and component parts. Volkswagen had manufactured vehicles with high local content. From the survey, Volkswagen's Citi Golf had 281 defects per 100 vehicles sold in the domestic market. Despite its quality defects, Volkswagen continued manufacturing the Citi Golf for the South African market after its phase-out in overseas markets. Reasons for the abovementioned were that the Citi Golf was established as reliable, and one of the most affordable cars in the South African market.

Figure 10: Average internal quality performance among South African component suppliers, 2002-2014



Data source: B&M Analysts

8.5.4. Reliability

Reliability in deliveries is vital in achieving WCM standards as well as in optimising the relationship between customers and suppliers in the supply chain. Along the supply chain, it becomes important for more frequent JIT deliveries to reduce overhead costs and improve internal control costs. OTIF reliability in supplier deliveries achieved positive gains over the study period with improvements from 84.8% in 2002 to 86.7% in 2014, and peaking in 2008 at 90.3%. OTIF delivery to customers also improved over the study period from 90.7% in 2002 to 96.3% in 2014. Despite improvements in OTIF reliability, the percentage of on time deliveries are still at very low levels raising competitiveness concerns for component firms. South African component firms need to push forward JIT methods and frequent deliveries to improve their supply chain flexibility. Unreliable or missed deliveries lead to a loss in the firm's credibility, disruptions, excess inventory holding days and shop floor inefficiencies.

Supplier proximity improves the relationship with potential customers. Pressures of global integration favour supplier proximity to end markets as a way to ensure flexibility and increase deliveries to end markets. Geographical distances define a thin line between the minimum cost of a new plant and a maximum delivery level to customers and suppliers (Bennett and Klug, 2012:1284). Those benefits added to a reduced distance between customer and supplier and induced better practices in the logistics of lean manufacturing. Long distances require large transportation lot sizes to minimise unit transportation costs, and given the distance that South African component products must travel to reach end markets, particularly Europe and Asia, these present as a major hurdle to achieving absolute value chain reliability.

Customer reliability in the South African components industry remained steady at above 89%, excluding 2008 where it declined to 87.2%. Post 2010, customer reliability showed improvements, reaching 96.3% in 2014, this was the highest customer reliability percentage recorded over the study period.

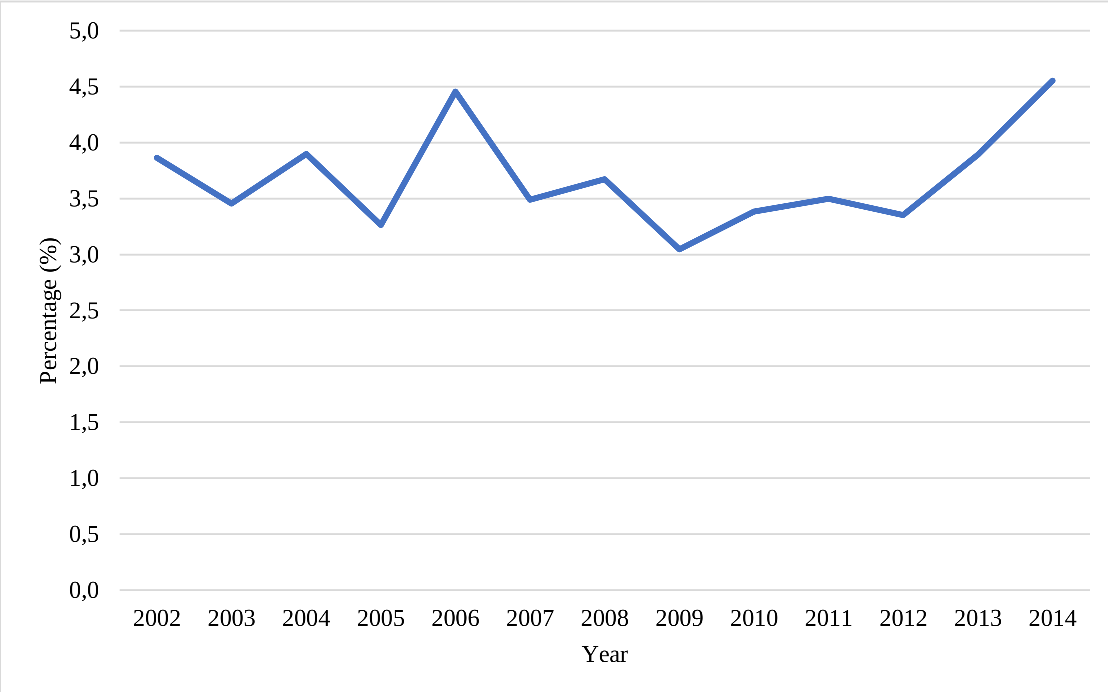
8.5.5. Throughput time for five major products

Operational flexibility aims to minimise throughput and lead time in production when looking to improve efficiency. Throughput is a measure of the time required for a material, part or sub-assembly to pass through a manufacturing process following the release of an order to the manufacturing floor i.e. from raw materials right through to the finished good (Johnson, 2003: 5). Throughput time or manufacturing cycle time consists of process time, inspection time, move time and queue time. In this paper, average throughput time is measured for five major products manufactured by a firm. Throughput in this study shows deterioration over the sampled period. In 2002, it required 34.9 hours for materials to pass through production processes, however by 2014 throughput increased to 48.8 hours. Many firms struggle in their attempt to improve throughput and failure to do this lowers firm operational flexibility, increases work-in-progress and inventory levels, lowers productivity and leads to firms taking longer to respond to customer orders. This affects firm competitiveness and profitability, especially due to increased market pressures for JIT deliveries and lead time deliveries for customer orders. Factor changes that may reduce throughput are not always understood and identifying bottlenecks may be difficult, however increased throughput may be attributable to the following: increased rework rates, unplanned and costly changes in machinery and equipment and firms' inability to adopt single-minute exchange of dies (SMED); a lean manufacturing principle leading to faster machine changeover times meaning less equipment downtime and smaller lot sizes which enable more frequent product changes and flexibility (Barnes, 2000:31; Alden *et al.*, 2006:9, Suthar and Deshpande, 2014:544).

8.5.6. Absenteeism

Lean practices recognise the role of factory workers in production and look for ways of ensuring high levels of employee satisfaction and less absenteeism, as well as providing the necessary training for workers to adequately perform their tasks, eliminate waste and achieve cost saving solutions in production and organisational processes. Levels of absenteeism do not follow a consistent trend. In Table 6, absenteeism levels improved between 2006 and 2009 by 33.3%, reaching levels below 4%. Levels below 3% are considered an acceptable rate, however in the highly competitive industry that South African firms compete in, they need to ensure that absenteeism levels are constantly monitored and kept at a minimum. South Africa's absenteeism levels are higher than developing countries and developed countries (NAACAM report, 2018:6). The high levels in 2013 (3.9%) and 2014 (4.6%) (Figure 11) could be a result of the labour strikes in the industry during the two periods. In Mashilo's findings (2010:64), given the intensification of work as a measure to increase labour productivity and production volumes, shop stewards in an automotive plant said they were overworked, subject to nonstop production lines operating at maximum speed with no breaks. Consequently, employees face health and safety hazards leading to fatigue and associated absenteeism. In a series of interviews conducted with various human resource and line managers by Mandleni (2011: 55-60), he reports that high levels of absenteeism affect South African firm productivity and its ability to meet production and quality targets. Managers stated that unauthorised absenteeism is very costly to the firm. Due to the rise in unauthorised absenteeism, firms deal with sudden changes by rearranging production lines, which leads to slower lead times, work flow disruptions and impacts on training and team work, all features key in lean production and improving competitiveness in the industry.

Figure 11: Absenteeism 2002-2014



Data Source: B&M Analysts

8.5.7. Research and Development

Research and Development contributes to the growth of firms through the innovation of design, and production technologies. Innovation capacity measures R&D calculated as a percentage of total sales. Barnes (2001:101) notes that South African based component firms benefit from the diffusion of foreign technology, regardless of ownership, thus being able to meet production specifications, standards and processes. Firms increased their innovation capacity between 2010 and 2014. Investments into MNC component subsidiaries and government support via the AIS contributed to R&D activity and rewarded investment in new components that will increase plant production volumes and sustain employment. More investment in R&D is needed in the industry to enable growth. Still, the NAACAM report (2018:7) states that many component suppliers in the automotive industry consider R&D as a low priority.

8.6. International comparative benchmarking analysis

As previously stated, the global automotive industry has become fiercely competitive as international players all strive to cut manufacturing costs. Below is an assessment of benchmarking performance comparing South Africa's competitiveness in the components industry to India and Hungary. Data used in this analysis was supplied by B&M Analysts.

Table 7: Number of days of total inventory for South Africa, Hungary and India 2010

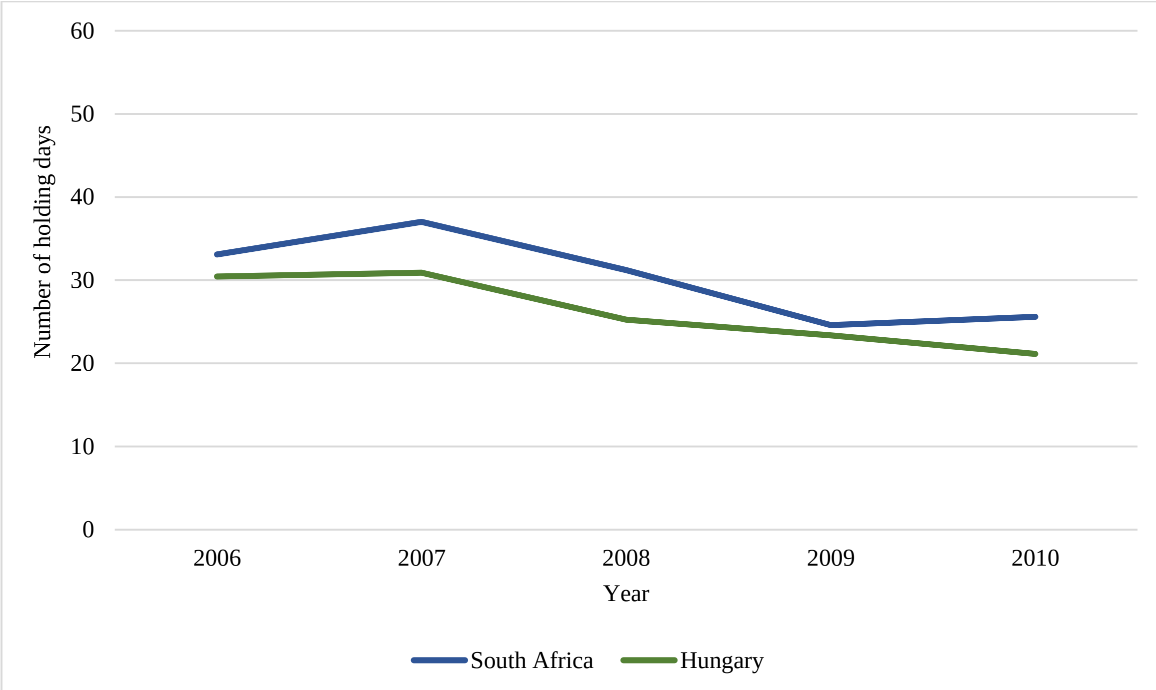
	Sample size	Raw materials	WIP	Finished goods	Total inventory (days)
South Africa	n=23	17.4	3.6	4.6	25.6
Hungary	n=5	11.0	5.3	1.9	18.2
India	n=7	7.3	0.9	3.8	11.9

Data source: B&M Analysts

South Africa, Hungry and India have all adapted to JIT ensuring that total inventory in the production system is minimised. However, when looking at total inventory, Table 7 illustrates that on average, South Africa's total inventory performance falls behind its international peers, with the largest gap observed in raw materials. South African firms on average hold 33.8% and 73.1% more inventories compared to Hungary and India, respectively (Table 7). A higher confidence level requires a large sample size, thus the smaller sample sizes in both India and Hungary result in greater uncertainty and therefore cannot account for a 'true' representation of the components industry population.

Figure 12 shows that South Africa experienced low levels of total inventory compared to Hungary, with both countries following a similar trend in moving towards reducing average holding days. In Hungary, component firms can reduce total inventory days because of close co-operation with MNC subsidiaries leading to the frequent shipment of component parts. Additionally, direct rail connections to Western Europe allows European based MNC subsidiaries to obtain component parts within a reduced time (Barlett and Seleny, 1998: 331). Suzuki's entry in India's automotive industry in the mid-1980s influenced the domestic industry to adapt to lean techniques at an earlier stage compared to Hungary and South Africa. Low inventory levels in India suggest that efficient working capital management and quality improvement efforts in first and second tier component suppliers are successful. South Africa remains disadvantaged in fully implementing lean production methods, JIT in this case, because of the country's distance to its exporters and end market customers. Also owing to distance, raw materials are often held in relatively large quantities.

Figure 12: Total inventory in South Africa and Hungary 2006-2010

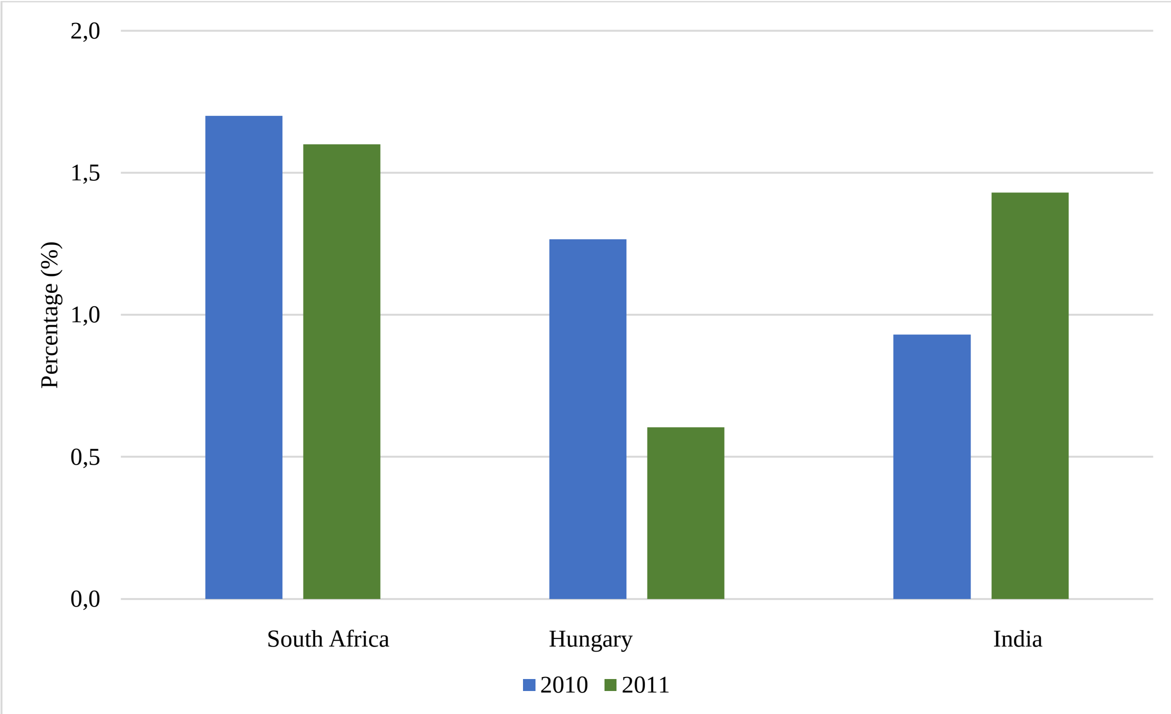


Data source: B&M Analysts

8.6.1. Quality in South Africa, Hungary and India 2010-2011

In measuring internal quality performance in this comparative study, reject rate, internal scrap rate and re-work rate are analysed. As previously highlighted, reject rates are a key indicator of the tightness of quality control during the production process. The rate is based upon a count of all units that are pulled from production during the production process, or on component parts that fail to pass the first inspection (Sutton, 2005:10).

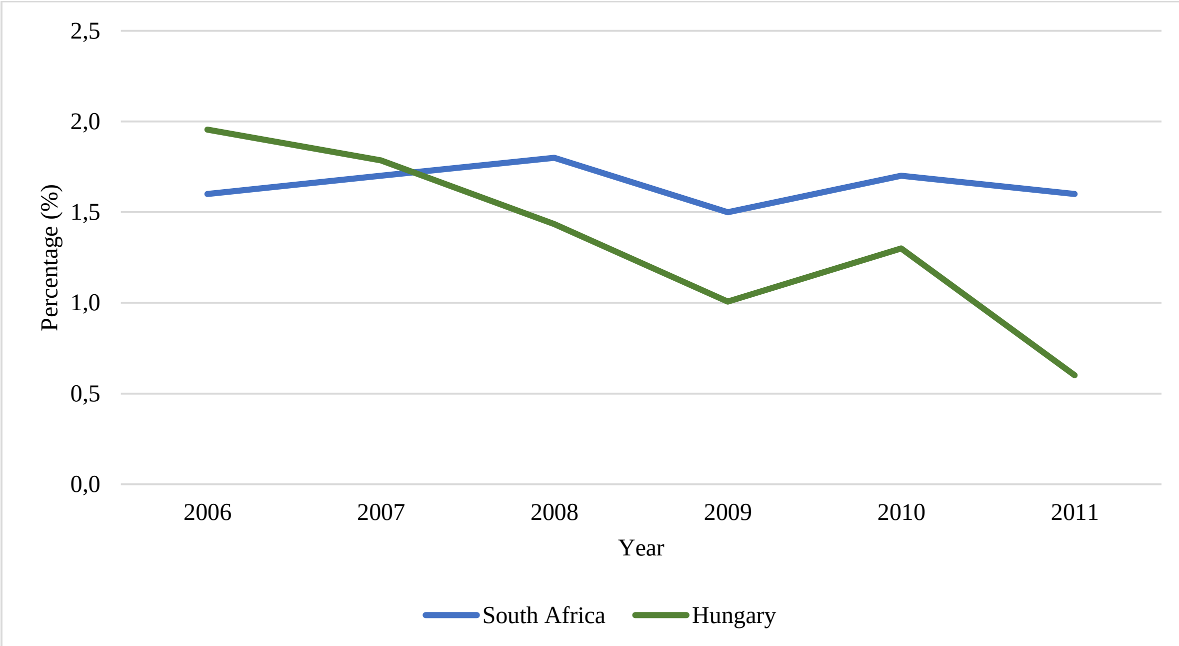
Figure 13: Reject rates 2010-2011



Data source: B&M Analysts

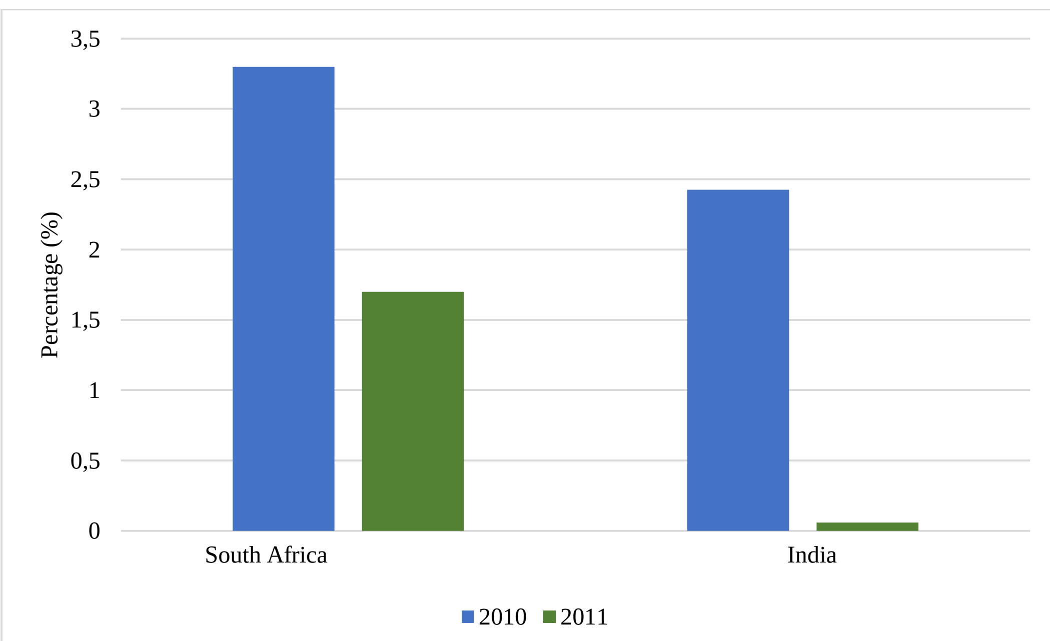
Component manufacturers perceive the reject rate as the leading indicator of quality. On average, out of a total of 7 sampled firms in Hungary, 5 firms in India and 20 firms in South Africa, South Africa performed poorly as reject rates reached above 1.5%. Both Hungary and India performed better than South Africa, with Hungary improving by 52.8% to achieve 0.6% reject rates in 2011 (Figure 13), however Indian's rates worsened and its reject rates remain high at 1.4%. Figure 14 below shows a trend line of reject rate for South Africa and Hungary from 2006 to 2011. The increasingly large gap shows that South African firms on average performed poorly relative to their competitors in Hungary. For South African firms, reject rates over the five-year period remained between 1.5% and 1.9%. From 2006 to 2009, there was a dramatic improvement in reject rates in Hungary from 1.9% to 1.1%, and although reject rates worsened in 2010, the trend shows that they will continue to improve from 2011. In moving towards leanness and WCM, it is imperative for firms to improve quality controls and reduce reject rates. High defect rates require re-working and repeated inspections, adding to labour and material costs and resulting in delays and reduced reliability. This impacts on throughput and JIT therefore undermining the firm's potential to achieve improved leanness in their production system. To spread best practices along the value chain, it becomes important for first tier suppliers to work closely with lower tier suppliers, and to de-select suppliers who have high defect rates. Given the highly competitive nature of the components industry, especially in terms of producing high quality standards, the cost of inspection and reworking is unacceptable as it impacts on firm competitiveness.

Figure 14: Reject rate in South Africa and Hungary 2006-2011



Data source: B&M Analysts

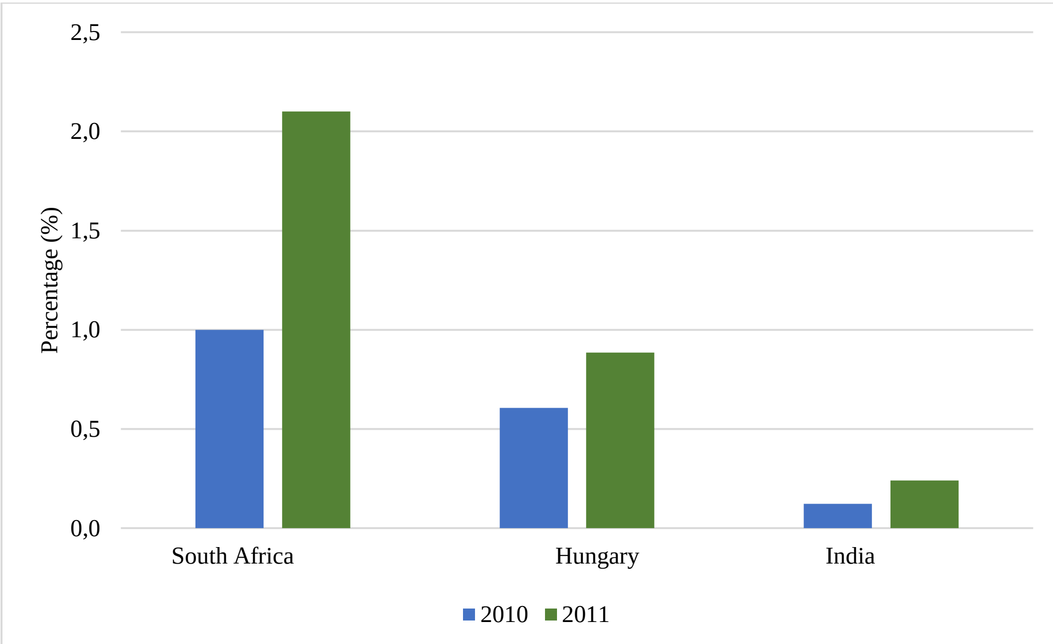
Figure 15: Re-work rate in South Africa and India 2010-2011



Data source: B&M Analysts

South African firms on average have higher re-work rates in both years than India (n=5). In 2010, India had re-work rates exceeding 2%, which is very high, however by 2011, the reject rate fell below 0.5% showing a massive improvement in the industry's re-work rates. Although South African firms also significantly improved from 3.3% to 1.7%, their re-work rates remain high.

Figure 16: Scrap rates 2010-2011



Data source: B&M Analysts

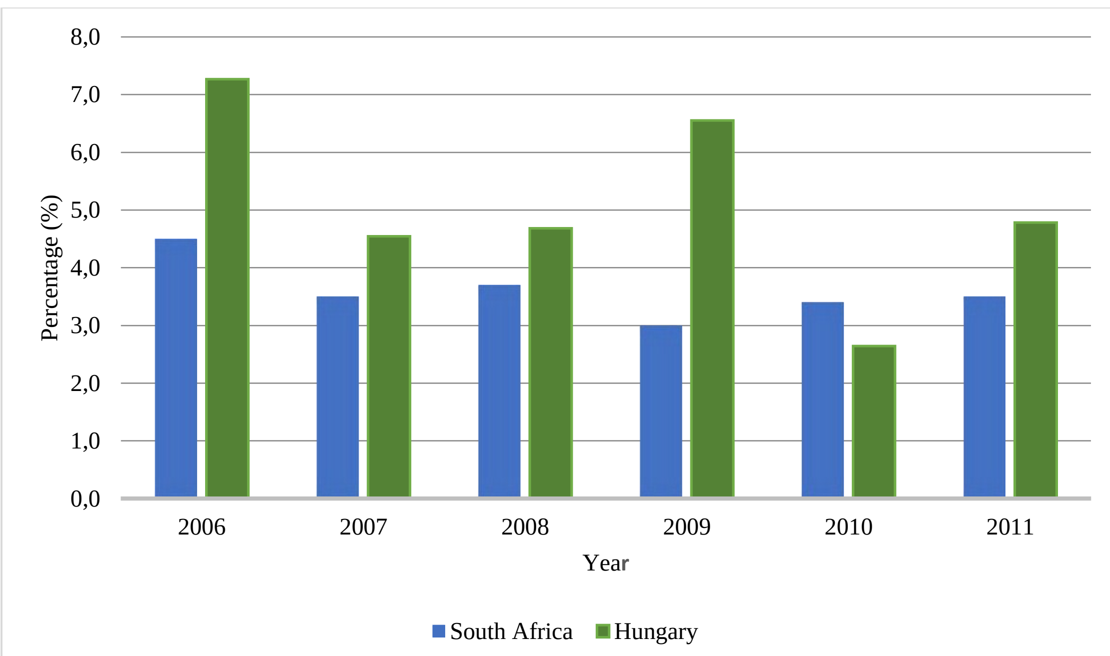
Scrap rates were lower in India (n=10) in both 2010 and 2011 compared to South Africa (n=20) and Hungary (n=13). In the two-year period, South Africa's scrap rates increased from 1.0% to 2.1% showing a significant deterioration, while Hungary performed relatively better than South Africa.

Quality is one of the key sources of increasing competitiveness. As a result, almost all the component firms in South Africa and the Indian organised industry have either QS9000-11, ISO9001/2-14 or TS 16949 quality certification (Barnes, 2000:131; Saranga, 2009:2). Quality performance of the components industry plays an important role as the savings (or costs) are passed down to the OEMs. Overall, South African component firms on average achieved lower quality standards due to high defects and re-work rates, compared Hungary and India. Although there are improvements in quality of some component firms in South Africa's industry, firms in the industry need to work harder in tightening their quality control management to improve their competitiveness in the global industry.

8.6.2. Absenteeism in South Africa and India

Absenteeism is a major problem in the automotive industry. Internationally, an absenteeism level of under 3% is considered acceptable and in line with lean practices. Mandleni (2011:1) notes that 3% matches benchmark levels achieved in excellent WCM and highly competitive firms that strive towards improving the existing benchmark and therefore seek to reduce absenteeism even further. Experience shows that low absenteeism is synonymous with better quality, lower costs and greater productivity. Hungary in 2010 achieved absenteeism levels below 3%, however by 2011 levels rose to above 4%, being the highest among the three countries (Figure 17). Figure 17 shows absenteeism levels between Hungary and South Africa from 2006 to 2011, Hungarian firms were the least competitive between the two, with firms reaching very high levels of absenteeism of above 3%. Over the period, absenteeism in the Hungarian industry reached over 7%, and would have lowered productivity. Absenteeism in South African firms remained below 4%, except for in 2006, as shown in Figure 17.

Figure 17: Absenteeism in South Africa and Hungary 2006-2011



Data source: B&M Analysts

8.6.3. Throughput for five major products in South Africa and India

Table 8: Throughput for five major products (hours) 2010-2011

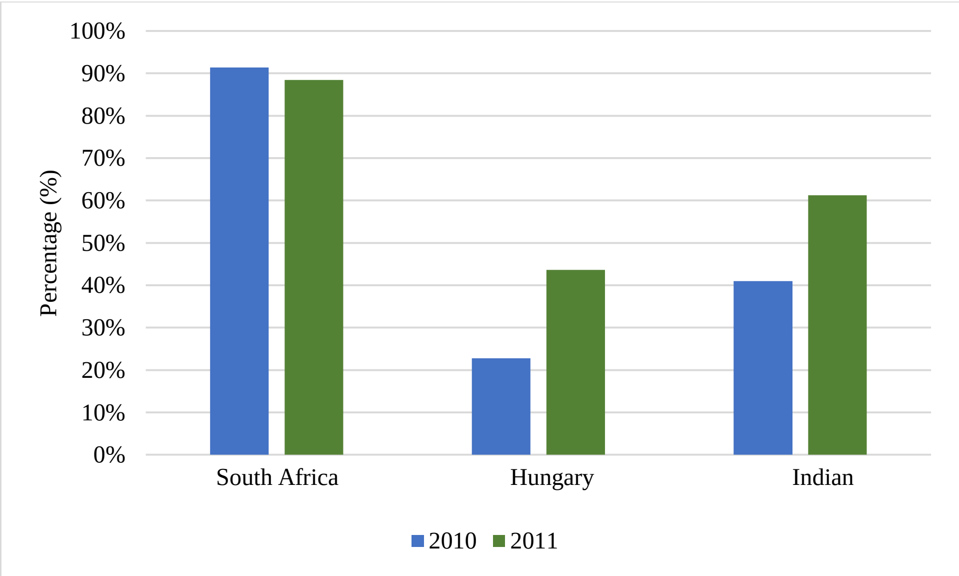
	Sample size	2010	2011
South Africa	n=22	39.8	53.4
India	n=8	20.5	6.6

Data source: B&M Analysts

Another measure of plant efficiency is throughput. Throughput for five major products in the Indian components industry was 20.5 hours in 2010, compared to 39.8 hours in the South African industry in the same year. In 2011, throughput times in India dramatically declined by 67.8**%** to 6.6%. Based on India's successful implementation of lean techniques i.e. SMED, Indian was successful in reducing throughput and enabling Indian component firms to achieve improved flexibility, lower manufacturing costs and standardised changeover processes. No data was available for Hungarian firms.

8.6.4. Delivery reliability in South Africa, India and Hungary 2010-2011

Figure 18: Delivery reliability from suppliers in South Africa, India and Hungary 2010-2011

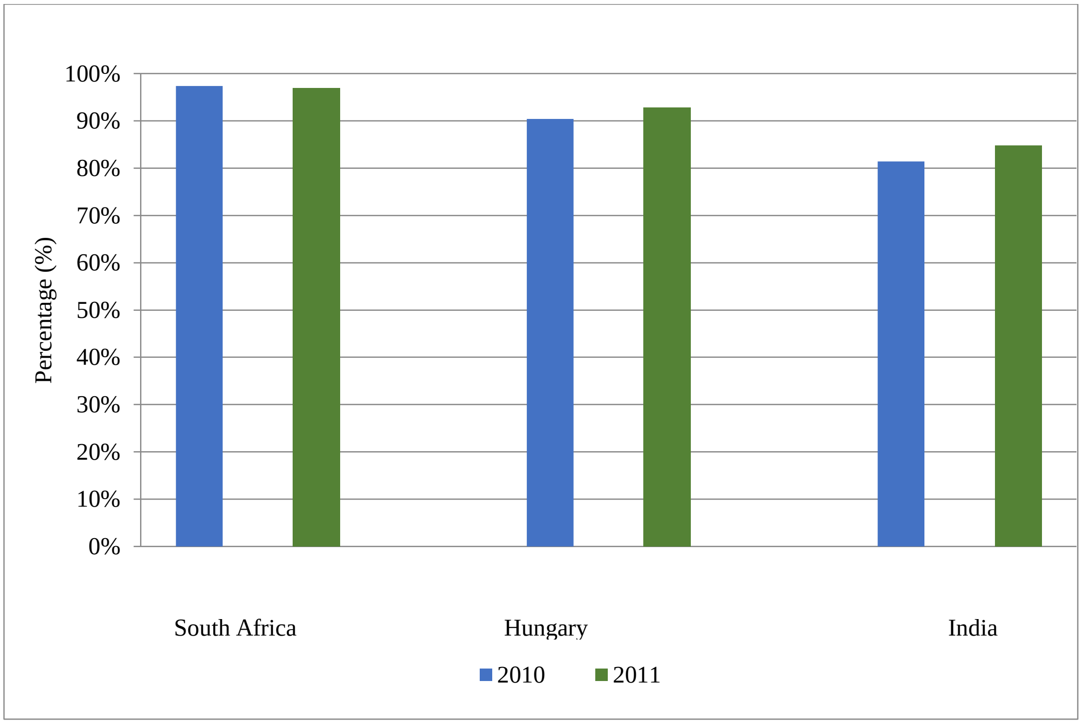


Data source: B&M Analysts

The average delivery reliability from suppliers in South African firms was higher than in Indian and Hungarian firms. South African firms achieved delivery reliability levels above 80% in 2010 and 2011.

Delivery reliability from suppliers in India (n=5) and Hungary (n=8) is extremely low, but because of the small sample size, these results are only indicative. Both countries however show an improvement in delivery reliability from suppliers from the previous year with Hungary showing improvements from 22.7% to 43.6%, and Indian firms improving from 41.0% to 61.3%. According to a study by Bhattacharya *et al.*, (2014:54), Indian automotive firms established the Vendor Managed Inventory (VMI) model with its component suppliers. This has resulted in considerable reduction in inventory levels and enabled greater flexibility and reliability in deliveries. Although many component suppliers in the Indian industry meet global industry standards, there is a need to develop lower tier suppliers to ensure global competitiveness. Most Indian component suppliers operate on an 'operational excellence' agenda, and only a few managed to focus on international growth. Those who did grow outside India have performed much better than the rest thus indicating that growth outside India is clearly an imperative for most suppliers. The qualitative findings from the Bhattacharya (2014:54) study contradict the data, and one reason for this could be the very low sample size used in this study.

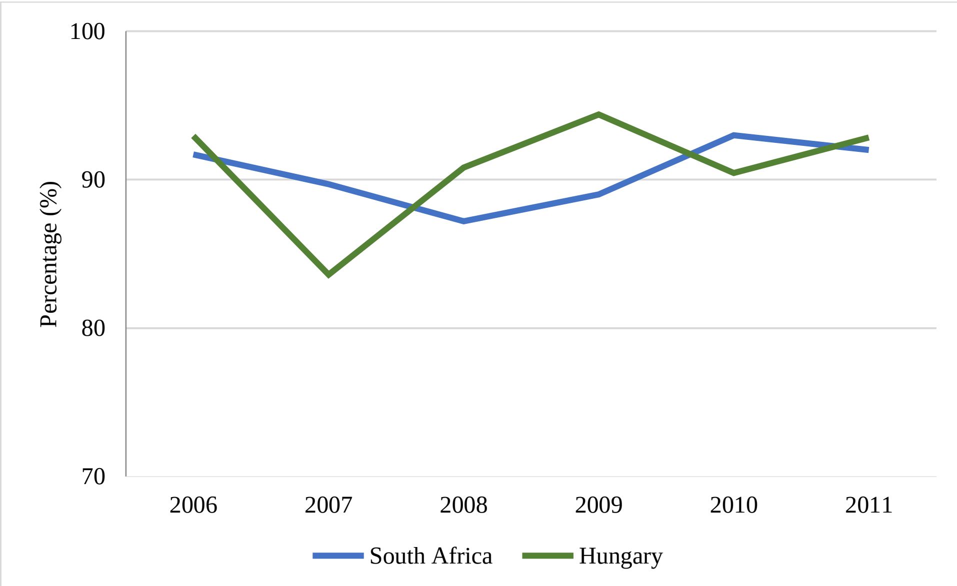
Figure 19: Delivery reliability to customers 2010-2011



Data source: B&M Analysts

For delivery reliability to customers, South African firms performed better than India and Hungary in 2010-2011 Indian firms performed below 90% in both 2010 and 2011, the worst performance in the two-year period. That said however, average delivery reliability to customers in both India and Hungary improved. Component firms should aim to increase their delivery reliability to customers to above 90% as this signifies that firms better understand their customers, but most importantly, that they are able to meet their customers' expectations and delivery needs. The improvements in delivery reliability to customers in Indian and Hungary could be a result of improved pricing, design, safety and being able to meet evolving customer needs.

Figure 20: Delivery reliability to customers in South Africa and Hungary 2006-2011



Data source: B&M Analysts

From Figure 20, delivery reliability to customers for South African firms was on a decline from 2006, dipping in 2008 following the financial crisis due to the negative disruptions in the automotive value chain. In 2018 however, there was a peak in customer reliability for South African firms at 93.0%. The trend from 2011 shows a declining trend in delivery reliability to customers. Hungarian firms performed better than South African firms between 2008 and 2009. Although delivery reliability to customers in Hungary remained above 90% over the study period, in 2007 delivery reliability to customers dropped to 83.6%, its lowest level over the period.

Table 9: Summary benchmarking performance 2006-2011

8.6.5. A snapshot summary of benchmarking performance in South Africa and Hungary

Performance indicator	South Africa	Hungary
Total inventory	Improved	Improved
Reject rate	Improved	Improved
Delivery reliability to customers	Worsened	Improved
Absenteeism[4]	Improved	Worsened

Key	Most competitive	Least competitive

A snapshot of benchmarking between 2006-2011 in Table 9 shows that South African component firms improved their total inventory, reject rates and absenteeism, however Hungarian firms were still more competitive in reject rates, total inventory and delivery reliability to customers than South African firms. South African firms were the most competitive in absenteeism. Hungarian firms improved performance in 3 out of 4 benchmarking indicators. The snapshot reveals that South African firms are closing the competitive gap between domestic firms and their international peers, however more improvements are needed. These are only summaries and they do not reflect the true picture of component industries in South Africa and Hungary due to the limited sample size for both countries.

[4] Absenteeism for South African firms improved from 2006 to 2011, although the improvement was not significant, South African firms achieved lower absenteeism levels compared to Hungary.

SECTION 9: CONCLUSION

The purpose of the paper was to explore the extent to which policy and lean production techniques have impacted on the South African automotive industry, particularly the components industry. The restructuring of the automotive industry, along with trade liberalisation and integration into global value chains forced the uncompetitive and highly inefficient local industry to re-think its objectives and to better position itself within a global context. The results from the study, particularly improvements in inventory, external and internal quality show that most sampled firms in the components industry implemented lean and WCM production techniques to a certain degree, resulting in significant improvements in the industry's operational performance over the study period. Therefore, it is clear that South African component firms are making progress, and that world class performance is attainable within the local context. The overall improved performance is reflected in the commitment of component firms to adopting lean practices. The challenge for the local industry is to decide on the appropriate use of benchmarking processes in order to determine constraints in the attainment of world class performance and the factors and practices that lead to world class performance being achieved.

It is important to compare developments in South Africa's automotive industry against its international peers who have been exposed to similar policies and global pressures. A comparative benchmarking study comparing South African, Indian and Hungarian component firms showed that although South African firms improved their performance and thus managed to narrow the competitive gap with their peers, they were the least competitive out of the group. South Africa's geographic isolation in relation to suppliers and markets in Europe and America remains a challenge, as it is difficult to improve flexibility and implement effective JIT in meeting customers' deliveries. Although South Africa's automotive industry remains the least competitive and produces a small number of vehicles especially in comparison to India, there is no doubt about the importance of the industry for the South African economy. The industry therefore remains under pressure to meet the challenge of becoming competitive within the global industry.

Inadequate management and the rigidity of the South African labour market limit firms' ability to effectively compete in the global automotive industry. It is therefore important for government to implement policies that will increase labour productivity, and at the same time create jobs and promote investment in human capital and learning, along with training incentives. Failure to do so will weaken the quality of the labour force, lower labour productivity and restrain competitiveness. Simultaneously, firms need to look into ways of better understanding and implementing lean processes, and make sure workers are adequately involved in these processes through training and skills development programmes. Furthermore, component firms need to ensure that the necessary support and capabilities for increasing productivity exists such as (i) investing in capital equipment (ii) investing in training and skills development, and (iii) creating an enabling environment to increase competitiveness in export markets.

Despite the slowdown in South Africa's economic growth rate impacting on the demand for motor vehicles, demand in the rest of Africa is on the rise, therefore with strong regional and global linkages, there is potential for South Africa's industry to further its growth and increase production volumes and exports to Africa.

MIDP instruments such as the IEC, PAA and duty free allowance successfully managed to achieve the policy's objectives of improving global competitiveness, increasing production and exports, attracting FDI and job creation. However, these instruments largely favoured OEMs, consequently limiting the growth and performance of the components industry, which is crucial for developing a firm and stable domestic automotive industry.

Under both the MIDP and APDP, component suppliers were offered less protection and there was a rejection of a minimum local content programme, which further disadvantaged the components industry. OEMs and component suppliers should both gain from policies, but policy should be managed and analysed in the broader national interest of the country's consumers, direct workers and workers in upstream industries. In this respect, conditions should be set for OEMs by the government to follow in making sure that their South African based subsidiaries are successfully integrated into global networks.

Increasing exports and improving production and competitiveness is important to the industry as this not only reduces the heavy dependence on imports, but could potentially lead to firms expanding their scale of production thereby reducing their average costs of production. Local content is important for job creation and skills development across downstream industries linked to the automotive industry. It is vital that government looks into implementing policies that would encourage the local sourcing of raw materials and therefore create competitive downstream industries. It is therefore important for the government to put policies in place to achieve these objectives. A more balanced growth path involves a gradual move to rates of protection and assistance for production, which are set at low to moderate levels. A combination of policy instruments should not attempt to achieve too many policy objectives simultaneously. Policy needs to ensure sustainability of rising exports, increasing production volumes and relatively affordable vehicle pricing, but it also needs to account for the failures of the MIDP and APDP and adopt policies that would lead to their correction.

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