SOUTH AFRICAN AUTOMOTIVE INDUSTRY: GLOBALISATION, RE-STRUCTURING AND WORLD-CLASS MANUFACTURE.

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A research report submitted in partial fulfilment of the requirement for the degree of Magister of Commerce (Management), University of the Western Cape.

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APPENDIX I

SOUTH AFRICAN AUTOMOTIVE INDUSTRY: GLOBALISATION, RESTRUCTURING AND WORLD CLASS MANUFACTURE

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KEYWORDS

World -class manufacture

Lean thinking

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Just-in-time

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Globalisation

Production overcapacity

Tariff reductions

Competitiveness

Global value chains

Zero defect

ABSTRACT

SOUTH AFRICAN AUTOMOTIVE INDUSTRY: GLOBALISATION, RESTRUCTURING AND WORLD CLASS MANUFACTURE

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Political and economic sanctions between 1970 and 1994 isolated the inward-oriented economy of South Africa from global trends. A variety of factors, such as a challenging new global competitive environment, production overcapacity, falling protectionist tariff barriers in a period of liberalisation, world-class manufacture and globalisation, are contributing to the reform of the economy and the automotive industry. The South African automotive industry therefore faces a major reform in trade policy.

The South African government introduced the Motor Industry Development Plan (MIDP) in 1995, to create the necessary levels of competitiveness, promote world-class manufacture practices, increase levels of investments and exports that would consequently lead to the successful reconstruction and development of this sector of the South African economy.

Subsequent research has shown that the successful adoption of world-class manufacture (or lean production) processes in the South African automotive industry is necessary not only for survival, but also for increased competitiveness of the industry and the improved economic performance of automotive firms.

However, complicated links exist between the adoption of world-class manufacture for improved levels of operational competitiveness for firm-level success, on the one hand, and long-term sustainability of the industry, on the other hand. Combined firm-level economic success and long-term sustainability of the industry depend on factors such as international trends, connectivity to global value chains, modern technological capabilities, lean production and enterprise systems, substantial investments, increased exports, world-wide quality standards, as well as customer satisfaction, human resource development, advanced education, skills development, worker participation, government policy and institutional support.

This is borne out by a recent study of the auto component sector, utilising a lean production 'market driver' toolkit. The study found that although component manufacturers significantly improved their operational competitiveness, they have not necessarily experienced improved economic performance levels. More important is connectedness and integration into global value chains, via intermediaries, mergers and acquisitions. The changing political economy of automotive value chains is also important in shaping firm-level operational success and industry sustainability.

In this research paper, we review global automotive industry trends which influenced the introduction of the government's visionary MIDP. We then discuss their impact on the performance of the South African assembly and component sectors at industry and firm level. This leads to a series of recommendations for improved performance to world-class manufacture, world-wide quality standards and global competitiveness.

August, 2002

APPENDIX III

DECLARATION

I declare that South African Automotive Industry: Globalisation, Restructuring and World-class Manufacture is my own work, that it has not been submitted before for any degree or examination in any other university and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

FRANK A. VAN DER HORST **AUGUST 2002**

SIGNED .....Frank A. van der Horst.....

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SOUTH AFRICAN AUTOMOTIVE INDUSTRY: GLOBALISATION, RESTRUCTURING AND WORLD CLASS MANUFACTURE

SECTION ONE : INTRODUCTION

1.1 BACKGROUND

The political and economic isolation during the apartheid era, between 1970 and 1994, retarded the development of the South African automotive industry and its competitiveness in the global automotive industry. The new democratic government introduced radical economic reforms and a new trade policy to re-integrate the automotive industry into the global environment. Factors such as the challenging global competitive environment, production overcapacity, reduced tariff barriers in a period of liberalisation, world class manufacture and globalisation, contribute to the reform of the economy in general, and the South African automotive sector, in particular.

In this chapter the concepts of globalisation, with its multiplicity of economic and trade linkages and interconnections, triadization, and global commodity value-added chains, are briefly examined as a context to the introduction of structural and economic trade changes in the South African automotive industry.

1.2 GLOBALISATION

The rapid spread of globalisation simultaneously spurred the growth, and facilitated the global diffusion, of world-class manufacturing strategies and methods. The dynamics of globalisation are characterised by Ricardo Petrella (1996) as the

1. globalisation of financial markets
2. internationalisation of corporate strategies, especially the commitment to competition as a source of wealth creation
3. diffusion of technology, related research and development (R&D), and knowledge world-wide
4. transformation of consumption patterns and the development of world-wide consumer markets
5. internalisation of the regulatory capabilities of national societies into a global political economic system and the
6. diminished role of national governments in designing the rules for global and national governance.

A feature of globalisation is the giant transnational corporations (TNCs) or multi-national corporations (MNCs) which account for nearly 90% of the world automobile production and trade, and are concentrated in three main regions: North America, Western Europe and Japan. This has been described as Triadization (Gereffi, 1994; Petrella, 1996).

1.3 TRIADIZATION

The privatisation of the function of organising and governing the world economy is increasingly based on "triadization" - a process of technological, economic, and socio-cultural integration amongst the three most developed regions of the world, viz. North America, Western Europe, as well as Japan and the NICs from South East Asia. Exchanges between these three richest and fastest- growing regions have intensified, but the exchanges with the rest of the developing world, including Africa, have decreased (Gereffi, 1994; Petrella, 1996). A complex network of integration between the three regions and the rest of the world is achieved through a multiplicity of linkages and inter-connections, largely to the exclusion of the developing world, including South Africa.

1.4 MULTIPLICITY OF LINKAGES AND INTER-CONNECTIONS

The global movement of capital has become the nerve centre for the globalisation of the international economy. Globalisation creates a multiplicity of linkages and interconnections between firms, states and societies that operate worldwide. Monetary and financial flows linked to trade of goods and services, foreign direct investment (including transfers of physical, human and technological capital), as well as portfolio investments and other types of financial transactions, increase inter-connectedness. World-class manufacture and globalisation in investment, trade and industrial competition have therefore become inextricably intertwined (McMillan, 1990; Norman and Raminez, 1993; Petrella, 1996). These linkages and inter-connections facilitate the growth of global commodity chains and value-added supplier networks for global competitive advantage.

1.5 VALUE-ADDED GLOBAL COMMODITY CHAINS

Global Commodity Chains (GCC) are rooted in transnational production systems, giving rise to co-ordinated international trade that can be divided into producer-driven chains or buyer-driven commodity chains (Gereffi, 1994). The automotive sector is one of the leading examples of a buyer-driven GCC where trans-national manufacturers play a central role in co-ordinating production networks including their backward and forward linkages. These GCCs are created through inter-firm strategic alliances, mergers or take-overs established to

1. reduce the costs for Research & Development
2. ensure access to complementary technology
3. capture a partner's tacit knowledge and technology
4. shorten the product life cycle
5. share costs in product development
6. gain greater access to foreign markets
7. obtain access to highly qualified people
8. broaden access to financial resources

Value-added chains (or GCC) are extremely important to achieve global competitive advantage but they require good, continuing and improving relationships. One producer's value-added chain is pitted against that of a competitor's. Partners in the value chain are required to help one another constantly, to upgrade quality, innovate ideas, create value and lower costs. To optimise performance, the partners must provide incentives, flexibility, technology, timely delivery, minimum inventory, information sharing and avoid creating weak links. Value-added chains and world-

class manufacture are completely inter-linked and inter-dependent organisational issues (Kogut, 1985; McMillan, 1990; Johnson and Lawrence, 1991; Gereffi, 1994).

1.6 METHODOLOGY

A literature review approach of recent publications was chosen to examine the impact of environmental factors on the transfer of world-class manufacture on the automotive assembly and components industry of South Africa and other developing economies. The available literature within the scope of the research project proved to be vast, highly complex, multi-factored and over-arching because many variables are globally and locally inter-linked, inter-active and constantly changing.

As the author is based in the Western Cape and had limited resources and restricted time available, he was unable to travel nationally or overseas to conduct in-depth interviews with key industry players and rigorously verify information or data from secondary sources. A literature review thus proved to be the most cost-effective and feasible means to cover this topic given the limitations of a research project at master's level. This literature review should also be seen in context as it represents the first phase of a larger project on export competitiveness in the automobile sector funded by the National Research Foundation. This literature review provides a contextual overview for other empirical dissertations on world class manufacturing and supply chain management.

Despite these limitations, the literature review creates awareness, generates and refines research ideas by giving an informative insight to the state of knowledge, and helps to understand theories and identifies current trends. A review of quantitative and qualitative secondary data is useful for both descriptive and explanatory research. Following Saunders, Lewis and Thornhill (1997), previously published research work

was examined for strengths and weaknesses, issues of coverage, validity, reliability and measurement bias.

The scope of the literature review covers a wide range of recent publications, mainly 1996 to 2002 although some are dated earlier, on world-class automotive manufacturing and trends transforming the auto industry in major developed and developing industrialised countries, particularly South Africa. Information and data was gained from secondary sources like case studies, books, academic and trade journals, business reports, newspaper articles and web-sites.

The literature review is divided into five sections as follows:

1 Section Two outlines the growth and development of world-class manufacture (also known as lean production) based on Japanese manufacturing philosophies, modern production systems and highlight its potential for firms in developing economies.

2 Section Three examines trends in the international automotive industry and their impact on the industry in South Africa as a developing country.

3 Section Four assesses the crisis that faced the South African automotive industry, the government's inclusive policy response in the form of the Motor Industry Development Plan (MIDP) and the recent performance of the assembly and component sectors at industry level.

4 Section Five analyses the impact of world-class manufacture, government

policy and tiered global supply chains on the growth and development of the South African automobile assembly and components sectors at firm level.

5 Section Six identifies recommendations for local firm and industry level success.

The above structure has some limitations as overlapping and inter-related issues caused some repetition between the different sections. This arose because core factors in lean production and associated techniques are highly inter-connected, inter-active and include many variables which are difficult to measure precisely, given the diversity of application in different countries.

More detailed, continuous, comparative research, analysis and rigorous debate are required to fully explore this topic. This can best be achieved by an on-going, integrated, multi-variate longitudinal study of the South African automotive industry (and firms) and comparisons with those of leading advanced and developing countries. This method could probably identify, measure and evaluate key indicators, other inter-connected aspects and the degree of effective transfer of core methods of world-class manufacture (or lean production). This large-scale study could holistically determine the relative progress in the implementation of world-class manufacture in South Africa and the economic sustainability of the automotive industry and its constituent firms in the face of global competition.

SECTION TWO : DEVELOPMENT OF WORLD-CLASS MANUFACTURE

2.1 INTRODUCTION

World-class manufacture (lean production) emerged as a superior model of industrial organisation and developed in the period of globalisation of trade and production, with its interconnected corporate strategies and linkages. This chapter examines the Japanese origins of world-class manufacture (WCM), as a paradigm shift from Fordist mass production. It describes the major conceptual features of world-class manufacture, such as the just-in-time system, new supply chain relations, the emphasis on total quality management, zero defect and world-class operational strategies which made it a superior method of production.

2.2 EMERGENCE OF WORLD-CLASS MANUFACTURE

Since the 1970's, revolutionary changes have transformed the way that automobiles are developed and manufactured to meet new competitive challenges. These changes, led by Japanese producers, dramatically reshaped the industry into a competitively superior model of industrial organisation. This more intelligent form of industrial organisation, termed "lean production" (Womack, Jones and Roos, 1990 p6, 13, 277) is best illustrated by the seminal Toyota Production System which proved to be a paradigm shift that rapidly displaced the more traditional, standardised, mass production techniques, widely labelled as Fordism.

The advantages of 'Toyotism' have redefined the conditions of global competition (Deyo, 1996 p3). Lean production, in the view of Womack et al (1990 p6), "combines the best features of both craft production and mass production – the ability to reduce costs per unit and dramatically improve quality - while at the same time providing an even wider range of products and even more challenging work. Toward this end, lean producers employ teams of multi-skilled workers at all levels of the organisation and use highly flexible, increasingly automated machines to produce volumes of products in enormous variety". They argue that 'lean production' based on innovations such as just-in-time supply networks and shop-floor production teams, has proven its superiority and will replace mass production and 'change the world'.

This new model has been variously termed 'flexible specialisation' (Sabel, 1986), 'systemofacture' (Hoffman and Kaplinsky, 1988), 'innovation-mediated production' (Kennedy and Florida, 1993) and 'post Fordism' (Lipietz, 1987), [all cited by Deyo, 1996]. Schonberger (1996 p24-25) developed the idea of lean production by introducing 16 principles of world class manufacture that are customer-focussed, employee-driven, and uses data-based performance. Although the terms lean production and world-class manufacture are used interchangeably in this paper, some negative and less desirable connotations are associated with 'lean production', hence the term world-class manufacture is preferred. Lean production is best illustrated by Japanese automotive assemblers, particularly the Toyota Production System (TPS).

2.3 THE JAPANESE CHALLENGE

Womack Jones and Roos (1990) in their seminal study - 'The Machine That Changed the World' - used detailed statistically-based documents and firm-level efficiency

measures compiled from a global comparative study, to effectively demonstrate that Japanese automotive assemblers had a multi-fold comparative advantage over their Western counterparts.

Table 1: Major characteristics of craft production, Fordist mass production and Japanese flexible (lean) production

Characteristics	Craft production	Fordist mass production	Japanese flexible production
Technology	Simple, but flexible tools and equipment using unstandardised components	Complex, but rigid single – purpose machinery using standardised components. Heavy time and cost penalties involved in switching to new products	Highly flexible methods of production using modular component systems. Relatively easy to switch to new products
Labour force	Highly skilled workers in most aspects of production	Very narrowly skilled professional workers design products but production itself performed by un-skilled / semi-skilled 'interchangeable' workers. Each perform a very simple task repetitively and in a predefined time and sequence	Multi-skilled, polyvalent workers operate in teams. Responsibilities include several manufacturing operations plus responsibility for simple maintenance and repair
Supplier Relationships	Very close contact between customer and supplier. Most suppliers located within a single city	Distant relationships with suppliers, both functionally and geographically. Large inventories held at assembly plant 'just-in-case' of disruption of supply	Very close relationships with a functionally tiered system of suppliers. Use of 'just-in-time' delivery systems encourages geographical proximity between customers and suppliers
Production Volume	Relatively low	Extremely high	Extremely high
Product variety	Extremely wide – each product customised to specific requirements	A narrow range of standardised designs with only minor product modifications	Increasingly wide range of differentiated products

Source: Based on material in Womack, Jones and Roos (1990)
From: Dicken, 1996.

By the late 1980s, Japanese companies produced twice as many car models as did American or European companies; replaced models every four years (compared to nine years for the Big-Three American producers); were able to achieve normal quality standards after the introduction of a new model in less than two months

(compared to 11-12 months for US and European producers); and maintained a significant lead in avoidance of defects (Womack, et al, 1990).

Japanese vehicle manufacturers increased their output from 300 000 units in 1960 to 11 million units in 1982 and captured 25% of the North American passenger vehicle market by 1991, an increase of 39% on 1982 levels (Sturgeon & Florida, 1999 p36-7). These achievements were facilitated by the lean production philosophy that was developed by Toyota Motor Company to lower costs. A comparison between the major characteristics of lean production, craft production and the mass production model are listed in Table 1.

2.4 CHARACTERISTICS OF WORLD-CLASS MANUFACTURE

Initially Womack, et al (1990 p13) saw the entire process of "lean production" as being lean because it used less of everything compared with mass production (the human effort in the factory, the manufacturing space, the investment in tools, the engineering hours to develop a new product, the time and the needed inventory), resulting in many fewer defects, and producing a greater and ever-growing variety of products.

Lean Thinking

Lean thinking, an essential aspect of world class manufacture, involves eliminating waste (muda): specifically any human activity that absorbs resources but creates no value. Lean thinking can be summarized in five principles - precisely specify value by specific product, identify the value stream for each product, make value flow without interruptions, let the customer pull value from the producer, and pursue perfection. Managers can make full use of lean techniques and maintain a steady

course by clearly understanding these principles, and then tying them all together (Womack et al, 1996 p 10).

Specify Value by Specific Product

The critical starting point for lean thinking for an organisation is to accurately specify value. Value can only be defined by the ultimate customer and is only meaningful when expressed in terms of a specific product (a good, or a service, and often both at once) which meets the customer's needs at a specific price, at a specific time (Womack et al, 1996 p 16).

Identify the Entire Value Stream

The value stream is the set of all the specific actions required to bring a specific product through the three critical management tasks of any business: the problem-solving task running from concept through detailed design and engineering to production launch; the information management task running from order-taking through detailed scheduling to delivery; and the physical transformation task proceeding from raw materials to a finished product in the hand of the customer. Identifying the entire value stream for each product (or in some cases for each product family) is the next step in lean thinking, a step which firms have rarely attempted but which almost always exposes enormous, indeed staggering, amounts of muda (Womack et al, 1996 p 19).

Value Flow without Interruptions

The remaining value-creating steps must be made to flow continuously, which requires a complete rearrangement of one's mental furniture. The lean alternative is to redefine the work of functions, departments and firms so they can make a positive

contribution to value creation, and to speak to the real needs of employees at every point along the stream. So it is actually in their interest to make value flow (Womack et al, p 21).

Customer Pull Value from the Producer

The first visible effort of converting from departments and batches to product teams and flow is that the time, required to go from concept to launch, sale to delivery, and raw material to the customer, falls dramatically. In fact, it is the ability to design, schedule and make exactly what the customer wants, just when a customer wants it, that permits you to throw away the sales forecast and simply make what customers actually tell you they need. That is, you can let a customer pull the product from the operation as needed rather than pushing products, often unwanted, onto the customer (Womack et al, 1996 p 24).

Pursue Perfection

There is no end to the process of reducing effort, time, space, cost and mistakes while offering a product that is ever more nearly what the customer actually wants. Pursuing perfection, the fifth and final principle of lean thinking, therefore occurs as a result of the four initial principles interacting with each other. Getting value to flow faster always exposes hidden muda in the value stream. And the harder you pull, the more the impediments to flow are revealed so they can be removed. Dedicated product teams, in direct dialogue with customers, always find ways to specify value more accurately and often learn of ways to enhance flow and pull as well (Womack, et al, 1996 p 25).

Lean Enterprise

The lean production concept was extended by Womack and Jones (1996 p 276), by going beyond the firm to create a new mechanism to look at the whole, a channel for the value stream. They called this the lean enterprise.

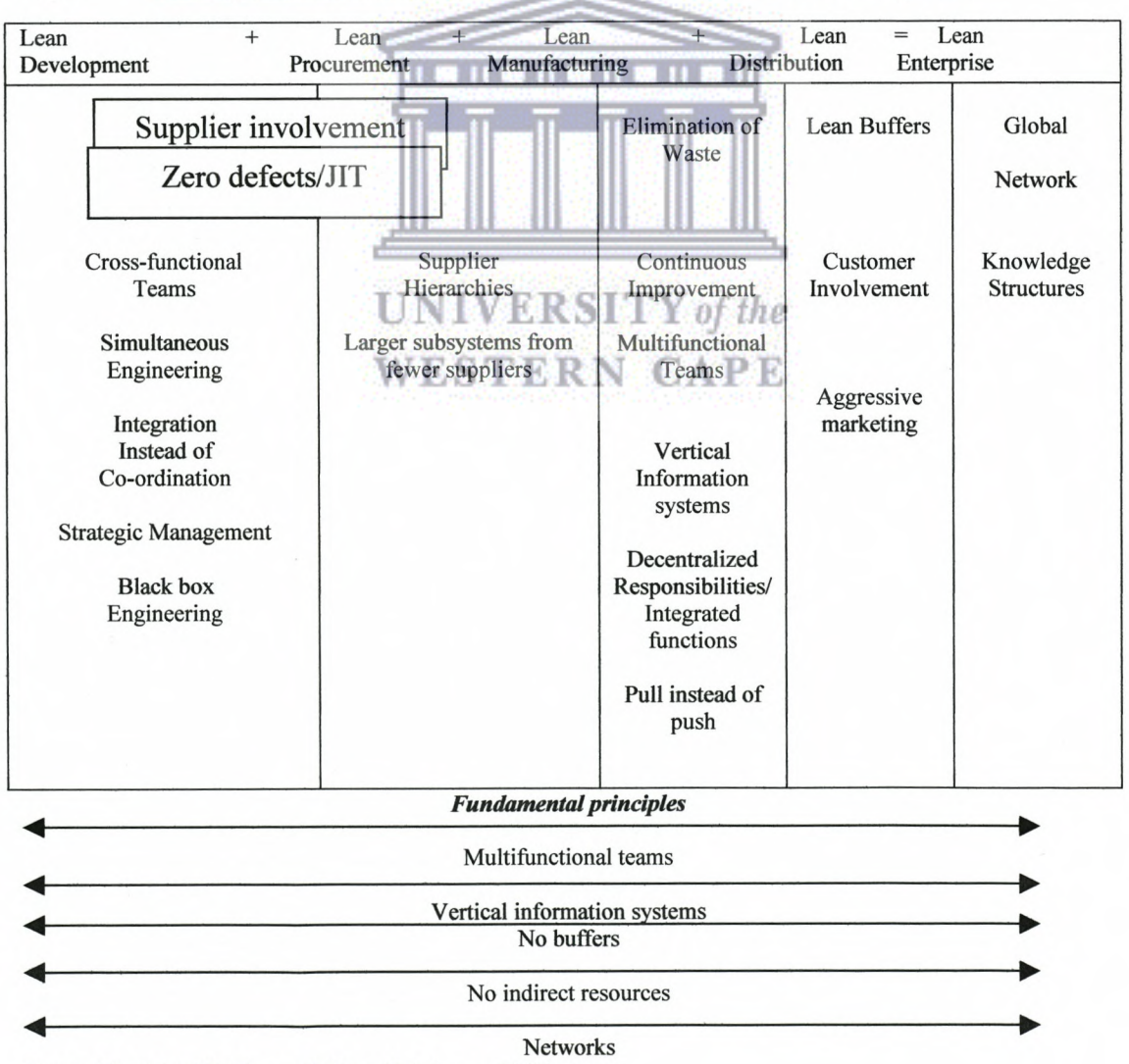
The objectives of the lean enterprise are to correctly specify value for the customer and avoid the normal tendency for each firm along the stream to define value differently to favour its own role in providing it. All the actions required to bring a product to launch, from order to delivery, from raw material into the hands of the customer and on through its useful life must be identified. Those actions which do not create value must be removed and those which do create value should be made to proceed in continuous flow as pulled by the customer. Finally, the results should be analysed and the evaluation process started over again. This cycle must be continued for the life of the product or product family as a normal part, indeed the core activity, of 'management'.

The organisational mechanism for the lean enterprise is therefore a continuing conference of all the concerned parties, to create a channel for the entire value stream for each product (or family of products); to dredge away all the muda; to redefine the role of firms, functions, and careers; and the development of a lean strategy (Womack and Jones, 1996). All participating firms along the stream, assisted by technical staff from 'lean functions', should periodically conduct rapid analyses and then take fast-strike improvement actions. The leader is logically the firm bringing all of the designs and components together into a complete product. However, the participants must treat each other as equals, with muda as the joint enemy to look at the whole -

the entire set of activities entailed in creating and producing a specific product from concept through detailed design to actual availability, from the initial sale through order entry and production scheduling to delivery, and from raw materials produced far away and out of sight into the hands of the customer.

Karlsson and Ahlstrom (1996 p 26) formulated the lean enterprise concept more schematically and developed an operational model of the change processes, as illustrated in Figure 1: lean development + lean procurement + lean manufacturing + lean distribution = lean enterprise

Fig 1 Conceptualization of World Class Manufacture /Lean enterprise



From Christer Karlsson & Par Ahlstrom, 1996.

2.5 COMPONENTS OF LEAN ENTERPRISE

The model above suggests that elimination of waste, continuous improvement, zero defects, just-in-time, supplier involvement, pull instead of push, multifunctional teams, total quality control, customer involvement, lean buffers and global networks, etc., are all important components of the lean enterprise. In addition, supply chain relations is a fundamental component of lean production where independent firms pool their resources for collective economies of scale to optimize productivity, cost control, quality management, competitiveness and profitability.

Elimination of waste

The elimination of waste is the most fundamental principle of lean production. Waste does not add value to the product and is something that the customer is not willing to pay for and should therefore be eliminated. Waste includes mistakes that require rectification, production of items no-one wants so that inventories and remaindered goods pile up, processing steps which are not actually needed, movement of employees and transport of goods from one place to another without any purpose, groups of people in a downstream activity standing around waiting because an upstream activity has not delivered on time, and goods and services which do not meet the needs of the customer (Womack & Jones, 1996 p 15).

Continuous improvement

The second most important principle of lean enterprise is continuous improvement (kaizen), involving everyone in the value chain. The work of improvement is often accomplished through quality circles where operators gather in groups to come up with suggestions on possible improvements. Manufacturing tasks are organised in

multifunctional teams where employees work with problem-solving and process improvements (Womack et al, 1996 p 90; Karlsson & Ahlstrom, 1996 p 30).

Zero defects

While mass producers set a limited goal of 'good enough' with an acceptable number of defects, lean producers set their sights on perfection, continually declining costs, zero defects, zero inventories and endless product variety (Womack et al, 1990 p13). There is an obsessive preoccupation with quality control as an intrinsic element in all stages of the productive process. The concept of total quality management (TQM) involves building in quality from the beginning, rather than checking for faults at the end. There is a comntinuous drive towards 'zero tolerance' of faults. This requires the development of a particular set of attitudes within the workforce, at all levels (Dickens, 1996 p 170).

The seven basic requirements of Japanese total quality control:

1) ensuring that every work station is an inspection point during production to guarantee total process control
2) displaying measurements on easy-to-see boards
3) insisting on compliance to ensure that quality comes before output
4) investing the authority in each worker to stop the production line to correct quality problems
5) encouraging each worker to correct his or her own errors
6) ensuring 100% check at each workstation and
7) promoting project-by-project improvement in production and quality and teamwork (Karlsson & Ahlstrom, 1996 p 26).

Just-In-Time

Customer - supplier relationships take on a particularly close form as firms attempt to reduce inventory to a minimum through the use of ' just-in-time' (JIT) systems. Schonberger (1982) [cited in Dicken, 1996] contrasted this with the 'just-in-case' systems characteristic of Fordism, shown in Table 2 below:

The just-in-time system is an important element in total quality control to reduce wastage and cost in order to improve competition, efficiency and profitability.

Table 2. The Characteristics of 'just-in-case' and 'just-in-time' Systems

'Just-in-case' system	'Just-in-time' system
Characteristics	
Components delivered in large, but infrequent batches	Components delivered in small, very frequent, batches
Very large 'buffer' stocks held to protect against disruption in supply or discovery of faulty batches	Minimal stocks held – only sufficient to meet the immediate need
Quality control based on sample check after supplies received	Quality control 'built in' at all stages
Large warehousing spaces and staff required to hold and administer the stocks	Minimal warehousing, space and staff required
Use of large numbers of suppliers selected primarily on the basis of price	Use of small number of preferred suppliers within a tiered supply system
No incentive for suppliers to locate close to customers	Strong incentive for suppliers to locate close to customers
Disadvantages	
Lack of flexibility – difficult to balance flows and usage of different components	Must be supplied throughout the entire supply chain
Very high cost of holding large stocks	Reliance on small number of preferred suppliers increase risk of interruption in supply
Remote relationships with suppliers prevents sharing of developmental tasks	
Requires a deep vertical hierarchy of control to co-ordinate different tasks	

Source: Based on material in Sayer (1986).
From: Dicken, 1996.

Pull instead of Push

Closely related to the principle of just-in-time is the way in which material is scheduled, through pull by the customer instead of push which overcomes the difficulty in making correct forecasts (Karlsson & Ahlstrom, 1996 p 33).

Multifunctional teams

The most salient feature of the work organisation in lean enterprise is the extensive use of multifunctional teams. The employees are able to perform many different tasks and are organised along a cell-based part of the product flow (Karlsson & Ahlstrom, 1996 p 34).

2.6 SUPPLIER CHAIN RELATIONS

The increasing challenge to be globally competitive has put well-managed automobile firms under tremendous pressure to critically select and develop a dependable and co-operative network of domestic and international suppliers, that are strategically segmented, clustered or tiered according to their evaluated performance and competencies.

Supplier involvement

The system adopted by companies like Toyota is one of tiered suppliers, with each tier having different tasks. The first-tier (or preferred) suppliers relate directly to the customer, second-tier suppliers to first-tier suppliers and so on, each locating its supply plant in close proximity to final assembly plants throughout the global operations of the automobile assemblers. There is also a clear trend for the number of first-tier suppliers to be smaller and decreasing, utilising 'just-in-time' during all its

processes of industrial production. The development of supply relationships is aimed at reducing global inventories, as well as achieving economies of scale in both production, new product development, and technological capabilities (Dicken, 1996; Dyer, Cho and Chu, 1998; Barnes and Kaplinsky, 2000).

To optimise supplier effectiveness, firms allocate different levels of resources to each tier group, with scarce commodities earmarked to strategic relationships or close partners, whose inputs are typically of high value and play an important role in differentiating the buyer's final marketable and profitable product (Nishiguchi and Brookfield, 1997).

The strategic suppliers' relationships are long-term (rather than short-term) and integrated with the dominant firm's value-added supply chain on a basis of mutual inter-dependency, trust, respect between firms and management competence. The supply chain builds improving inter-company communications, alignment of organisational objectives, joint resource commitment, high levels of information sharing and critical relation-specific investments (Carter et al, 2000).

The dominant firm provides suppliers with managerial assistance where necessary, exchanges dedicated personnel, implements effective performance monitoring, establishes global benchmarking, upholds intellectual property agreements, executes long term strategic plans, ensures capacity planning, and provides state-of-the-art training. The supply chain also establishes learning organisations with global 'best practices', innovative technological inputs, continuous co-operation, close co-ordination between manufacturing engineers and supplier's engineers, ease of construction, relation-specific investments in dedicated plant and equipment, and

constant improvement so that these suppliers have world-class capabilities (Handfield, et al, 1999).

There is a constant striving to minimize total (unit and administrative) costs, secure required flexibility, give satisfactory customer service, provide consistent high quality with zero defects, ensure timely delivery of a marketable profitable product for stringent global competitiveness and create incentives that meet both present and future needs (Handfield et al, 1999).

The strategic supplier relationship consists of a near vertical integration of two or more independently-owned entities who pool their resources for collective economies of scale, to build a long mutually beneficial relationship, for faster time-to-market of new products, effective performance of the required design, bilateral problem-solving as well as meshing of schedules, mutual understanding of systems, procedures and processes for flawless fit (Dyer, Cho and Chu, 1998).

Consultation between customer and supplier in a lean production system differs markedly from that in a mass production system. Not only are there close functional relationships, but the use of just-in-time methods encourage geographical proximity, although the distances involved may be very variable, ranging from suppliers located literally next door to assemblers (e.g. in 'supplier parks'), to those located within the broad region (Carter Carter, Monczka, Slaight, Swan and Winter, 2000).

Automobile component suppliers are now increasingly involved in different kinds of functional relationships with the automobile assembler who are shifting more

responsibility (and risk) on to the supplier firms. The evolving relationships can take a number of different forms as Table 3 shows. Each type involves different kinds of supplier responsibility. The most significant trend is for first-tier suppliers to manufacture entire 'sub-assemblies' or modules rather than individual components (Dicken, 1996 p 328).

Firms strive for effective supplier management through lean production and efficient sourcing, by down (or right-) sizing, focusing on their 'core competencies' while outsourcing all other 'non-core' activities to outside suppliers.

This should involve shorter design periods per model, ease of assembly, and development of world-class manufacturing capabilities in growing foreign markets (Carter et al, 2000).

Table 3: Types of Supplier Responsibilities within the Automobile Industry

Traditional subcontracting	Provision of component system	Parallel development	Co-development
Production of components from detailed specifications provided by auto manufacturers	Production and assembly of complete component systems based upon technical directives of automobile manufacturers	The supplier is involved in the manufacture, assembly and development of components	The supplier has complete responsibility for the design and production of components
The supplier has full responsibility for performance and quality	The supplier controls the quality and cost of parts procured from their suppliers	The supplier has the capability of making technical and cost adjustments during the design process	Application of simultaneous engineering of product and process
The supplier delivers the components to the assembly plant	The supplier controls the logistics chain of the component system	The automobile manufacturer retains control of development, design and prototype testing	The automobile manufacturer manages the technical interface between components

Source: Based on Laigie (1996, Table 1)
From: Dicken (1996)

2.7 DIFFUSION OF LEAN PRODUCTION

The diffusion of these lean production practices outside Japan is occurring in two ways. One is through the overseas expansion of Japanese firms themselves and their attempts to transfer their domestic practices to different contexts. The evidence suggests great variability in the extent to which such firms are able to implement these transfers without a considerable degree of adaptation to local conditions, producing what Abo (1994, cited in Dicken, 1996) calls 'hybrid factories'. The second way is through the 'demonstration effect' – often provided by Japanese firms operating overseas but also through the acceptance and promotion of these ideas as 'best practice' by influential writers in management (Dicken, 1996 p171).

Many earlier studies suggest that the co-operative team-oriented production system associated with large Japanese firms depend on a favourable cultural environment and/ or on encompassing enterprise-level socialisation, but other studies indicate that the desired aspects of this management system can be effectively transferred to other countries in disaggregated form (Dicken, 1996).

2.8 HUMAN RESOURCE DEVELOPMENT

The organisation of production is flexible, both in use of facilities and, especially in the way in which the labour force is organised. In Japan, work teams, job rotation, learning-by-doing and flexibility have been used to replace the functional specialisation, task fragmentation and rigid assembly-line production of US Fordism. There are few job classifications, work rules overlap and production is organised on the basis of teams. Tasks are allocated by team members, workers can cover for each other and experiment with new allocations and machine configurations. Learning-by

doing at many levels makes the Japanese firm an information-laden enterprise with problem-solving capabilities, which far exceed its Fordist counterparts.

Human resource practices include extensive broad-based training, some degree of shop-floor participation in quality improvements, in-process inspection and correction of problems, performance-based pay, and a fluid deployment of workers to a variety of different tasks as dictated by changing needs and circumstances (Dicken, 1996).

It is claimed that the Japanese lean production system is more humane than the Fordist management production system because

- It involves the re-skilling of workers, notably through the requirements of multi-task operations within work teams, job rotation and 'learning by doing'
- It provides workers with a substantial degree of control and involvement
- Team working and self-management reduce alienation
- Individualised payments systems create significant incentives for workers
- It is based upon long-term (lifetime) employment contracts (Dicken, 1996 p171).

However, it could actually be highly exploitative of the labour force because

- The multi-skilled team-based workforce is subject to strict managerial control. Work teams are used as the means to extend such control.
- The emphasis on continuous improvement places great pressure on workers.
- The individual payment system is used as part of a managerial strategy to 'divide and rule' the workforce.
- Long-term contracts apply only to 'core' workers in large companies; the remaining workforce is peripheralised with no job security (Peck and Miyamachi cited in Dicken, 1996).

However, much of the literature suggests that human resource practices such as the above are most easily implemented where other employment conditions (including job security and stability, adequate wages and work conditions) exist. Information sharing and equitable distribution of productivity or profit gains foster trust, commitment and workforce stability (Katz and MacDuffie, 1994, cited in Dicken, 1996; Deyo 1996; Dyer, Cho and Chu, 1998; Barnes and Kaplinsky, 2000). The new concept is to gain the agreement of the employee to acquire more skills that can be applied to more difficult problems - which is good for the employee, the value flow and the future of self-perpetuating lean enterprises (Womack and Jones, 1996).

2.9 ROLE OF UNIONS

The pillars of Japanese-style industrial relations are enterprise unions, and Japanese management literature stresses other forms of employee involvement, including labour-management councils, quality circles and consensus-based decisions. In practice, employee involvement (in Japan, transplants overseas and firms emulating the Japanese model) is almost entirely on management's terms, and the independent power of unions, to struggle against management to uphold the employees' interest, is severely circumscribed (Dicken, 1996).

However, strong unions may either force management to institute progressive labour policies which favour flexibility, or they may oppose such managerial efforts as this might compromise other labour goals such as humanisation of work, reduced stress and enhanced union/worker control over scheduling and work organisation (Deyo, 1996 p 6).

Competitive pressures and reforms may undercut union membership and bargaining power, as fears of layoffs and threats to union strength could trigger confrontation and opposition. While such reforms may be easy to introduce, they could generate a climate of distrust and fear that may make union strategies less coherent and unified as union leaders struggle to find an appropriate response (Katz and MacDuffie, 1994, cited in Deyo, 1996).

2.10 CONCLUSION

The emergence of this intelligent, efficient and highly productive form of industrial organisation system of world-class manufacture / lean production in the context of globalisation, pioneered by the Japanese and which caused a paradigm shift from Fordist mass production to flexible lean production, underpins the basis for success in the fiercely competitive global automotive industry.

SECTION THREE: GLOBAL AUTOMOTIVE INDUSTRY TRENDS

3.1 INTRODUCTION

The international automotive industry, one of the largest sectors in the global economy, plays a significant role in value-added and trade flows in a number of developing and industrialised countries. It consists of giant transnational corporations, many of which are increasingly organised on internationally integrated lines, leading to the rapid globalisation of finance, ownership, technology and trade flows, and the growing complexity of both product and process technology (Barnes and Kaplinsky, 2000 p 70).

This section will examine the formation of regional trade blocs, mergers and acquisitions, the role of national governments, innovations, platform rationalisation and the effects of global market trends, all of which influence the growth and location of automotive industrial plants, thereby posing severe challenges to the future of the South African automotive industry.

3.2 GLOBAL AUTOMOTIVE NETWORK BLOCS

The ten leading automobile producers account for 71% of the world production and twenty companies produce almost 90% of the world total (Dicken, 1996). The global distribution of automobile production and trade network is dominated by three blocs - Asia, (Japan and Korea), Western Europe (Germany, France, Britain, Spain, Sweden and Italy) and North America (USA, Canada), and to a much lesser extent Latin America (Brazil, Mexico and Argentina). See Growth of Automobile Production by

Major Countries (1960-1995) in Addendum A. The tendency to regional integrated trade areas has resulted in a single European market, the North American Free Trade Agreement (NAFTA) and regional integration in Latin America (Mercosur), which favour local geographical interests. These blocs impact on the industry insofar as they regionalise the control of investments, production, trade and co-operation to the virtual exclusion of emerging markets.

The global automotive companies based in Japan, United States and Europe exert such market dominance that there have been very few new entrants in the industry during the past twenty-five years. The major exception is South Korea which, in the space of a decade, has emerged as a significant international force. The strategy of the leading companies was clearly to establish a major integrated production system in each of the three global regions. As is the case in South Africa, the automotive industry in Argentina, Brazil and Mexico - though quantitatively large - is entirely dominated by foreign firms (Dicken, 1996 p 334).

3.3 MERGERS AND ACQUISITIONS

Mergers and acquisitions have further concentrated the marketing and design capacity of the global industry within a few industrialised localities, namely North America, Western Europe, Japan and to a lesser extent South Korea. This trend is illustrated by the recent merger of Daimler-Chrysler and its subsequent purchasing of a controlling stake in Mitsubishi; Ford acquiring Volvo's passenger vehicle division: and General Motors that of Saab. Also, Hyundai purchased 51% of Kia, and Renault's acquired 37% of Nissan. High-profile mergers and acquisitions, amongst both OEMs and automotive component firms, influence the changing global environment. Even

previously successful firms are struggling as a result (Barnes, 2000 p 66; Barnes and Kaplinsky, 2000).

3.4 ROLE OF NATIONAL GOVERNMENTS

Governments influence the global pattern of production through tariff, or especially non-tariff barriers that exert an important influence on both developing and developed economies. Some countries (e.g. France, Japan and Korea) allow limited access to foreign firms, while others (e.g. Britain, Germany and the USA) tend towards unlimited access in order to support domestic firms. Because governments tend to encourage local content and promote exports of locally assembled automobiles, giant global corporations have developed consummate skills in playing one government off against another to gain the maximum advantage (Dicken, 1996 p 329).

National governments struggle to secure new automobile industry, or retain their existing large manufacturing plants for localised concentrations of employment and 'knock-on' effects in the general manufacturing and component industries.

3.5 INNOVATIONS

Important innovations have been directed towards reducing fuel consumption, reducing the weight of materials (use of plastics), increased use of electronics and reducing the size of cars (also affected by the impact of oil prices). Government safety and anti-pollution regulations have created pressures for changes in car design such as pollution-free, battery-operated cars or cars powered by alternate fuels (Dicken, 1996 p327). Keeping abreast of technological and innovative developments

and research in order to capture 'niche' markets is essential for future growth and development.

3.6 PLATFORM RATIONALIZATION

'Platform rationalization' enables a larger number of models to be created with fewer platforms, shared major systems and components, and forces the assemblers to concentrate on overall vehicle design and systems integration. This compels first-tier suppliers to assume greater responsibility for the technological content of their sub-systems, for the upgrading of their supply chains (Barnes and Kaplinsky, 2000) and the location of their supply plants in close proximity to final assembly plants. Through the development of 'platform engineering', the intellectual property rights remain with the parent company. This "design-in" process requires that suppliers have a significant engineering capability to fulfil the Original Equipment Manufacturer's (OEM) requirements for an ever-increasing development and ownership role (AIDC, 2001).

3.7 CUSTOMER QUALITY REQUIREMENTS

Trends towards built-to-order vehicles such as customer quality requirements and increasing levels of vehicle personalization, result in reduced stockholding levels (AIDC, 2001), increased sales and expanded markets. Firms are therefore required to read, hear, be sensitive and respond to customer requirements, as well as radically adapt their production methods and systems, to improve customer satisfaction and drastically reduce problems per vehicle.

3. 8 GLOBAL MARKET TRENDS

The global market trends discussed below impact directly on, and must be taken into account by, the South African automotive industry in order to remain competitive.

Global Over-capacity

The world's major vehicle manufacturers expect global passenger vehicle output to remain relatively stagnant from 2001 through to 2003 as the industry has become increasingly competitive, due to global over-capacity. All Original Equipment Manufacturers (OEMs) are cutting costs and bringing new products to markets sooner to improve the competitiveness of their products which will be determined by price, quality, reliability, innovative design, improved sales and profits. The life span of a new model has decreased from about 8 years to between 2-4 years. The complexity of these processes is compounded by a significant global over-capacity in automotive production, exceeding 30% in mid-1999 (Barnes, 2000 p 54).

Market Decline

According to the autoPolis Report, the output of the global automotive industry which declined 0,6% in 2001, faces an estimated fall of 5% or 2,6m vehicles in 2002 and an anticipated decline of 2,5% in 2003. This will result in an estimated loss of 4,3m vehicles a year from the market or nearly 8% of world demand (equal to the entire domestic market in Japan). Car and truck sales are now falling in the world's three largest markets of North America, Japan and Europe (75% of all vehicles sold). The emerging markets and Latin America are struggling and demand is subdued in Asia (except in China and Australia), while only Eastern Europe remains healthy (NAACAM, 2002).

Expected Surge in Demand

It is expected, however, that the industry recovery will start in the second half of 2003 and will experience a period of strong growth between 2004 and 2010. Global demand will return to the record level of 2000 again by 2005, reach 61m vehicles by 2010 and the average rate of growth will be far greater than in the last 30 years. There should be a surge in demand in Mexico, in much of Asia and Eastern Europe, as well as a recovery in Latin America. Africa will also show signs of growth, albeit from a low base. The idea that the automotive sector is mature and slow growing will need to change (Maxton, in **auto**Polis report, cited in NAACAM, 2002). [See Sales of new motor vehicles by world region, 1995 – 2010, in Addendum B].

Changes in Demand

Automobile production is strongly market-oriented and reflects the changes in the level, composition and demand, as well as the problems facing many traditional producing nations and firms. Demands tend to converge, at least in the mass market sector, for particular types of cars for particular uses. The changing demand characteristics are highly cyclical, long-term, amid signs of increasing market segmentation and fragmentation. Demand for automobiles is very sensitive to the level of economic activity as a whole.

The more mature North American and West European markets reflect not only cyclical forces but also deeper structural characteristics that will limit future growth in car sales. More and more, car purchases are merely replacements as new production technologies make possible a far greater variety of vehicle types, and the development of niche markets (e.g. luxury cars). New markets with large populations are becoming

more attractive and new centres of automobile production are developing in East and South -East Asia (Dicken, 1996 p349).

3.9 CONCLUSION

The automobile industry is very sensitive to production cost (mainly labour), modern technological changes and the implementation of lean production. There is a global battle raging in the automobile industry ('car wars') - in a period of over-production, which is expected to result in restructuring of operations, plant closures and contractions. This will lead to large-scale job losses in the short term, in the US, Western Europe and elsewhere, as trans-national corporations (TNCs) seek to survive and flourish in an increasingly competitive global market (Dicken, 1996). The expected surge in demand after 2003 however, should open up lean production opportunities in developing countries, provided they are integrated into the global supply chains of OEMs.

SECTION FOUR: SOUTH AFRICAN AUTOMOTIVE INDUSTRY: IMPACT AT INDUSTRY LEVEL

4.1 INTRODUCTION

The automotive industry is critically important to South Africa and contributes 5,4% of the total manufacturing GDP. It employs 32 500 people directly in the assembly industry, 48 600 people in the component industry (including 9 100 people in the tyre industry), and 167 000 people indirectly in the automotive industry. South Africa has 6,2m vehicles, many of which are older than 10 years (AIDC, 2001; Business Times, 28 July, 2002).

As in many other developing countries, previous strategies had been aimed at developing the local automotive industry by protecting it with high tariff barriers on imported vehicles, and imposing local content requirements. Of the 32 countries surveyed by the World Bank, the automotive industry in South Africa was, by the end of the 1980s, protected by the highest quantitative controls to limit imports (Kaplinsky & Morris, 1999 p 718).

However, within the new, highly competitive context of globalisation, world-class manufacture and global automotive trends, the production patterns of the local automotive industry, which were stagnant prior to 1994, required transformation. The restrictive controls were removed in 1995 when the new government introduced the Motor Industry Development Plan (MIDP), starting with radical tariff reform (Hirschsohn 1998a p 45; Kaplinsky and Morris, 1999 p719) that resulted in

fundamental change in trade and industrial performance. These policies led to the restoration of global ownership links, far-reaching structural changes, an improvement in production, increased investment as well as export and import of vehicles and components, better production quality, improved environmental standards and more productive labour relations.

4.2 PRODUCTION PATTERNS

Numerous factors were responsible for the production patterns that severely hampered the growth and development of the South African automotive industry prior to 1994. The seven decades of Import Substituting Industrialization (ISI), characterized by restrictive tariffs, quantitative restrictions, and various other local content programmes, helped establish the South African automotive industry. However, ISI caused problems of high costs, inefficiency, unproductive overheads and low volumes of production which were compounded by rapid trade liberalisation and a stagnant internal market. (Hirschsohn 1998a p45; Barnes and Kaplinsky, 2000; Barnes, 2000 p52; and Black, 2001b p4;).

The industry's high-cost structure was caused by assembling low volumes of a large number of models and makes of vehicles for a small tariff-protected market (Black, 2001b p3). The industry was inward oriented (TISA, 2001) and production performance over the two decades prior to the 1990s was stagnant. South Africa had a platform run which was low even by standards of other developing countries (Black, 1998). In 1987, its 7 plants had produced 22 platforms, which increased to 34 in 1993 with an average platform run of only 11 500, contrasted with 30 000 in Brazil and 50 000 in Australia (Black, 1995). This state of the South African automotive industry

was due to a low level of investment into upgrading and new capacity (Barnes and Kaplinsky, 2000; Barnes, 2000 p 63).

South African manufacturers also suffered from poor competitiveness with minimal exports due to the impact of sanctions, and vehicle prices that increased above the inflation rate and international levels (Black, 1998; Barnes 2001). The General Export Incentive System (GEIS) which was established in 1991 as a cash incentive for exports - to counter the growing external debt and anti-export bias - proved costly, was GATT-illegal and removed in 1998 (Kaplinsky & Morris, 1999 p718).

Amongst developing countries, South Africa was the largest car producer in 1960. Despite its long history (since 1926) of automobile assembly, with the only other sizeable presence in Africa being Egypt and Nigeria (and some insignificant assembly operations in Kenya and Zimbabwe), it now lags far behind Korea, Mexico and Brazil because of the past impact of international sanctions, the economically retarding effect of the system of apartheid that inhibited industrial restructuring, and its relatively smaller population and market (Barnes & Kaplinsky, 2000). See Table 4.

Table 4: Production of Passenger Cars in Developing Countries 1995 and 1997 ('000).

Country	1995	1997
Korea	2 003	2 088
Brazil	1 303	1 680
Mexico	700	833
China	376	543
India	394	490
Argentina	227	393
Malaysia	239	330
Taiwan	281	258
South Africa	223	246

Source: Financial Times, 23rd February 1998
From Barnes and Kaplinsky, 2000

Until the mid-1990's, the South African industry involved a relatively high degree of local ownership and was not directly integrated into global supply chains.

4.3 RE-INCORPORATION UNDER GLOBAL OWNERSHIP

The imposition of sanctions against apartheid in the late 1970s elicited a mixed reaction from global automotive chains. The two largest US pioneer assemblers (Ford and General Motors) dis-invested, selling their holdings to local parties in the 1980s. German assemblers Volkswagen and BMW, however, continued to operate in South Africa through wholly owned subsidiaries, whereas another German assembler, Mercedes Benz had 50% equity in Mercedes Benz SA. On the other hand, Japanese entrants (Toyota and Nissan) produced under franchise to locally-owned automotive industries, with Toyota enjoying a dominant share of the South African market. This was unique for a developing country, as neither of the two Japanese companies had other global plants working as franchise producers (Barnes, 2000 p70; Barnes and Kaplinsky, 2000).

With the ending of sanctions in 1994 and the introduction of the new policy regime, the American producers, Ford (1994) and GM (1997), bought back into the firms they had disinvested from, and entered into joint ventures. Daimler Benz increased its equity in Mercedes Benz in 1992, followed by Toyota in 1996 (increased their share to 74,9% in 2002) and Nissan in 1997 (AIDC, 2001). By 1997, the formerly locally-controlled assembly industry had been re-incorporated under global ownership (Barnes and Kaplinsky, 2000; Business Times, 28 July 2002). See Table 5. See Addendum C for changing strategic perspectives on the preferred ownership of South African based automotive component suppliers.

Table 5: South African OEMs, Vehicles Manufactured and their Ownership Base, 1998

SA OEM	Vehicles Manufactured	Ownership
Toyota SA	Toyota	25,1% local (listed on the Johannesburg Stock Exchange with Wesco as main shareholder), 74,9% Toyota Motor Corporation (Japan)
Volkswagen SA	Volkswagen, Audi	Volkswagen AG
BMW SA	BMW	BMW AG
Mercedes Benz SA	Mercedes-Benz, Colt (Mitsubishi)	Daimler Benz AG
Samcor	Ford, Mazda, Mitsubishi	55% Anglo American, 45% Ford (but has management control)
Automakers	Nissan, Fiat	Sankorp (local) 37% Nissan Motor Company (Japan) 50%, Nissan Diesel Motor Co (Japan) 4.3%, Mitsui and Company (Japan) 8.7%.
Delta	Opel, Isuzu	51% local management, 49% General Motors

Source: Black, 1995; Business Day, 11 December 1997; Financial Mail, 9 May 1997; F&T Weekly, 11 October 1996.
From Barnes and Kaplinsky, 2000 (amended)

4.4 THE MOTOR INDUSTRY DEVELOPMENT PLAN (MIDP)

The new South African democratic government adopted a more open trade philosophy after 1994, based on a study into the competitiveness of the sector by the Motor Industry Task Group in the early 1990s and the findings of the Industrial Strategy Project.

Motor Industry Task Group (MITG)

Representatives from the trade unions, assemblers, components suppliers and government formed the visionary Motor Industry Task Group in 1994 to develop a consensus-based strategy that would

1. ensure the industry's continuous growth, develop human resources and create employment opportunities

2. minimise the use of foreign exchange
3. encourage the industry to become more productive and increasingly internationally competitive, and
4. reduce tariffs to meet South Africa's commitments under the 1993 General Agreement on Trade and Tariffs (Hirschsohn, 1998a; 1998b p45)

The report of the MITG in 1994 ushered in a radical new phase aimed at precipitating structural adjustment by infusing progressively more intense international competition. The state hopes that this strategy of steadily reducing tariff protection will improve efficiency, productivity and competitiveness, and secure the long-term future of the industry (Hirschsohn, 1998a; 1998b p 45). In addition it wanted to increase the low levels of value added to automotive imports and to stimulate the growth potential in other sectors (Black, 1995).

First Phase of the MIDP

The first phase of the MIDP was therefore launched in 1995, in the context of rapid trade liberalisation, to re-orient the structure of the industry to achieve global competitiveness while slowly and systematically it was integrated into the global automotive industry.

This was a major shift in government policy, ushering in a new operating environment for automotive firms, which rapidly reduced the level of protection of the local industry. The GATT commitments on import tariffs was set at 50% but the government felt that this level of protection was too high, and subsequently reduced tariffs on imports of vehicles and components at a faster pace than required by the

World Trade Organisation (Padayachee, 1997; Jenkins and Siwisa, 1997). The industry was therefore no longer protected to the same degree that it had been under the various local content programmes which had isolated it for over three decades (Hirschsohn 1998a; 1998b p 45; Black, 1998; Barnes, 2000 p 53).

Government introduced supply side measures and reduced its demand-side support for industry to assist the manufacturing sector to promote innovation, enhance efficiency and become more internationally competitive. Government hoped this would help firms to cope with imports and assist them to export by substantially reducing various tariff and import control protective measures (Barnes and Kaplinsky, 2000).

Objectives of the MIDP

The MIDP is regarded as an excellent example of public and private sector co-operation, moving from being internally focussed to becoming part of the global industry. This was to ensure that high levels of competence and skills are developed in South Africa to facilitate the growth of the local industry. As the levels of protection were reduced over the past six years from 115% to 40% in 2002, local companies now had to compete with the best in the world in order to survive. This shift required a major adjustment and restructuring on the part of each company and the automotive industry as a whole (Department of Trade and Industry, 2001; TISA, 2001). The objectives of the MIDP are to

- improve international competitiveness
- improve vehicle affordability in real terms
- enhance the growth of the assembly and components industries, particularly through exporting and gradually rationalising models produced locally

- improve the industry's trade balance
- stabilise employment levels
- encourage a phased introduction (via tariff reductions) into the global automotive industry
- encourage the upgrading of capacity and modernisation of the automotive industry throughout all spheres, by introducing investment incentives, thereby promoting higher productivity and facilitating global integration and
- encourage higher volumes and a greater degree of specialisation by allowing exporters to earn rebates on automotive import duties (Barnes and Kaplinsky, 2000; Department of Trade and Industry 2001; TISA, 2001).

These objectives are not mutually exclusive, and could be achieved through the global integration by the South African automotive industry.

Second Phase of MIDP

The second phase of the MIDP, extended from 2002 to 2007, aims to further reintegrate SA into world markets. Amendments involve a rapid reduction in import duties on completely built-up (CBUs) light motor vehicles and completely knocked-down (CKDs) original equipment components. See Table 6.

In addition, a duty-free allowance was given to assemblers of 27% of the wholesale value of the vehicle, and a small vehicle incentive (SVI) operated as a subsidy for the manufacture of more affordable vehicles. It operated via a duty drawback mechanism with the value of the drawback being contingent on the value of the motor vehicle. The minimum content provision was abolished and an import-export

complementation (IEC) scheme was introduced that allows both automotive and component manufacturers to earn duty credits from exporting. These duty credits can be used either to offset import duties on cars, components or materials, or they can be sold on the open market (Barnes and Kaplinsky, 2000).

Table 6
Rate of import duties on completely built-up light motor vehicles & original equipment components in terms of the MIDP

	Rate of CBU light vehicle	Rate of OEM CKD component
	Import duty	Import duty
1 Jan 2000	**47%**	**35%**
1 Jan 2001	**43,5%**	**32,5%**
1 Jan 2002	**40%**	**30%**
1 Jan 2003	**38%**	**29%**
1 Jan 2004	**36%**	**28%**
1 Jan 2005	**34%**	**27%**
1 Jan 2006	**32%**	**26%**
1 Jan 2007	**30%**	**25%**

From TISA, 2001 and NAACAM, 2002

Furthermore, a production rationalisation programme called Productive Asset Allowance (PAA) was introduced for those manufacturers who invested in productive assets for the assembly of light vehicles and the manufacture of automotive components, in accordance with a set of qualifying criteria (Department of Trade and Industry, 2001).

As a result of these pressures and incentives, the automotive industry is in a state of rapid change from its pre-1994 stagnant position towards a viable, competitive globally integrated industry. The industry now includes a focussed domestic market, a proliferation of locally produced models, and an export-driven industry focussed on selected models (Barnes and Kaplinsky, 2000; AIDC, 2001; NAACAM, 2002; Business Times, 28 July 2002).

Operation of MIDP

Industry rationalisation was addressed through a policy of 'guided integration', via tariff reductions and export complementation arrangements. It was aimed to encourage a phased transition from CKD assembly to full manufacturing with the benefits of higher volumes and increasing localisation of components (Black, 2001).

The assemblers are able to bring in duty free components through the SVI window, as well as through the IEC scheme. They could either export components directly or on behalf of the component manufacturers, or they could buy-in duty credits from the component suppliers.

The industry will be influenced by growing international integration (which impacts on investment and trade), productivity initiatives and rapid structural changes (which include the diffusion of world class manufacture methods and pressure from parent companies to reduce productive costs); as well as growing global competition and domestic demand (which are affected by lower prices) (AIDC, 2001).

The government policy is also implicitly directed at the small number of multinational vehicle producers and major component suppliers that dominate global production through economies of scale and extend their lean enterprise operations to South Africa. Government hopes to influence and attract new investments, encourage the import of modern technology, and increase vehicle and component exports through influencing the global strategy of multinational corporations. These MNCs consider comparative advantage, host country policy and domestic market conditions (Black, 2001b) as important determinants, as well as low costs, availability of materials, technical abilities and labour skills.

Industry Plan Will Soon Get Tougher

Globally, the motor industry tends to be regulated for economic trade-related reasons and South Africa is no exception. While the MIDP has been credited with stimulating the growth in exports of motor cars, it is about to become much tougher for South Africa's motor manufacturers. Export credits will gradually be reduced to phase the scheme down to encourage the industry to become more efficient.

The ational Association of Automotive Component and Allied Manufacturers (NAACAM) says that the MIDP is a tough policy for manufacturers which will be severely felt from 2003, as export credits will reduce by 7% annually until a level is reached where every one Rand of exports earn only 70 cents worth of imports. The industry therefore has five years to become fully, globally, competitive (Business Times, 28 July 2002).

Phase Three of MIDP

Discussions about Phase Three brought together the four major associations in the industry – NAACAM, NAAMSA, the Retail Motor Industry (RMI) and trade union NUMSA. They co-operated in making recommendations to the government to extend the MIDP to 2012 in the hope that this would give the industry planning stability (Business Times, 28 July 2002).

The MIDP has been revisited and fine tuning adjustments will encourage local assemblers to produce volumes in excess of 30 000 vehicles per model, while some are planning 60-80 000. Some vehicles will be exported and the local model range will be supplemented by imports. This will encourage local material content of 65%-75%, thus local component volumes should increase between two and four times, so

that local component manufacturing should become a very attractive business (NAACAM, 2002).

4.5 PRODUCTION, EXPORT AND IMPORT

The introduction of the MIDP that has gradually reduced tariffs and reintegrated the South African automotive industry into global markets has resulted in a rapid increase in production, exports and imports of vehicles, and investments.

Table 7 displays comparative figures for 1998 and 2001 to illustrate the relatively rapid growth of the automotive industry of South Africa in the production of domestically assembled vehicles, and growth in both exports and imports, in spite of a small and sluggish domestic market. See Addendum D for Industry Vehicle Sales, Export and Import Data: 1995-2004 (Actual and Projected) and Addendum E, for the value of sales of motor vehicles, parts and accessories, from 1994 to 2001.

Table 8 shows the rapid growth between 1998 and 2001, in the total value of sales of motor vehicles, parts and accessories. Table 9 shows the rapid growth of automotive imports and exports from 1995 to 2001 and the shrinking of the adverse trade balance.

See Addendum F for data on cars (domestically produced, CBU imports, exports and total local market) from 1995 to 2004 (actual and projected); Addendum G for light commercial vehicles; Addendum H for medium and heavy commercial vehicles and Addendum I for data on total aggregate market, total aggregate exports and domestic market.

Table 7: S. A. AUTOMOTIVE INDUSTRY COMPARATIVE DATA: 1998 AND 2001

	1998	2001
CARS		
Domestically Produced	193 212	270 538
CBU Imports	59 951	78 329
Export (CBU)	18 342	93 307
Total Local Market	234 821	251 560
LIGHT COMMERCIALS		
Domestically Produced	106 584	123 340
CBU Imports	4 100	4 535
Exports	6 806	10 229
Total Local Market	103 878	117 646
MEDIUM & HEAVY COMMERCIALS		
Exports	748	465
Imports	1 300	2 200
MCV/HCV Market	12 811	14 893
TOTAL AGGREGATE MARKET	351 510	384 099
TOTAL AGGREGATE EXPORTS	25 896	108 001
DOMESTIC MARKET	325 614	276 098
GDP GROWTH RATE	0,8%	2,2%

Source: NAAMSA, 2002

Table 8: TOTAL VALUE OF SALES

	1998	2001
TOTAL VALUE MOTOR VEHICLES, PARTS & ACCESSORIES	R35,30bn	R65,04bn
MOTOR VEHICLES	R24,28bn	R45,82bn
PARTS & ACCESSORIES	R 9,35bn	R17,60bn
BODIES FOR MOTOR VEHICLES, TRAILERS & SEMI-TRAILERS	R 1,67bn	R1,62bn

Source: Statistics SA: Bulletin of Statistics Vol 36(2), 36(1), 34(1), 32(3&4), 31(1)

Table 9: AUTOMOTIVE IMPORTS AND EXPORTS IN BILLIONS

	1995	1996	1997	1998	1999	2000	2001
Imports	16,4	19,2	17,2	19,9	22,8	29,7	38,0
Exports	4,2	5,1	6,6	10,1	14,8	20,0	30,0
Trade balance	12,2	14,1	10,6	9.8	8,0	9,7	8,0

Source: TISA, 2002

The tremendous success of the MIDP (after 6 years of reintegrating the local assembly and components industries into global supply chains) is demonstrated by the rapid growth in both automotive imports and exports of OEMs and components, and the gradual reduction in the automotive trade balance. The trade balance, however, is still a problem area that needs to be addressed.

Table 9 shows that imports of vehicles and components rose rapidly from R 16,4bn in 1995 to R 38,0bn, and exports of vehicles and components rose from R 4,2bn in 1995 to R 30,0bn in 2001. The balance of payments deficit therefore decreased from R 12,2bn to R 8,0bn from 1995 to 2001. Most imported passenger cars in 1999 came from Korea (22 700), Germany (9 909), and Japan (6 770), whereas Germany and Japan together supplied approximately 80% of the imported components (AIDC, 2001).

NAAMSA notes that whilst world vehicle production declined by 3,9% in 2001, vehicle production in South Africa increased by 13,9%. The South African production against world production (in units) in 2000 was 357 364, against 58 058 921 or 0,61%, and in 2001 was 407 036, against 55 770 001 or 0,73%. See Table 10. The increase in vehicle production is now above the ratio of the South African population compared to the world population.

Table 10: INCREASE IN VEHICLE PRODUCTION IN SOUTH AFRICA

	2000	2001	% Change
World Production (units)	58 058 921	55 770 001	-3,9%
South African Production (units)	357 364	407 036	+13,9%
South African Production as a % of World Production	0,61%	0,73%	

From Department of Trade and Industry, 2002

Component Exports

Component exports have also grown rapidly as a result of the output of a rapidly emerging new group of mainly foreign owned firms, frequently with links to vehicle manufacturers, and not by 'traditional' component suppliers. Much of the expanded exports was in a small range of 'peripheral' components such as catalytic converters, which showed a dramatic growth from R2 569,1m (1999) to R8 989,0 m (2001), or

48,4% of total component exports by value, as well as in automotive leather, which increased from R1 887,5 m (1999) to R2 391,4 m (2001).

The value for exports increased by 31% from 1999 to 2000, and by 47% in 2001. About 70% of exports in 2001 went to the European Union (of which 37,4 % went to Germany) and 12,5% went to NAFTA (of which 12,1% went to USA). See Tables 11 and 12 (TISA, 2002).

Table 11 TISA MOTOR INDUSTRY DEVELOPMENT PROGRAMME (MIDP) EXPORT DATA FOR COMPONENTS – FOB VALUE – Rm

		1999	2000	2001
3	Automotive tooling	264,0	362,2	440,8
8	Catalytic converters	2 569,1	4 682,5	8 989,0
11	Engine parts	382,6	408,9	519,7
15	Glass	146,5	170,7	240,9
20	Road wheels/parts	518,1	551,4	724,7
22	Seat parts/leather covers	1887,5	1926,0	2391,4
25	Silencers/exhaust pipes	597,9	377,4	282,1
29	Tyres	639,2	681,8	780,6
30	Wiring harnesses	304,3	319,0	390,8
	Others			
TOTAL		9674,3	12640,2	**18585,7**
Vehicles - (total MIDP)		5,080	7,400	**11,400**

From TISA, 2002

Opportunities presented by African Growth and Opportunity Act (AGOA) of the USA, together with continuous new export market penetrations and expected domestic market growth, are expected to lead to higher production volumes and sales, both locally and internationally, despite the decline in the global economy (TISA, 2001). Combined with exports, the total automotive activity has the potential to increase significantly and contribute greatly to employment, investment and the SA economy as a whole (Department of Trade and Industry, 2001).

Table 12: MAIN DESTINATION OF COMPONENT EXPORTS

	2000	2001
Germany	**41,0%**	**37,4%**
USA	**9,5%**	**12,1%**
UK	**9,5%**	**10,7%**
France	**4,4%**	**7,5%**
Belgium	**6,7%**	**5,5%**
Italy	**5,8%**	**4,1%**
China	**0,9%**	**2,4%**
Spain	**3,4%**	**1,8%**
Japan	**0,9%**	**1,7%**
Zambia	**1,0%**	**1,5%**
Zimbabwe	**1,9%**	**1,3%**
Netherlands	**1,3%**	**1,3%**
Mozambique	**1,0%**	**1,0%**
Austria	**1,2%**	**0,8%**
EU	**69,8%**	**70,5%**
NAFTA	**10,1%**	**12,5%**
AFRICA (incl. SADC)	**6,8%**	**7,1%**
SADC	**5,6%**	**5,8%**
MERCUSOR	**0,4%**	**0,5%**

From TISA, 2002

4.6 INVESTMENT

Interestingly, investment has been rising in both the assembly and the component sectors. Fixed investment in the assembly sector increased from R492m in 1994 to R2 078m in 2001 (Black, 2001 p13; TISA, 2002). New investments or investment approvals increased by 33% from R1 561,5m in 2000 to R2 078,2m in 2001 and a projected 61% annual increase to R3 347,6m in 2002 (Department of Trade and Industry, 2002a). This expansion is significant in the face of adverse market conditions and the declining protection that the industry faces. See Tables 13 and 14.

Table 13: INVESTMENTS BY OEMS IN BILLIONS

1996	1997	1998	1999	2000	2001
1,171	1,266	1,343	1,511	1,562	2,078

Table 14: New Investment / Investment Approvals : 2001 Actual and 2002 Projection

NAAMSA reports the industry's aggregate capital expenditure in Rand millions

	2000	2001	Projection 2002
Product, Local Content and Export Investments	1 108,7	1 072,1	2 137,8
Plant, Machinery and Production Facilities	2 025	727,9	839,7
Land and Buildings	109,7	33,3	64,1
OEM Support Infrastructure (including research and development/ engineering/ technical.)	140,6	244,9	306,0
TOTAL	**1 561,5**	**2 078,2**	**3 347,6**

From Department of Trade and Industry, 2002
[2001 Capex data from 8 large OEMs and 2 specialist truck manufacturers]

4.7 PRODUCTION

By 1999, improvement in both automotive industry productivity and labour productivity had been rapid, while employment had declined marginally. Fixed capital, the capital to labour ratio, and multi-factor productivity have all improved substantially. These improvements reflect the impact of the government's MIDP to reduce tariffs that facilitated re-integration of the local automotive industry into the highly competitive global network chains. This resulted in greater inflow of fixed capital, import of modern technology, greater diffusion of world class manufacturing and the increasing extension of lean enterprises into the SA automotive industry. See the National Productivity Institute statistics on motor vehicles, parts and accessories (Addendum J), interaction between productivity, employment and unit labour costs, productivity indices, etc. for the period 1990 to 1999 (see Addendum K).

Using 1995 as a base index of 100, the following changes occurred:

- Real output index first decreased to 90,7 in 1998 and then improved to 102,5 in 1999

- Employment decreased from 80 045 to 75 985 in 1999, as did real earnings per employee, from R41 968 to R 35 535
- The fixed capital input index improved to 111,2 by 1999
- The multi-factor productivity index rose marginally to 101,9 by 1999, reflecting an increase in the labour productivity index which rose to 108,0 but a decline in the fixed capital productivity index to 92,2
- Unit labour cost index rose to 105,7 but real earnings per employee decreased from 41 968 to 35 535 per annum
- Capital labour ratio index improved to 117,1 in 1999 (National Productivity Institute, 2001)

Productivity Indices

Productivity indices have a positive trend from 1993 onwards with capital productivity being somewhat of a retarding influence because of increased capital intensity in the sector while employment levels dipped in 1993 (Productivity, Jan/Feb 2002).

Despite this, labour productivity levels, in the motor vehicle parts and accessories sector, have improved consistently and most significantly in 1995 and 1999, when compared with unit labour cost and virtually static employment (Productivity, Jan/Feb 2002). See Addendum K.

The average assembly plant, however, compared unfavourably with assembly plants in other countries, due to low levels of automation and the complexity of most local assembly plants that produce a range of models in relatively low volumes. The rate of improvement has however, been rapid, with direct labour hours per vehicle being

reduced by 32% between 1994 and 1996. Similar improvements have been made in the component sector (Black, 2001b p 22).

Industry Capacity Utilisation Levels

Industry capacity utilisation levels continue to improve due to increased production for export markets and relatively buoyant conditions in the medium and heavy truck market. In recent years, South Africa's vehicle manufacturing capacity utilisation rate has moved upwards to competitive levels, close to the global average capacity utilisation rate of about 76,0%. (DTI, 2002) See Table 15. It is noteworthy that some plants are operating at very low capacity utilisation levels.

Table 15: AVERAGE MOTOR VEHICLE ASSEMBLY INDUSTRY CAPACITY UTILISATION LEVELS

	Year 1999	Year 2000	Year 2001	1st Qt 2002	1st Qt 2002 Range Low	High
Cars	64,6%	66,1%	72,2%	72,2%	30,9%	100,0%
Light Commercials	57,5%	60,2%	62,6%	70,2%	40,0%	80,7%
Medium Commercials	69,7%	64,2%	69,8%	76,5%	75,1%	78,0%
Heavy Commercials	61,9%	74,8%	78,1%	85,0%	74,9%	98,0%

From Department of Trade and Industry, 2002

4.8 QUALITY AND ENVIRONMENTAL STANDARDS

Rapid improvement to world-class manufacture levels is reflected in developments of quality and environmental standards. The automotive industry's quality standards are certified by way of the SABS ISO 9000 Registration Scheme that is recognised and implemented, internationally, by more than 70 countries including member states of the European Union, Australia, the USA, Japan, Singapore and India. The SABS ISO series consists of the following standards:

- SABS ISO 9000 - Quality management and quality assurance standards. - Quality systems
- SABS ISO 9001 - Model for quality assurance in design, development, production, installation and servicing. - Quality systems
- SABS ISO 9002 - Model for quality assurance in production, installation and servicing.

  SABS ISO 14001 - Environmental management.
- QS 9000 - Quality management applicable to the motor industry.
- VDA 6,1 - Quality management applicable to the motor industry (TISA, 2001)

ISO 9002

The drive to become a world-class manufacturer is to satisfy the requirements of SABS/ISO 9002 through a process of documentation, implementation, and then improvement of a structured quality system. Nissan SA introduced this process through assistance from Nissan Motors of Japan but relied on its South African culture to develop its own systems for day-to-day operations. ISO 9002 standard says that an organisation, its suppliers and customers need to identify, arrange and manage its network of processes and inter-relationships. If these processes are arranged, monitored and improved to give consistent quality outputs to each subsequent process, then a foundation for quality will prevail. This is a fundamental conceptual basis for the ISA 9000 family of quality standards (Productivity SA, May/June 1998).

An increasing number of component manufacturers are being registered, to conform to the QS 9000 quality management system, applicable to the motor industry. The

SABS Directory of Registered Suppliers to the automotive industry 2000/2001 indicated that 89 companies currently conform to the QS 9000 system, 40 suppliers conform to the VDA 6,1 quality management-applicable to the motor industry, and 170 suppliers conform to the ISO 9001/2. See Table 16 below.

Table 16 QUALITY STANDARDS OF DOMESTIC VEHICLE ASSEMBLERS

Domestic Vehicle Assemblers	Quality Standards
BMW SA (Pty) Ltd	Conforms to ISO 9001, ISO 14001 and BS 8800
Delta Motor Corporation (Pty) Ltd	Conforms to ISO 9001
Daimler Chrysler of SA (Pty) Ltd	Conforms to ISO 9001
Nissan SA (Pty) Ltd / Fiat Auto SA (Pty) Ltd	Conforms to ISO 9002 and ISO 14001
Ford Motor Company of Southern Africa / Land Rover SA (Pty) Ltd	Conforms to ISO 9002 and ISO 14001
Toyota SA Manufacturing (Pty) Ltd	Progressively implementing ISO 9001/2 throughout the plant. Currently the engine plant, trim shop, tool and die manufacturing, and one of the body shops, have already been certified by the SABS as conforming to ISO 9002. Implementation of ISO 14001, in all manufacturing operations targeted, to be completed by November 2002
Volkswagen of SA (Pty) Ltd	Conforms to ISO 9001, ISO 14001 and VDA 6.1

From TISA, 2001.

Apart from quality standards, environmental standards are also increasingly dictating vehicle manufacture. Conforming to SABS ISO 14001 is becoming a greater prerequisite for OEMs and component manufactures to export (TISA, 2001).

4.9 EMPLOYMENT LEVEL

Total employment in the vehicle manufacturing industry (assembly and components) increased from 73 800 in 1994, to 81 900 in the boom year of 1996, followed by a decline to 76 000 in 1999. See Addendum J. The decline is due to trade liberalisation, introduction of lean production measures and market growth. Market growth in turn

is due to the reduced price of vehicles in real terms. The automotive industry is exceptionally cyclical and with present moderate market growth, employment is again increasing. The export sector has now become a major source of employment. The prospects for massive productivity gains make employment losses in the assembly sector likely in the absence of rapidly expanding output, while the potential for employment growth will be primarily in the component sector (Black, 2001b p 22).

The number of persons employed by the South African vehicle assembly industry - comprising seven major vehicle manufacturers and eight specialist commercial vehicle manufacturers - is fairly constant around 32 473 jobs (the first quarter average of 2002) compared to 32 692 for calendar 2001 and 32 280 in 2000. Employment levels in the component manufacturing industry also continue to show modest growth (Department of Trade and Industry, 2002).

4.10 TRADE UNION INFLUENCE

Trade union involvement, labour stability and worker participation are important factors to build the lean enterprise, to reduce waste, add value, improve productivity and raise quality standards. NUMSA used a well developed vision to help create a viable assembly industry and its drive in the early 1990s was to have world class manufacturing standards, a democratic non-racial, human resource development with work reorganisation, adult basic education, training and multi-skilling, restructuring and participatory work organisation (Hirschsohn, 1997 p231-2; 1998b p47). NUMSA co-operated with the MITG in 1994 and is co-operating closely with NAAMSA, NAACAM, the Retail Motor Industry (RMI) and the government, in formulating recommendations to extend the MIDP to 2012 (Business Times, 28 July 2002).

The role played by NUMSA provided a distinct shift from adversarialism to co-determination in its striving for life-long job security, skills development, the introduction of quality measures, performance benchmarks, and industrial competitiveness for a world class industry. The outcomes of industrial action in Volkswagen were a form of contested co-determination, and at Gabriels an adapted form of co-operation. This outcome was influenced by parent company pressures to encourage diffusion of world-class manufacture practices to achieve improved productivity with an emphasis on team-building (Hirschsohn, 1997 p232;1998b p 45).

4.11 SKILLS DEVELOPMENT

Lean enterprise requires an educated, highly skilled and trained workforce engaged in continuous learning and problem solving skills. The Skills Development Act of 1998 that attempts to fulfil this requirement is greatly influenced by the German vocational model. It aims to develop skills of workers, raise their quality of life, improve productivity, promote self-employment, increase the levels of investment in education and training, encourage learnerships and training, and improve labour mobility. A National Skills Authority will develop apprenticeship programs with incentives for payroll deductions for business. The Skills Development Act involves tripartite institutionalisation of government, business (firm and sector level) and union structures (Barry and Norton, 2000; Vally, 1997; and Kraak, 1997).

4.12 CONCLUSION

The South African automotive industry, critically important to the local economy, faced a dire crisis due to inefficiency, high-cost, low productivity, protectionism, isolation, out-dated production methods, low-value added products, inward-looking

marketing and stagnant production which was incurred prior to 1994. In the face of present global overcapacity, the bold intervention of the government (together with labour and industry) initiated the Motor Industry Task Group to formulate the visionary MIDP which radically transformed and systematically reduced tariff protections, to re-integrate the industry into the highly competitive global supply chains of the dominant TNCs.

The seminal MIDP introduced supply side measures (and reduced demand side measures) which caused structural industrial changes, forced the increasing use of world class manufacturing methods, compelled more rigorous application of lean thinking, and encouraged the extension of global lean enterprises into South Africa that increased both export and import trade in vehicles and components. These rapid changes caused increased labour productivity, improved industry performance, higher investments, use of modern technologies and leaner production methods. The competitive impact of global re-entry will be critical and directly affect firm-level production, requiring a more fundamental industrial and operational re-organisation.

SECTION FIVE : SOUTH AFRICAN AUTOMOTIVE INDUSTRY: IMPACT AT FIRM LEVEL

5.1 INTRODUCTION

This section examines the impact of the MIDP and global industry trends on the South African assembly and components sectors at firm level. It attempts to show how firms in both sectors engage in a radical process of change through positive engagement to implement world-class manufacture production methods whilst competing globally by adopting dynamic export strategies and integrating into the international supply chain arena and global export networks of OEMs.

Some firms have achieved global levels of excellence and these are discussed together with findings of firm level research undertaken in the South African automotive components industry, in comparison with international counterparts, using the 'market driver' measurement system. Present and potential production processes, utilising indigenous resources, raw materials and skills, as well as international involvement for manufacturing components with increasing local content on both a competitive and qualitative basis, are briefly discussed.

5.2 RE-INTEGRATION INTO INTERNATIONAL SUPPLY CHAIN

The South African automotive industry was faced with an imperative of "Find an international partner or die", according to NAAMSA Executive Director, Clive Williams (Engineering News, 18-24 May 2001).

The government's positive policy response, driven by the MIDP was seen as one of the greatest economic success stories (Engineering News, 20-26 July 2001), which

introduced a radical process of change of the assembly industry aimed at high-volume production of fewer models, low-cost production strategies, and positive engagement with the components sector and labour (NAACAM, 2002). This dynamic strategy meant major adjustment and reconstruction, to re-integrate the local industry back into the international supply chain arena and the parent's global network, forcing it to comply with the manufacture of vehicles and components at internationally competitive levels and world-wide quality standards. This led to a rapid rise of local exports, many into niche markets and an equal growth of imports. Industry capacity-utilsation levels continue to improve and moved closer to the global average of 76% due to increased production for export markets and relatively buoyant conditions in the medium and heavy truck markets. Government helped in announcing phase two and three of the MIDP that provided a longer-term, predictable plan as a major boost to the industry (Business Times, 28 July 2002).

As in the rest of the world, the 7 local OEM assemblers hold a strong position in the industry that often led to confrontational relationships with retailers and the 200 component suppliers. The lifting of protection changed relationships up and down the supply chains as people realised the formation of partnerships is the only way forward. Export credits earned under the MIDP have attracted billions in foreign investment from the international principals of local manufacture and some OEMs import their entire range of vehicles based on MIDP credits earned by component export e.g. catalytic converters (NAACAM, 2002).

5.3 FIRM STRATEGIES

The German car manufacturers BMW, VW and DaimlerChrysler have led the way to diffuse world-class manufacture in South Africa, and spearheaded the export drive by being the first to fully embrace the MIDP programme. They are increasing vehicle exports and direct investment, but do not have a wide, global geographical distribution of plants. South Africa is benefiting from German globalisation strategies to expand capacity outside of high-cost Germany, as well as retaining their strategic foothold in the southern African market. Examples of local car makers plugging into the global networks of their principals include VWSA's Golf 4 export order to the UK; BMW's appointment as the sole global supplier of the BMW 3 Series; and DaimlerChrysler SA's contract to become the sole global supplier of C-class right-hand-drive Mercedes-Benz cars. These companies have also made some of the biggest fixed direct investments into South Africa (Barnes and Kaplinsky, 2000; AIDC, 2001; Black 2001b p 12; Business Times, 28 July 2002).

The primary characteristic of production for export is zero deviation from source design, quality figures comparable to world-class manufacture, as well as more aggressive development and start of production timing than was previously the norm. Adherence to these factors allows seamless integration into global sourcing and supply chains of vehicles by each manufacturer (AIDC, 2001).

5.4 ACHIEVEMENTS OF ASSEMBLY FIRMS

The extent of restructuring, in order to become globally competitive, is illustrated below by the manner in which the industry responded to become reintegrated into the international supply chain arena, its strategy of high-volume production of fewer

models and the rise in export sales. Imports of cars have grown equally dramatically. These strategies have allowed some firms in the South African automotive industry to compete very successfully in the global market - as shown below in Table 17.

Table17: OEMs, ACHIEVEMENTS, INVESTMENTS AND EXPORTS.

OEM	ACHIEVEMENT	INVESTMENT & EXPORT
VOLKS-WAGEN SA	Productivity levels increased to max 450 units per day, i.e. 75 000 vehicles a year from 4 platforms, including 30 000 vehicles export to Europe, depending on vehicle mix and market conditions (Productivity, Feb/March 2002). Difficult to compare productivity: Europe is highly automated and manufacture 300 000 on one platform (Business Times, 28 July 2002). Important to eliminate waste and stay viable. In world terms this country lags behind global best practice plants in Europe, US and Far East with its variables of robotics and automation at these plants (Business Times, 28 July 2002). Introduced KVPsq programme (German equivalent of continuous improvement) by creating shop-floor teams to ensure rapid acceleration of quality, productivity and performance improvements (Grutter, 1997). Major drive to recruit and train labour force with minimum maths, science and technical aptitude) to produce vehicles at same quality as European plants. Increase productivity by 70% in 3 years (total number of employees / number of vehicles) or 50% (direct assembly employees / number of vehicles) (Productivity, Feb/March 2002). Provide extensive training and encourage major mindshift: Apply continuous improvement strategy, adopt latest logistic techniques, multi-skilling, group work, customer-focussed to meet expectations at plant and dealership level (Productivity, Feb/March 2002).	Export Jettas in early 1990s to China and 30 000 Golf 4 units annually. 34% VW suppliers based in E. Cape (Business Report, 6 November 2001). Exports R2,5bn : leading exporter in 1999 and 2000 (Business Times, 28 July 2002). Diverse component export programme of R1,4bn in 2002: catalytic converters, engines, alloy wheels, rubber-metal parts (Business Times, 28 July 2002). Short-term component exports to Audi & VW plants expected to grow between R1bn to R1,4bn this year (Business Times, 28 July 2002).
BMW SA	Global quality award of "best manufacturing plant in Europe" and set global benchmark with 85 problems per 100 vehicles, ahead of BMW Munich (87), Toyota in Asia Pacific (91 - 93), General Motors in North & South America (93-100) and Daimler Chrysler's German Sindelfingen plant (94). (Business Times, 28 July 2002).	Will supply global needs of RHD BMW 3 series by raising production to 200 cars per day, three quarters of which will be exported (Barnes & Kaplinsky, 2000). Increase investments by R2m to R3,3bn. Expected to produce 60 000 units each year. Increase exports to R50bn, especially to USA, Japan (Business Day, 4 December 2001) Domestic production of 54 000, only 12 000 to 15 000 for local market (Business Times, 28 July 2002).

DAIMLER CHRYSSLER SA	Joined the global manufacturing network as the source of the Mercedes-Benz C-class RHD: based on quality, output and cost factors. 5 500 workers in 1989 produced 21 500 vehicles with ability to deliver on time and at right price (Business Times, 28 July 2002). Employ world-wide engineering standards equal to that of German production units. Multi-skilling of employees in mere 18 months ramp-up phase, became highly flexible, focussing on consistent quality, efficiency, constant improvement and high volume production (Business Times, 28 July 2002). Construction of most modern plant in South Africa as a logical step of their global expansion strategy. Invested heavily in skills training and education, and is linked to Bremen plant by way of a mentoring programme to train others locally and to multiply skills base (Business Times, 28 July 2002).	Large export contracts (and increase in South African market share) of Mercedes Benz achieve operating profit of R171,51m despite 3 week strike stopping production (compared to planned operating profit of R31,98m in 2001). Increase in turnover to R13,9bn from R8,5bn in 2000. (AIDC 2001; Business Day, 27 February 2002; Business Report, 28 February 2002). After 1 year achieved target of 37 000 vehicles, 28 000 exported to Japan, Australia, United Kingdom, Mauritius, Thailand and Singapore (Business Times, 28 July 2002).
NISSAN SA	Ongoing quality and productivity improvement programme according to ISO 9001 via Top Sindan audit and monitoring to Japanese benchmarks standards by Japanese executive vice-president. Involve everybody by creating a climate of freedom to act without fear as competencies belong to firm. Create a suitable culture for improvement at all levels and all functions within the global corporate environment to mobilize each individual for success. This revolution in top management enabled local Nissan affiliate to gain access to export markets within its respective world-wide groups (Harding, in The Quality Edge, May 2001).	
TOYOTA SA	Now fully integrated in international supply network of parent Toyota Motor Company for high-volume production and major leap in exports. Japanese investments now control 74,9% of local company: lead to doubling of production to 150 000 vehicles annually in five years with turnover of R15bn. Wesco (Wessels family) retain 25% in Toyota SA and will contribute its share to R1,2bn investment . Already 20 Toyota Motor Company specialists are assisting with this project with substantial quality and cost improvements for the new Corolla with good communications with staff, dealers, customers and media to inform them of changes to become a true global player (Business Times, 28 July 2002).	Toyota SA will embrace process of globalisation starting with export of new Corolla for the Australian market in 2003 (Business Day, 14 June 2001). Toyota Motor Company's total investment over next few years could reach R3,5bn and strengthen their commitment to South Africa. Gradually expand exports within and beyond Africa, resulting in employment growth of 10%. Target domestic market share of 25% and once this is reached, half Toyota SA's output would be exported. Aim to integrate SA company with global strategy of quality and competitiveness (Business Day, 28 July 2002).
AMERICAN-BASED COMPANIES	Not integrated their SA making operations into their global network to same degree. Could be due to their low equity stakes in SA subsidiaries, surplus global capacity and have assembly plants in all significant markets (Barnes and Kaplinsky, 2000; Black, 2001).	An opening of the American market to SA vehicle exports is slowly taking place and with opportunities presented by African Growth and Opportunity Act (AGOA). (TISA, 2001).

5.5 IMPACT ON SOUTH AFRICAN SUPPLIERS

Some component exports from South Africa, like catalyst-related exhaust system components, automotive leather, wheels and shock absorbers, to vehicle assembly plants and the after-market around the world, continue to break records. But a broader range of components is now being exported in significant volumes, reflecting South Africa's cost-competitiveness, technical sophistication and the ability to meet global requirements for reliable delivery at high levels of quality (NAACAM, 2002). See earlier, Table 11.

5.6 COMPONENT EXPORTS

Significant variations resulted from the alternative routes the MIDP provided into the foreign exchange, balancing that which was required if the assemblers were to be allowed to import components and cars duty free (Barnes and Kaplinsky, 2000). A large part of the local component industry is linked to international parents that source certain products from South Africa and do reciprocal imports (NAACAM, 2002). Assembly manufacturers are assisting component manufacturers in huge export contracts (thereby earning tradeable import credits), as illustrated in Table 18.

5.7 FIRM-LEVEL DIFFUSION OF WORLD -CLASS MANUFACTURE

BMW set the benchmark for the global best in quality with the lowest problems per 100 vehicles; DaimlerChryssler attained high-class productivity equal to German world-wide engineering standards; Volkswagen SA instituted continuous improvement at shop-floor level to global 'best practice' standards; Nissan introduced top management commitment to diffuse knowledge and competencies; Toyota intends

to introduce its classic system of continuous improvement with both high quality and productivity; and Gabriel practised a successful Kanban system with self-managed, high performance teams.

Table 18 : ASSEMBLY MANUFACTURER'S EXPORT COMPONENT CONTRACTS

ASSEMBLY MANUFACTURER	EXPORT COMPONENT CONTRACTS
Volkswagen SA	R2,16bn catalytic converters to Europe in the next five years. (Business Day, 27 July 2001). R95m deal is for the supply of alloy wheels and drive shafts to Audi in Europe. The contract will run for the lifetime of the Audi models, bringing the value of Volkswagen SA's component exports to R4,2bn (Business Day, 1 November 2001) Working on making the company a supplier to the European market of the next generation of Volkswagen vehicles, and great potential was forecast for component exports, which should reach R 1,5bn in value this year (Business Report, 3 September 2001).
Ford Motor Company SA	Created between 100 and 150 new jobs at the Port Elizabeth engine plant when it started operating at full capacity for the production of the 1,3 litre RoCam engine in the first quarter of 2003 (Business Report, 5 July 2001).
Delta Motor Corporation (49% stake held by General Motors)	Local manufacturers of the Opel and Isuzu marques, announced it has joined forces with manufacturer Petri SA in a R 22m leather-covered steering wheel deal destined for the Opel Omega in Germany during January this year. (Business Day, 12 March 2001).
Renault (France)	First consignment of R7,7bn export order for automotive catalytic converters placed by Renault, the French motoring giant, had been shipped to France and Spain (Business Day, 25 October 2001).

Gabriel

The diffusion of world class manufacture methods at Gabriel (local affiliate of one of the world's largest shock absorber manufacturing groups, Arvin Industries) led to a process of fundamental production reorganisation and adaptive co-operation, influenced by the parent company, after an initial period of adversarial labour-management conflict (Hirschsohn, 1997 p 248; 1998a).

As a result of this, Gabriel won major export contracts against world-wide competition and accounts for more than 15% of the company's global production.

The company had long dominated the aftermarket replacement field with a sophisticated chrome-plating plant that is run on state-of-the-art lean production techniques with cell-based manufacturing.

Kanban Streamline Manufacturing Process

Gabriel streamlined its batch operation at its Retreat plant, to a cell-based manufacturing process according to Kanban principles. This reduced labour cost, made enormous savings, cut space utilisation by one third and increased output. The Kanban system was used to develop, implement and utilise processes that are contemporary, easily modified and responsive to customers' requirements. Ultimately, the goal is the elimination of waste (rejects and scrap reduced from 5% to 0,8% and still decreasing with careful management of toxic chemicals) through the effective design of products and processes, the efficient use of human resources (labour reduced by 66%) and equipment, as well as the prevention, rather than the detection, of errors.

Gabriel registered numerous 'firsts' in product development e.g. to manufacture strut cartridges, adjustable shock absorbers, gas-pressurized shocks, gas springs, sealed struts and adjustable MacPherson cartridges.

Forefront of Automotive Technology and Quality

The entire Kanban system provides visual inventory control triggered by 'pull' signals between internal as well as external customers and supplies. It is a customer-oriented system that drives the development of a highly flexible manufacturing process that can respond to customer needs. Gabriel is intent on staying at the forefront of

automotive technology and increasing the quality of its service to higher standards day by day. Extra capacity is being installed on an on-going basis to meet ever-increasing demand for the Gabriel SA product - not only in South Africa but around the globe (Hirschsohn, 1997 p 248; 1998a; Western Cape Review of Commerce and Industry, 2000 p 32).

Toyota SA a former independent, indigenous licensed assembler, was formerly not directly influenced by its Japanese OEM and practised a policy of "Toyotaism without co-operation" (Hirschsohn, 1997 p239). Now that the parent company has obtained the majority share in investments and management in Toyota SA, the classic model of Toyota's lean production could be introduced into the local industrial system. Initially twenty parent company specialists are helping to promote continuous improvement, increased productivity, top quality and the doubling of exports.

The diffusion is even more likely to be implemented in partnership with a visionary union like NUMSA that has compatible strategies to achieve world-class industrial restructuring, work re-organisation, improved quality, higher productivity, democratic human resource development, training, adult basic education and skills formation (Hirschsohn, 1997 p 232). Labour relations have been good by world standards for four years. The assemblers have made huge strides in three-year agreements and the component industry will soon announce ground-breaking agreements. Union management is working with manufacturing management in the component industry to win international confidence (NAACAM, 2002).

The history of industrial experience in the above firms tend to confirm Hirschsohn's observation that lean production cannot be transplanted without recognising the

distinctive social and institutional context in which it develops. A single pattern of workplace transformation therefore appears unlikely to emerge because each firm is influenced by the distinct local configuration and the history of industrial relations of each plant. Volkswagen SA and Toyota SA, for example, initially experienced contested co-determination that was constrained to particular techniques by industrial conflict and management's control of 'intellectual capital'. Gabriel, after a major strike, developed adaptive co-operation that was capable of systemic utilisation which showed potential of improved productivity and human resource benefits without major capital investment.

The automotive multinational corporations transfer their domestic practices of lean production - continuous improvement, just-in-time, zero defects, tiered supplier relations, cross-functional self-managed teams, simultaneous engineering, supplier hierarchies, larger subsystems from fewer suppliers, global benchmarks, elimination of waste, integrated information systems, decentralised responsibilities/ integrated functions, pull instead of push, lean buffers, customer involvement, aggressive marketing, and global network knowledge structures - to different social, political, cultural, economic and industrial contexts, with variability and a considerable degree of adaptation to local conditions. This transfer of lean production techniques and the need to achieve world-wide quality standards (the extension of the lean enterprise) compelled the leading local automotive firms to move away from mass production techniques towards more fundamental industrial restructuring, in line with world - class manufacturing standards.

Hirschsohn (1997, p 231-250; 1998b p 46) observed that diffusion of world-class manufacture methods was more influential from giant trans-national automotive corporations on the macro level (with cutting-edge lean enterprises) to micro level local affiliates or joint-venture firms. Tables 17 and 18 seems to confirm his observation that this diffusion was more likely in local firms that are integrated into their parent global commodity supply chains, than with independent firms that are not competing internationally in the export markets.

5.8 RESOURCES AND SKILLS FOR MANUFACTURING COMPONENTS

NAACAM (2002) believes that South Africa, rich in raw materials and skills that could be beneficiated locally into virtually any component required for modern vehicles, can generate enormous savings in logistical and other costs (NAACAM, 2002). See Table 19 below.

Table 19: RESOURCES AND SKILLS FOR MANUFACTURING COMPONENTS

Resources and skills	Advantage or Possibilities
Iron ore and metal skills: Valuable iron ore reserves; rich skills and equipment for forging, casting and working all metals	South African Iron and Steel industry very experienced in meeting the needs of the automotive industry in the new so-called light-weight steels; will be internationally competitive in three years in the flat products (NAACAM, 2002).
Increased use of Aluminium and light-weight alloys: Aluminium resources, expertise and practical experience available; some companies show world-class manufacturing capabilities (NAACAM, 2002).	Automotive makers increasingly using aluminium (now exceeds plastic for average vehicle content, second only to iron and steel) and light-weight alloys in body panels and in a wide range of components. The local material content in cars could approximately double in a whole new range of components and sub-components, with the increased volume of cars. Improving their competitive advantage by reducing weight, improving fuel consumption and making vehicles easier to recycle. The sophisticated, light-weight alloy rear suspension for the new Ford GT40 car is made in the Western Cape.
Meeting Recycling Requirements: Daimler-Chrysler SA doing research using natural materials such as sisal fibres	Automotive engineering to meet new recycling requirements of the European Union and other world markets (NAACAM, 2002).

5.9 POSSIBILITIES FOR THE FUTURE

The scramble for mergers and acquisitions amongst large component firms as a result of the introduction of tiered supply chain structures has both a direct and indirect impact on South African component firms. The T & N's takeover by Federal Mogul, and Mannesmann's take-over of Phillips Car Systems has meant that T &N's and Philips' South African operations are now part of entirely different global supply chains (Barnes, 2000 p 63; Barnes and Kaplinsky, 2000).

South Africa is a very small local market with 7 OEMs. Successful foreign involvement could centre around partnerships to produce locally for export. First world production facilities exist in a large number of companies that have already made the transition to world-class performance and are successfully integrated into the international supply web and could well be potential partners (NAACAM, 2002). However, not all suppliers in South Africa are in international mode. There is little chance of comparatively small South African firms operating as independent first-tier component firms as an indirect result of the global supply chain consolidations that are taking place (Barnes, 2000 p59). As with all economies in transition, some local component manufacturing companies feel threatened and need to establish international contacts to survive for licensing/ technology/ market access/ niche opportunities (NAACAM, 2002). See Table 20 below.

Table 20: COMPONENTS: POSSIBILITIES FOR THE FUTURE

Resources and skills	Advantage or Possibilities
Most auto technology stems mostly from the USA (40-50%), the UK (20%) and Germany (20%). NAACAM, 2002.	Many component manufacturers are in the process of establishing technology-sharing arrangements with European, Japanese or American component and system suppliers, allowing the local supplier access to the required intellectual property for the component or system (AIDC, 2001).
The radical change in vehicle technologies in forthcoming models	Local component suppliers must keep pace with this rapid change, and construction methods to achieve cost and weight savings. (AIDC, 2001).

Many independent suppliers are increasingly forced to supply products to the first-tier suppliers	First-tier suppliers integrate component into a modular system that is supplied on a just-in-time basis to the OEM, or also to a lesser extent to OES (Barnes, 2000).
German and British contacts at high level	Produced ' A Centre of Excellence' that could have a big impact, much like in Japan and Australia (NAACAM, 2002).
Independent supplier input, and local technology developed around local climatic conditions	Certain types of components need to be altered or designed for African operating conditions, such as suspension systems, vehicle security systems, seating, certain interior and exterior trim components, heat transfer systems and exhaust systems (Barnes, 2000). Some unique South African-developed technologies are available, e.g. a differential lock to give off-road vehicles performance similar to a 4x 4 at a fraction of the cost; aluminium welding technology for radiators; and design of components such as air cleaners and air conditioners appropriate to South African conditions (NAACAM, 2002).
Many independent firms survive by selling, both nationally and internationally, into the independent, more technologically stable automotive after-market (Barnes, 2000).	After-market is large with a long history of automotive production in the country and the average age of vehicles on South African roads (in excess of 10 years) (Barnes, 2000). Firms with strong brand names or economies of scale, are somewhat buffered from the threats posed by the tiering of the automotive components industry (Barnes, 2000).
Local producers frequently can do short runs.	E.g. at model run-out or for lower volume vehicles like Volvo or Porsche at low cost (NAACAM, 2002).
Competitive tooling under a foot (30cm).	Same quality as in Europe, but at lower cost (NAACAM, 2002).
A high degree of manufacturing flexibility is available.	Compared to overseas plants.
Access to Southern hemisphere markets closer to South Africa.	Distance- related transport costs are lower (NAACAM, 2002).
Technological developments like fuel-cell-powered vehicles, are becoming a realistic alternative to the petrol engine.	South Africa may take a big share of the global industry. Fuel cells depend on platinum to generate electricity, and platinum-rich SA could benefit from the new technology. Toyota plans to start limited marketing (by 2010) of a fuel-cell hybrid passenger vehicle to governments, research institutions and energy-related companies for a trial period (Business Times, 28 July 2002).

5.10 ADOPTION OF WORLD-CLASS MANUFACTURE

Barnes (2001a) undertook extensive firm level research in the SA automotive components industry in comparison to its international counter-parts, using the

'market driver' measurement system (utilised by the Industrial Restructuring Project for the DTI over the last few years). Using non-financial performance indicators, he critically examined their competitive progress since 1994, when the industry became exposed to intense international competition and the environment of globalisation. The firms were analysed in terms of cost control, internal and external quality, external (value chain) flexibility, operational flexibility, human resource development and innovation capacity (Barnes, 2001b p 6).

The key findings revealed that

- The domestic automotive components industry is, on average, moving in the right direction in terms of adherence to world-class manufacturing principles. This is evident in terms of almost all of the performance indicators generated for the SA-based firms. Performance improvements have been variable across different operational areas but improvements have clearly been evident, with no deteriorating performance visible. Key measures exhibited impressive average improvements such as customer return rates, internal reject rates, total inventory holding, absenteeism and output per employee levels in real inflation-adjusted terms. Measures such as lead times, and research and development expenditure have remained largely unchanged, while manufacturing through-put times have deteriorated somewhat (Barnes, 2001b p 6). See Addenda L and M.

- The industry appears to be improving its competitiveness at a fast pace, albeit unevenly, thus suggesting that is does have the propensity to 'catch up' to the continuously improving frontier of international competitiveness, with significant improvements recorded for most of the market drivers explored (Barnes, 2001b p 6).

- The SA components industry has moved forward very rapidly in terms of cost control, and external and internal quality performance. Performance improvement has been less impressive for external (value chain) flexibility and operational flexibility. The remaining two market drivers - of capacity to change (including human resource development) and innovation capacity - have produced mixed performance indicators. The innovation capacity findings are impacted upon by external economic factors connected to R&D facilities, which are located mainly in the developed countries (Barnes, 2001b p 6). See Addenda L and M.

- It is questionable whether the SA automotive component manufacturers can achieve world-class performance standards because there is a significant gap between the average operational performance standards of the South African based firms and that of the international firms included in the survey. The leading firms in the domestic automotive components industry have yet to achieve the performance standards of the leading international firms. For example, for the three key measures of total inventory holding, customer return rates and absenteeism, the gap between the average performance standards of the SA based firms and that of the international firms in 2000 was 19,5%, 151,7% and 17% respectively (Barnes, 2001b p 6).

- The leading SA firms generally perform at levels ahead of the international average but the magnitude of the gap between the best performing South African based and international firms is often as large as the gap between average performance levels, illustrated by using inventory control, customer return rates

and absenteeism rates as examples. The difference between the South African and international upper quartile figures for these three measures was 6,1%, 62,2% and 33,9% respectively (Barnes 2001b p 6).

- Potential blockages to the industry's competitiveness progress were identified as extremely weak second and third tier domestic suppliers, weak capacity to change initiatives at both the management and labour levels, as well as low levels of capital investment (Barnes, 2001b p 7).

This is an arena of research that must be conducted to gain a better understanding how these key impediments to the competitiveness of the industry can be over-come.

- A large number of the surveyed firms are now very successful exporters; whilst the general economic trajectory is also very positive (Barnes, 2001b p 7).

- Employment levels at the surveyed firms, increased by 10,9% from 1999 to 2000, and turnover levels in inflation-adjusted terms have increased by 17,5%, mark the most positive annual change recorded at the surveyed firms over the last seven years (Barnes, 2001b p 7).

- Profit margins before tax are once again showing a positive trajectory, after a number of years of declining levels.

- At the operational competitiveness level, significant recent progress has been recorded amongst 27 surveyed South African firms, whilst at the economic level the firms are looking increasingly healthy, after a number of years of decidedly lethargic performance. Despite this, the firms are, on average, still performing at levels 3-4 years away from matching the average for the group of 21 international firms' present performance level (assuming that the rate of change amongst the SA firms remains constant). Despite the leading SA-based firms performing at average international levels, only a few SA-based firms are performing at world class levels in any of the measures explored (Barnes, 2001b p 7).

- Additionally, the overall competitiveness trajectories of the upper and lower quartile figures suggest performance convergence for certain key measures. This is being driven most strongly by the lower quartile of firms that are rapidly catching up to the performance standards of the average and leading performers in the SA automotive components industry (Barnes, 2001b p 7).

Barnes argues that despite the very positive economic prognosis for the surveyed firms, with the industry slowly moving from a mass production model towards one based on world-class manufacturing standards, the findings are skewed by the significant performance divergence (as opposed to convergence on certain key measures, as mentioned above). This is because the upper quartile of firms are presently improving their output by substantial levels, whilst the lower quartile of firms are still struggling to maintain their output levels. These appear to be contradictory findings and require further elaboration.

He argues that much of the recent economic success of the industry is not therefore a direct result of operational competitiveness, but rather MIDP- linked export incentives, the devaluation of the Rand against major currencies and the recent upturn in the SA automobile market.

The DTIs supply-side support for the automotive components industry consequently needs to be consolidated to ensure that further competitiveness progress is made and that performance standards match that of the international competition. Whilst this will not guarantee the intractability of the industry's positive growth momentum, given political economy issues associated with the industry's immersion into global value chains, it is a necessary condition for the industry's future economic success (Barnes, 2001a; 2001b P 7).

Therefore, for the South African automotive components industry to succeed economically in the open, highly competitive operating environment, it is critical that competitiveness improvements continue to be made and that adherence to world-class manufacturing principles become standard practice. However, the industry is also likely to struggle over the next five years as international competitors increase their presence in the domestic market (in line with further tariff reductions) and DIT-derived exporting benefits become less lucrative (Barnes, 2000 p 70; 2001b p 7; Barnes and Kaplinsky, 2000; Black, 2001 p 22).

SECTION SIX: CONCLUSION

In a climate of rampant globalisation, trade liberalisation, over-capacity and intense global competition the new South African government, after inclusive consultation with assemblers, component manufacturers and labour, implemented the radical policy transformation, the MIDP. This policy, which compelled the local automotive industry to re-integrate with global automotive industrial chains and their international market networks, appears to becoming remarkably successful, given the inefficient, uncompetitive and stagnant production system inherited from the apartheid period. However, while it was easy to legislate tariff reductions to liberalise trade and promote exports, it was infinitely more difficult to implement the greater institutional support required by the industry in a period of rapid transformation.

Many assemblers, in co-operation with the leading component firms, achieved the objectives of the first phase of the MIDP and rapidly increased exports, secured substantial investments, upgraded technological capabilities and improved quality to world-wide standards. Some, like BMW, set world-wide benchmarks in reducing production defects which demonstrates that South Africa has the potential to successfully compete globally, an achievement that could be emulated by other firms. However, a large number of second and third tier component firms are struggling for survival and during the second and third phase of the MIDP they will either have to adopt world-class manufacturing standards and compete at global levels, or flounder.

The South African components industry's growth momentum is dependent on two factors. Firstly, adopt, successfully implement and continuously improving the whole range of world-class manufacturing principles to meet the global competitive

challenge, and secondly to be fully integrated into a viable global automotive commodity supply chain while being flexible to adapt to any mergers, acquisitions or supply chain changes.

Potential blockages to progress were identified as extremely weak second and third tier domestic suppliers, as well as weak capacity to change initiatives at both management and labour levels. This is exacerbated by the generally low literacy levels amongst workers, due to the legacy of inferior apartheid education, and requires the development of a culture of improving worker competencies, ongoing intensive training with active worker participation, and modern human resource development. This must be fostered to strive for high productivity, self-managed work teams with increasing responsibilities, greater autonomy in operational decision-making and a striving for zero defects, in order to compete at international level. For this to happen, individual firms will have to introduce sound contemporary management skills, by breaking the old blinkered mentality of Fordist mass production and implementing modern lean production methods and operating strategies. (See Addendum N.) Firms must shed past behaviour patterns and be able to identify niche markets, recognise the importance of non-price factors and take account of segmentation in re-orienting business strategies (Kaplinsky & Morris, 1999 p 731; Barnes, 2001a) .

In addition, the past adversarial industrial relations, slowly changing to a practise of constructive co-determination with trade unions (as spearheaded by NUMSA) should become more widespread, in order to accelerate continuous improvement at both firm-level and in the industry.

Local firms, still performing on average at levels three to four years away from matching the average international firms' performance level, will need to radically transform and re-organise their production systems to lean enterprises, rather than modify their mass production methods. This change is necessary to eliminate costly waste, rejects or reworks, institute state of-the-art just-in-time production methods, drastically reduce inventory holdings, minimise absenteeism, create external (value chain) flexibility, operational flexibility and innovation.

On the positive side, it was shown in Table 18 that excellent inter-firm and supplier relations developed when leading assemblers assisted in promoting component exports in order to earn credits under the MIDP, instead of the previous confrontational relationships which had prevailed (NAACAM, 2002). Such supplier as well as customer relationships should be systematically developed and formalised by industry associations. The building of effective supplier relations (whether first, second or third tier) should therefore involve pooling resources, build collective economies of scale, multi-lateral problem-solving, mutual understanding of systems, procedures and processes for seamless flow and flawless fit, and critical relation-specific investments in dedicated plant and equipment, to minimize costs. It should also involve high levels of information sharing, improving inter-company communications, state-of-the-art training, close functional relationships and effective performance monitoring. Firms can thus focus on their 'core' competencies, outsource 'non-core' activities to outside suppliers, facilitating shorter design or manufacturing periods to market or customer per product (that may be integrated into a modular system) through just-in-time, that involve supplier control over the logistics

chain of the component, or the application of parallel development or co-development responsibilities within the automobile industry.

A further strategy, which proved to be relatively successful was to couple tariff reductions with strong export support rather than simply liberalising imports. This provided a strong catalyst for the global automotive supply chains to strengthen their ties with their South African licensors and subsidiaries and drawing them into their global networks (Black, 2001b p 22). Although a large number of independent component firms in South Africa are rapidly employing world-class manufacture practices, it does appear that the third phase of the MIDP (which drastically reduces tariff protection) will leave many casualties. A likely event is the further entry of global first-tier component manufacturers into the South African market. This entrée by TNCs could result in existing firms forming close supply relations in joint ventures, or being absorbed in mergers or acquisitions as local subsidiaries, or building close alliances and supplier relations as independent firms with OEMs and their tiered supply chains. This requires ongoing research on the strategic objectives or requirements of various global value supply chains on the issue of connectivity into the local industry, other exogenous factors of firm-level success and of the broader political economy of the automotive industry (Barnes, 1999 p 15; 2000 p 70; 2001a p 4-6, 126,145; 2001b p 6-7; Black 2001b p22).

Lean enterprise, the mode of operation of TNCs, is however not fully applied in South Africa. The essence of lean enterprises is the technique of specifying maximum value-added per product, identifying its entire value stream, making the value flow without interruptions, letting the customer pull value from the producer and pursuing

perfection or zero defect in production. Its diligent application, therefore, would allow firms to develop world-class production and operation capabilities in order to sell their products at the same quality, price, reliability and appealing design into the domestic as well as global markets (Womack et al, 1996; Barnes and Kaplinsky, 2000; Barnes, 1999 p 15; 2000 p 70; 2001a p 4-6; 2001b p 6-7; Black, 2001b p 22).

Although government initiatives supported the transformation of the industry, it lacked the capacity to implement greater institutional support. Government should develop the capacity, acting jointly with industry to establish institutional support, sound governance and mutual co-operation in order to set global benchmarks for firms which will consolidate supply-side support, and close the gap at a fast enough pace between local and international performance levels. In order to ensure the future success of the automotive industry and its promotion of lean enterprises, modern world-class standards must be rigorously enforced as a fully integrated automotive policy. All assembly and component manufacturers should assist one another to raise competitive advantage, utilise local resources, skills and abundant raw materials (like aluminium, iron and steel, platinum, etc), develop overall lean production standards, increase trade, as a mandatory requirement to improve the balance of trade and profitability of the industry (Kaplinsky and Morris,1999; Barnes, 2000, Barnes and Kaplinsky 2000; Barnes, 2001a; Black 2001b; NAACAM, 2002).

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Table 10.1 Growth of automobile production by major countries, 1960–95

Country	1960		1989		1995	
	Production (000 units)	World share (%)	Production (000 units)	World share (%)	Production (000 units)	World share (%)
France	1,175	9.0	3,409	9.6	3,050	8.2
Germany	1,817	14.0	4,564	12.9	4,360	11.8
Italy	596	4.6	1,972	5.6	1,423	3.8
Spain	43	0.3	1,639	4.6	1,959	5.3
Sweden	108	0.8	384	1.1	388	1.1
UK	1,353	10.4	1,299	3.7	1,532	4.1
Canada	323	2.5	984	2.8	1,339	3.6
USA	6,675	51.4	6,823	19.2	6,350	17.1
Japan	165	1.3	9,052	25.5	7,611	20.6
Korea	–	–	872	2.5	2,003	5.4
Malaysia	–	–	94	0.3	195	0.5
Taiwan	–	–	–	–	282	0.8
Argentina	30	0.2	112	0.3	227	0.6
Brazil	38	0.3	731	2.1	1,303	3.5
Mexico	28	0.2	439	1.2	699	1.9
Australia	–	–	357	1.0	292	0.8
Czech Rep.	–	–	184	0.5	228	0.6
Poland	–	–	289	0.8	392	1.1
World	12,999	100.0	35,455	100.0	37,045	100.0

Note:
– data unavailable.

Source: OECD (1983, *Long-Term Outlook for the World Automobile Industry*); AAMA (1996, *World Motor Vehicle Data*); SMMT (1996, *World Automotive Statistics, 1996*).

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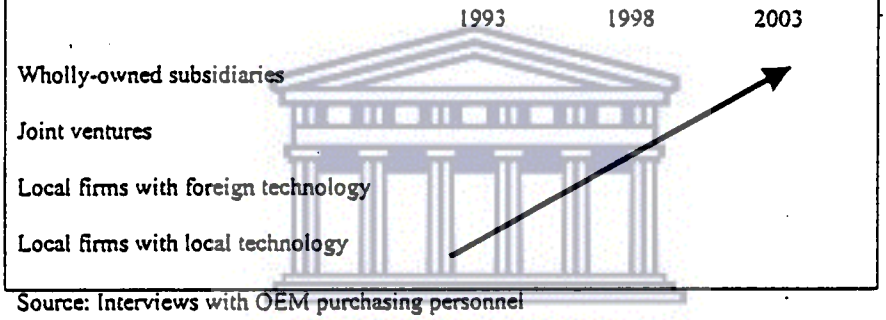
Sales of new motor vehicles by world region, 1995, 2000, 2005, 2010				
Vehicle sales (000)	**1995**	**2000**	**2005**	**2010**
Western Europe	13583	16642	15859	16750
Japan	6865	5964	5825	5810
Nafta	16089	19802	18380	20020
Pacific rim	5689	6016	7671	9551
South America	2382	1760	2075	2750
Eastern & Central Europe	1892	3021	3235	3840
Other markets	1698	1747	1997	2510
Total	**48198**	**54951**	**55042**	**61231**
Source: autoPOLIS Figures for 1995 and 2000 are actual, remainder are forecasts				

ADDENDUM C

Figure Two: Changing strategic perspectives on the preferred ownership of South African based automotive component suppliers



Source: Interviews with OEM purchasing personnel

From Barnes, 2001b

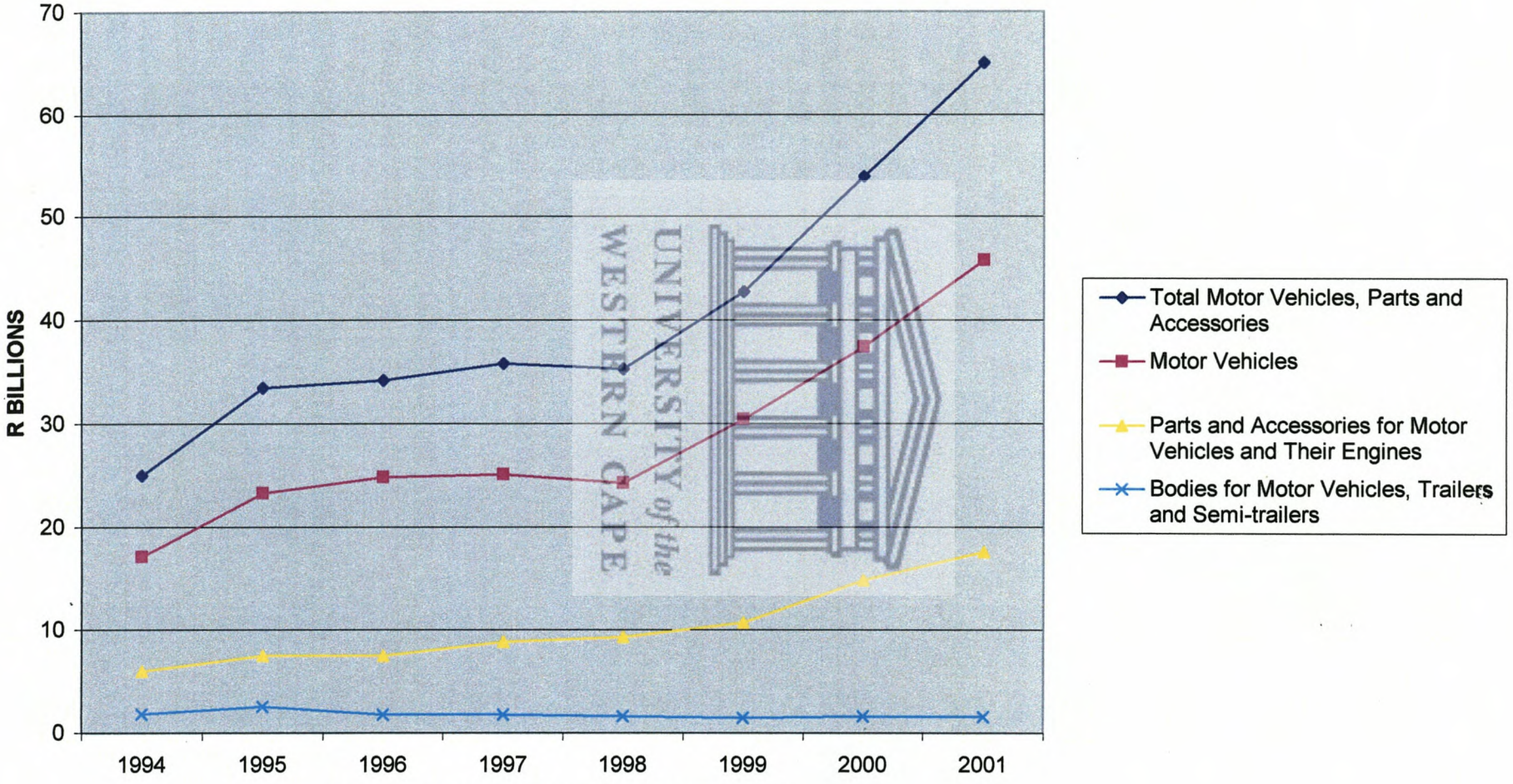
INDUSTRY VEHICLE SALES, EXPORT AND IMPORT DATA : 1995 – 2003

	1995	1996	1997	1998	1999	2000	2001	2002	2003 PROJECTIONS	2004
CARS										
Domestically Produced										
Local Sales	233 512	231 616	215 784	174 870	159 944	172 373	173 231	163 500	172 000	178 000
Exports (CBU)	8 976	3 743	10 458	18 342	52 347	58 204	97 307	124 500	153 000	165 000
Sub-Total	242 488	235 359	226 242	193 212	212 291	230 577	270 538	288 000	325 000	343 000
CBU Imports										
NAAMSA	7 246	18 268	23 978	28 951	29 426	51 749	65 829	62 000	70 000	75 000
Non-NAAMSA	15 059	23 500	28 000	31 000	25 000	10 000	12 500	10 000	12 000	12 000
	22 305	41 768	51 978	59 951	54 426	61 749	78 329	72 000	82 000	87 000
TOTAL LOCAL MARKET	255 817	273 384	267 762	234 821	214 370	234 122	251 560	235 500	254 000	265 000
LIGHT COMMERCIALS										
Domestically Produced										
Local Sales	128 397	129 575	113 992	99 778	96 169	105 235	113 111	103 000	110 000	114 000
Exports	6 356	7 125	8 000	6 806	6 581	9 148	10 229	9 500	10 000	10 500
Sub-Total	134 753	136 700	121 992	106 584	102 750	114 383	123 340	112 500	120 000	124 500
CBU Imports										
NAAMSA							2 035	3 000	4 000	4 000
Non-NAAMSA	3 000	3 500	3 762	4 100	3 500	3 000	2 500	2 500	3 000	3 000
LOCAL MARKET	131 397	133 075	117 754	103 878	99 669	108 235	117 646	108 500	117 000	121 000
MEDIUM AND HEAVY COMMERCIALS										
NAAMSA sales	11 803	13 567	12 759	11 511	10 236	11 725	12 693	12 500	13 000	13 600
Exports	432	685	1 111	748	788	679	465	500	550	580
Imports (Non-NAAMSA)	950	1 050	1 000	1 300	1 500	2 000	2 200	2 400	2 600	2 800
MCV/HCV MARKET	12 753	14 617	13 759	12 811	11 736	13 725	14 893	14 900	15 600	16 400
TOTAL AGGREGATE MARKET	399 967	421 076	399 275	351 510	325 775	356 082	384 099	358 900	386 600	402 400
TOTAL AGGREGATE EXPORTS	15 764	11 553	19 569	25 896	59 716	68 031	108 001	134 500	163 550	176 080
GDP GROWTH RATE	3,1%	4,3%	2,6%	0,8%	2,1%	3,4%	2,2%	2,3%	3,0%	3,5%

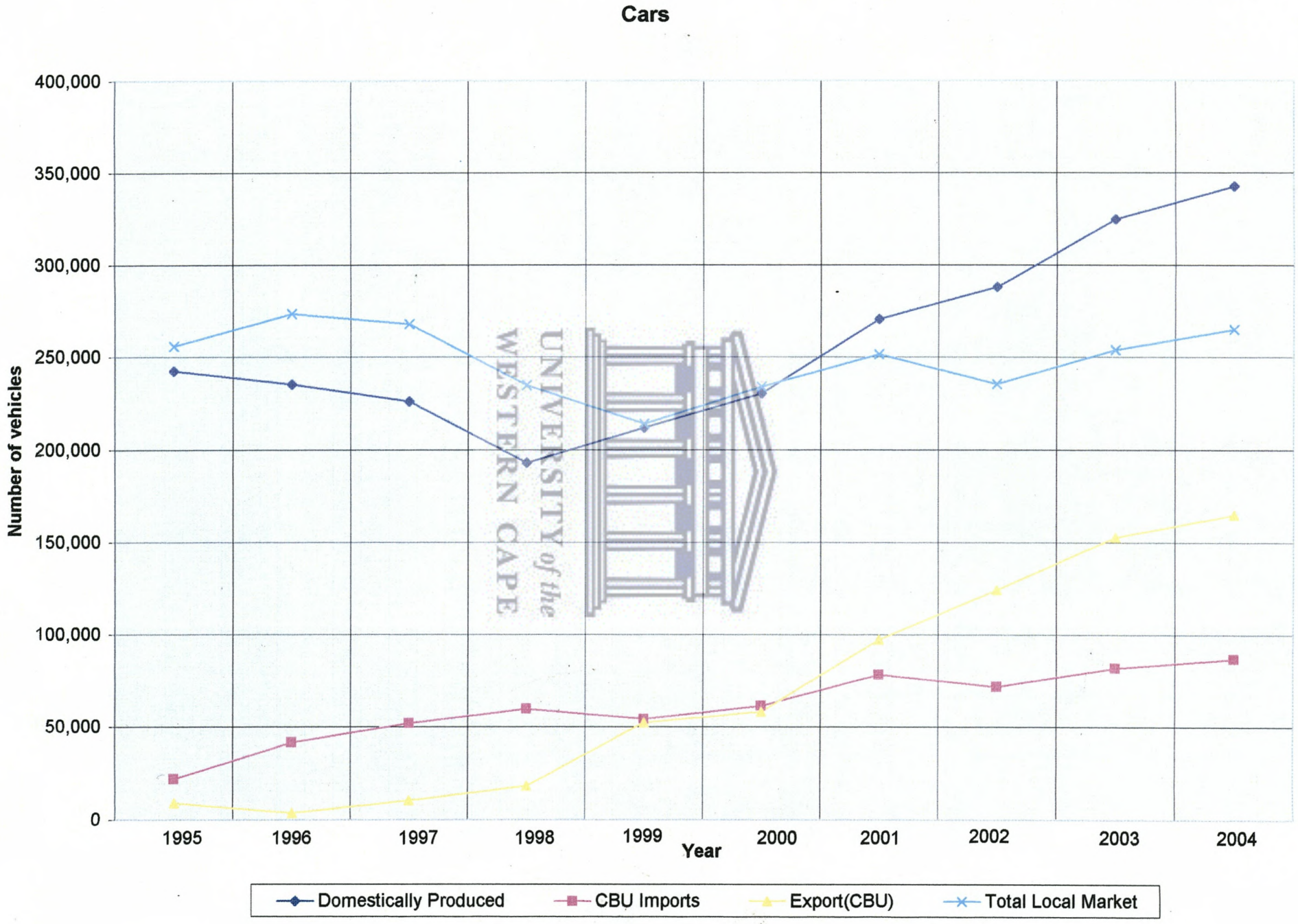
Notes:
From year 2000, car market includes Renault and Volvo.
Domestically produced cars and lcv totals represents a proxy for aggregate local production.
Data excludes imported vehicles which have been re-exported. In 2001, 292 imported cars were re-exported.
Information based on data collected by NAAMSA and estimates of non-NAAMSA sales.
GDP growth rate represents GDP annual changes at market prices in real terms.

May, 2002

TOTAL MANUFACTURING : MOTOR VEHICLES, PARTS AND ACCESSORIES

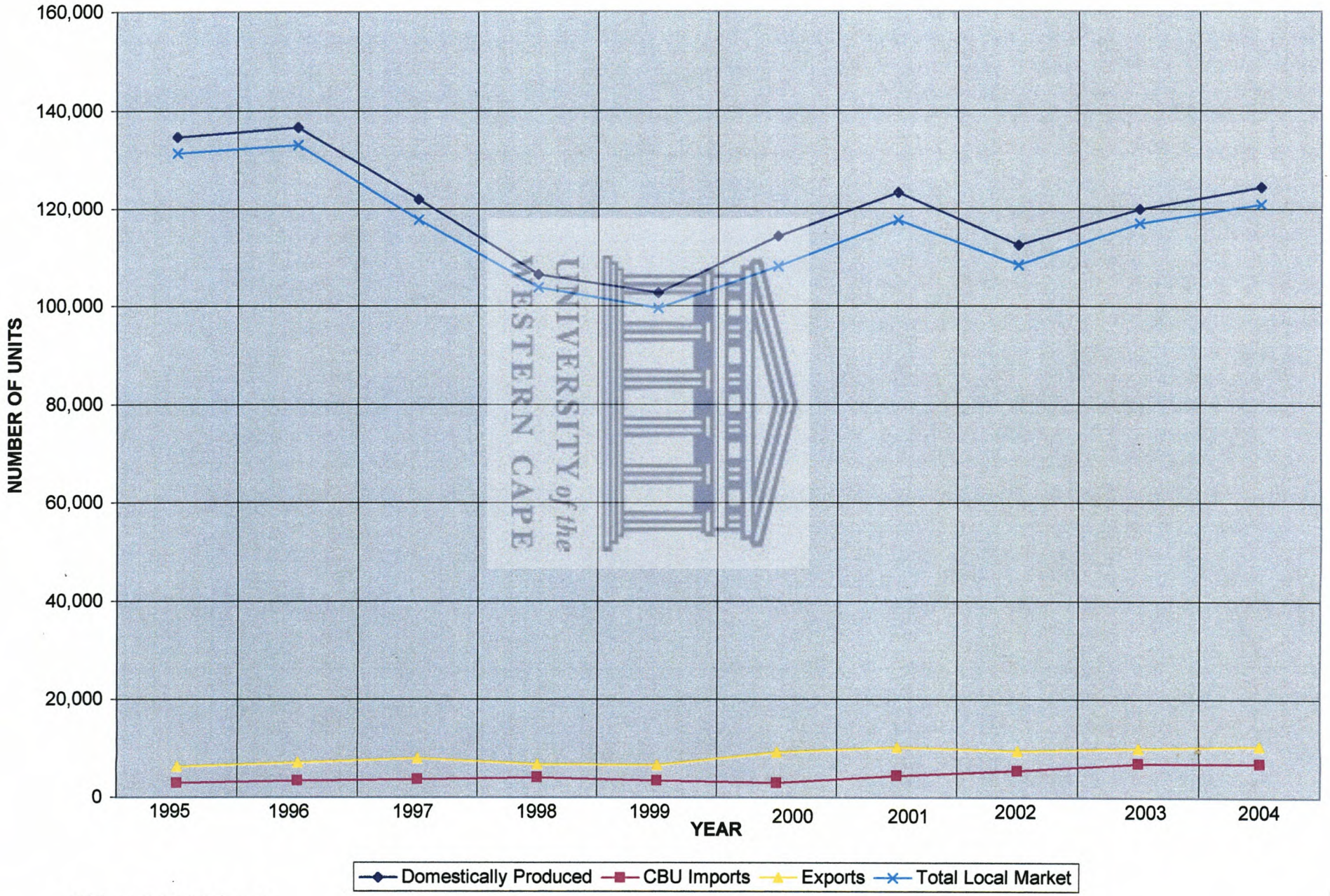


Source: Statistics SA : Bulletin of Statistics
Vol 36(2), 36(1), 34(1), 32(3 & 4), 31(1)



Source: NAAMSA, 2002

LIGHT COMMERCIALS



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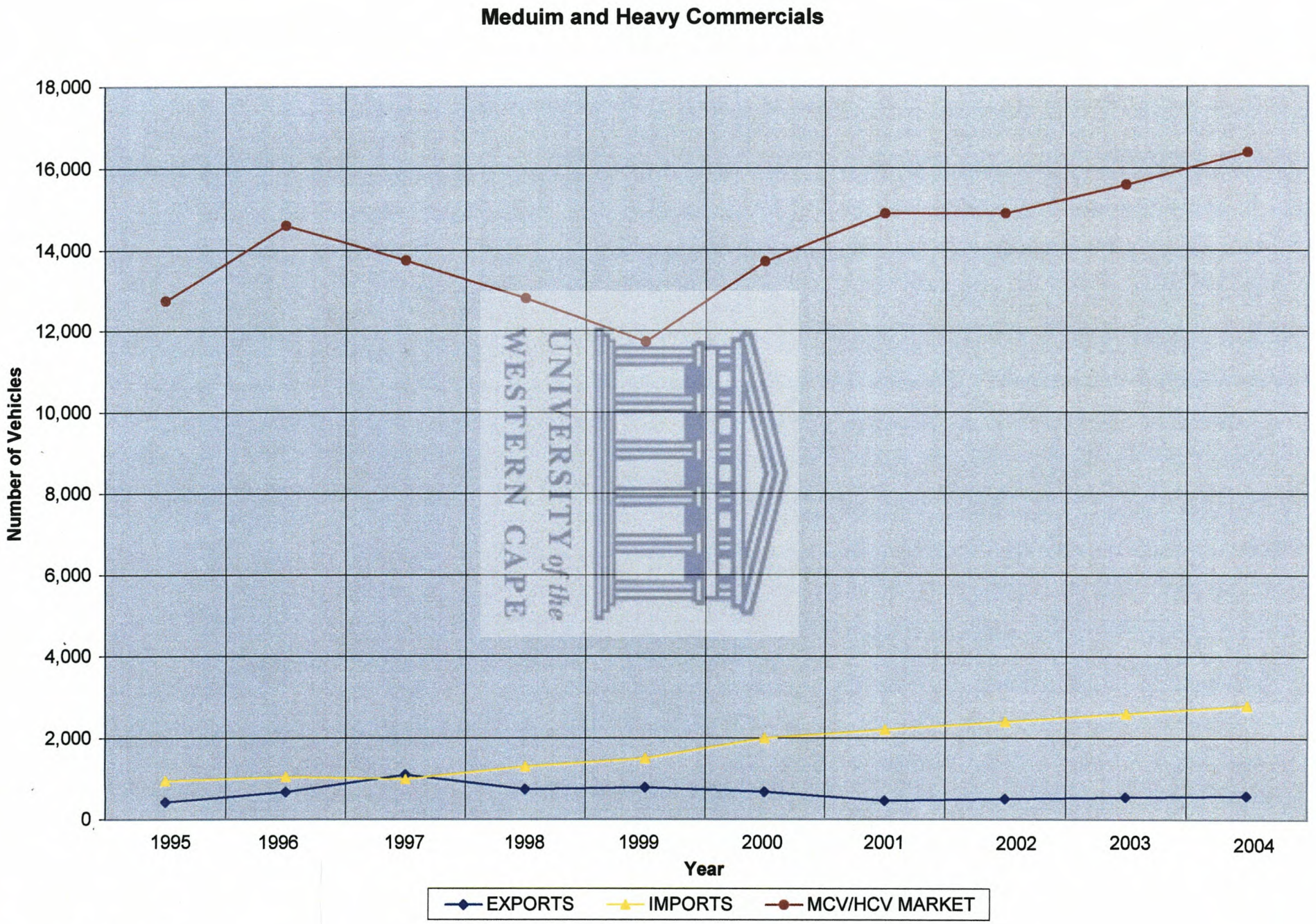
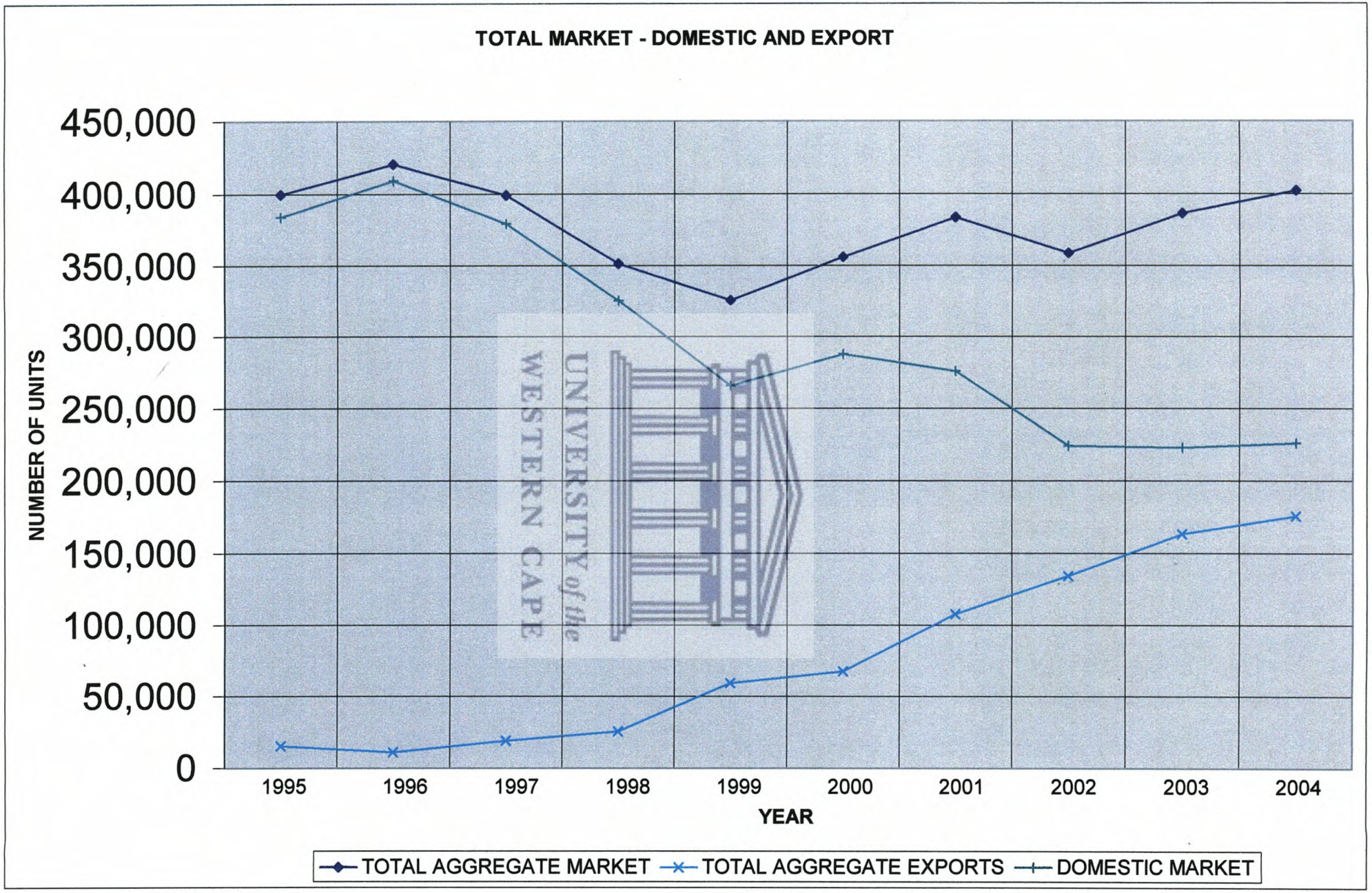


Source: NAAMSA, 2002



Source: NAAMSA, 2002

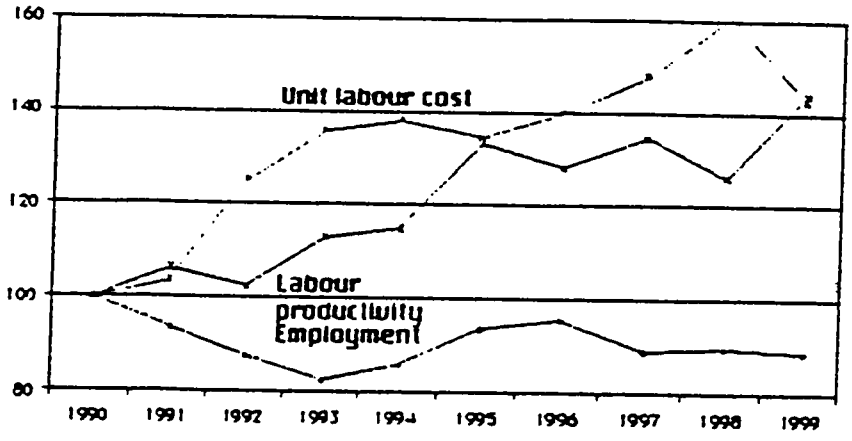
Productivity Statistics: South Africa

Motor vehicles, parts and accesories

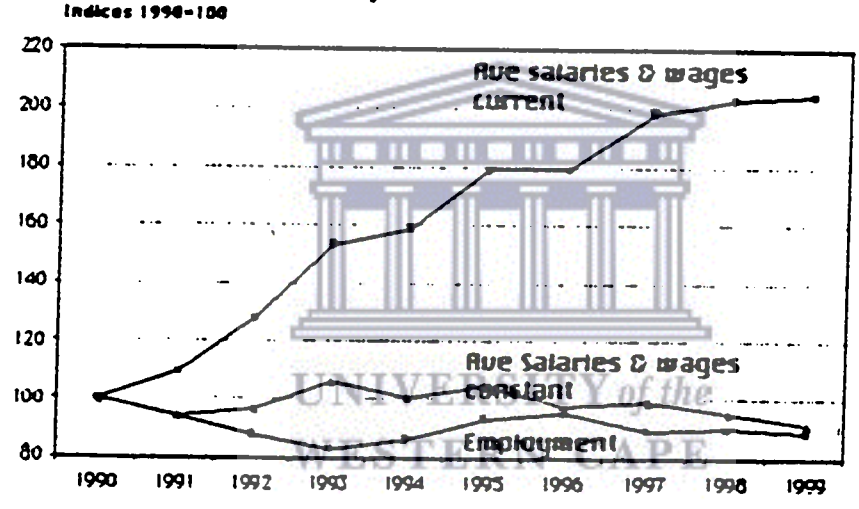
Year	Real output index	Employ-ment number	Fixed capital input index	Multi-factor produc-tivity index	Labour produc-tivity index	Fixed capital produc-tivity index	Earnings per employee (rand per annum)	Real earnings per employee (rand per annum)	Unit labour cost index	Capital labour ratio index
1970	66,9	62 816	29,4	98,0	85,2	227,5	1 457	26 933	4,1	37,5
1971	71,2	64 319	33,2	99,0	88,6	214,4	1 637	28 588	4,4	41,3
1972	75,8	64 006	36,7	103,2	94,8	206,6	2 046	33 538	5,1	45,9
1973	88,1	68 929	39,4	114,6	102,3	223,5	2 379	35 683	5,5	45,8
1974	97,2	74 279	42,2	115,8	104,7	230,6	2 518	33 749	5,7	45,4
1975	101,9	78 722	42,7	114,6	103,6	238,6	2 998	35 472	6,9	43,4
1976	94,2	83 910	41,2	102,4	89,9	228,8	3 015	32 099	8,0	39,3
1977	78,7	78 693	38,5	86,7	80,1	204,4	3 418	32 706	10,2	39,2
1978	81,6	82 697	36,4	98,1	79,0	224,0	3 737	32 206	11,3	35,3
1979	78,9	84 584	36,1	94,4	74,7	218,8	4 055	30 872	12,9	34,1
1980	101,6	91 760	39,6	127,8	88,6	256,2	4 904	32 834	13,2	34,6
1981	125,1	98 876	46,8	140,5	101,3	267,4	6 260	36 356	14,7	37,9
1982	116,9	106 772	53,9	105,9	87,6	216,8	7 184	36 412	19,5	40,4
1983	108,0	97 910	58,1	99,5	88,3	185,8	8 620	38 896	23,3	47,5
1984	99,4	97 547	62,6	87,5	81,6	158,9	10 374	41 938	30,3	51,3
1985	74,2	91 491	65,1	58,8	64,9	114,0	11 739	40 824	43,1	56,9
1986	69,9	85 132	61,2	70,0	65,7	114,2	12 874	37 739	46,7	57,6
1987	78,5	81 860	56,0	91,5	76,8	140,2	16 711	42 176	51,9	54,8
1988	92,7	87 582	53,4	110,2	84,7	173,6	18 036	40 350	50,7	48,8
1989	91,9	87 293	56,0	107,9	84,3	164,2	22 788	44 443	64,4	51,3
1990	80,2	85 589	69,0	85,4	75,0	116,3	23 436	39 992	74,4	64,5
1991	79,8	80 215	75,1	87,9	79,6	106,3	25 704	38 022	76,9	74,9
1992	71,9	75 036	84,7	80,2	76,7	84,9	29 976	38 936	93,1	90,4
1993	75,0	70 905	94,9	82,3	84,7	79,0	35 907	42 512	101,0	107,2
1994	79,5	73 792	94,9	85,2	86,2	83,8	37 229	40 449	102,9	102,9
1995	100,0	80 045	100,0	100,0	100,0	100,0	41 968	41 968	100,0	100,0
1996	98,3	81 858	103,9	95,4	96,1	94,6	41 962	39 076	104,1	101,6
1997	96,0	76 252	98,2	99,5	100,8	97,8	46 509	39 881	110,0	103,1
1998	90,7	76 810	103,5	93,6	94,5	87,6	47 516	38 129	119,8	107,9
1999	102,5	75 985	111,2	101,9	108,0	92,2	47 897	36 535	105,7	117,1
Average annual growth rate										
1970-74	10,1	4,1	9,3	4,9	5,7	0,7	15,8	7,0	9,6	5,0
1974-81	1,5	3,4	-0,1	2,1	-1,9	1,6	12,4	0,0	14,5	-3,4
1981-84	-7,4	-1,3	-9,9	-13,8	-6,2	-15,8	18,5	5,1	26,4	11,3
1984-89	1,1	-2,1	-3,5	9,6	3,2	4,8	17,0	1,1	13,3	-1,5
1989-96	1,9	-1,3	8,7	-0,2	3,3	-6,2	10,6	-0,5	7,1	10,1
1996-99	0,7	-2,1	2,6	1,4	2,9	-1,8	4,3	-2,4	1,3	4,8
1996-97	-2,3	-6,8	-5,5	4,3	4,9	3,4	10,8	2,1	5,7	1,5
1997-98	-5,5	0,7	5,4	-5,9	-6,2	-10,4	2,2	-4,4	8,9	4,6
1998-99	13,0	-1,1	7,4	8,9	14,2	5,2	0,8	-4,2	-11,8	8,6

Source: National Productivity Institute, 2001

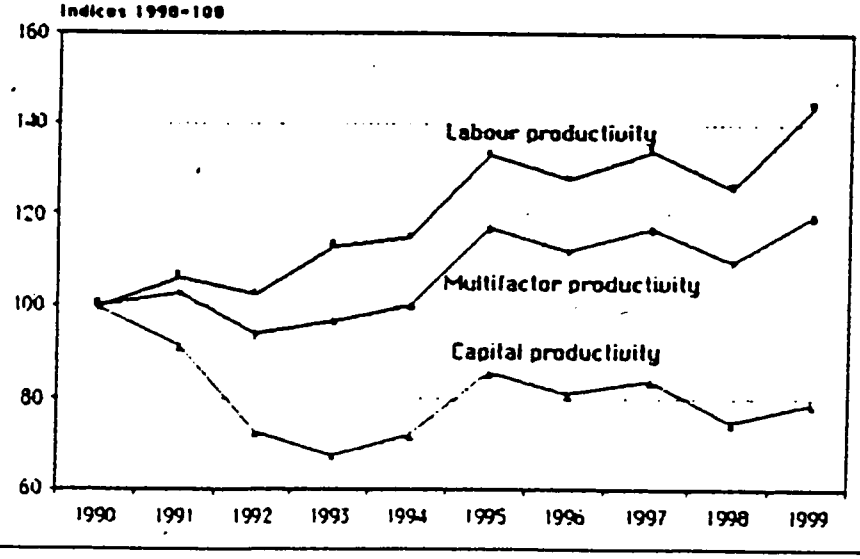
Motor vehicle, parts & accessories sector: Interaction between productivity, employment and unit labour costs



Motor vehicle, parts & accessories sector: Employment, salaries and wages in current and 1995 prices



Motor vehicle, parts & accessories sector: Productivity indices



Source: National Productivity Institute. 2001

Table 9: Summary of the surveyed firms' average competitiveness performance trajectory

Market driver	Measurement (measurement unit)	Average performance earliest year data		Average performance 2000	*Improvement over time period*	Gap: SA/ international average
		Year	Figure			
Cost control	Total inventory (days)	1997	65.11	47.02	*27.8%*	19.5%
	Raw material (days)	1997	38.46	25.42	*33.9%*	18.7%
	Work in progress (days)	1997	11.81	8.35	*29.3%*	20.8%
	Finished goods (days)	1997	14.85	13.24	*10.85%*	20.15
Quality	Customer return rate (ppm)	1997	6.869	1.558	*77.3%*	151.7%
	Internal scrap rate (%)	1998	3.99	3.1	*22.3%*	33.0%
	Internal reject rate (%)	1998	5.85	3.77	*35.6%*	40.6%
	Internal rework rate (%)	1998	4.87	2.93	*39.8%*	0%
Value chain flexibility	Lead time (days)	1998	37.01	36.92	*0.2%*	160.0%
Operational flexibility	Batch sizes (unit)	1998	2.075	1.684	*18.8%*	(37.6%)
	Throughput times (hrs)	1998	83.69	85.39	*(1.8%)*	152.4%
Capacity to change	Training expenditure (%)	1998	1.51	1.35	*10.6%*	*37.0%*
	Absenteeism (%)	1997	5.82	4.11	*29.4%*	17.0%
	Labour turnover (%)	1997	6.13	6.1	*0.5%*	(22.3%)
	Staff turnover (%)	1998	10.46	6.15	*41.2%*	26.3%
	Management turnover (%)	1998	9.11	3.77	*58.6%*	(27.3%)
	Output per employee (R)	1994	173 k	221 k	*27.7%*	N/A
Innovation capacity	R&D expenditure (%)	1998	2.55	2.46	*3.5%*	19.9%

Table 11: Upper quartile comparisons – Leading SA based firm performance levels against world class manufacturing standards

Market driver	Measurement (measurement unit)	SA based firms: Upper quartile	International firms: Upper quartile	Difference: SA versus International firms
Cost control	Total inventory (days)	32.9	30.9	6.1%
	Raw material (days)	13.3	10.0	24.8%
	Work in progress (days)	4.39	2.9	33.9%
	Finished goods (days)	4.15	2.3	44.6%
Quality	Customer return rate (ppm)	299	113	62.2%
	Internal scrap rate (%)	0.65	0.45	30.8%
	Internal reject rate (%)	0.55	1.0	(81.8%)
	Internal rework rate (%)	0.27	1.0	(270.4%)
	Supplier return rate (ppm)	4.500	1.000	77.8%
Value chain flexibility	Lead time (days)	14.0	1.25	91.1%
	Customer delivery reliability	95.38	98.13	2.9%
	Supplier delivery reliability	95.25	96.94	1.77%
Operational flexibility	Batch sizes (unit)	112.5	663	520.4%
	Throughput times (hrs)	3.5	2.25	35.7%
Capacity to change	Training expenditure (%)	1.35	2.53	87.4%
	Absenteeism (%)	2.98	1.97	33.9%
	Labour turnover (%)	2.0	2.81	(40.5%)
	Staff turnover (%)	3.42	1.23	64.0%
	Management turnover (%)	0	0	0%
Innovation capacity	R&D expenditure (%)	3.1	4.75	53.2%

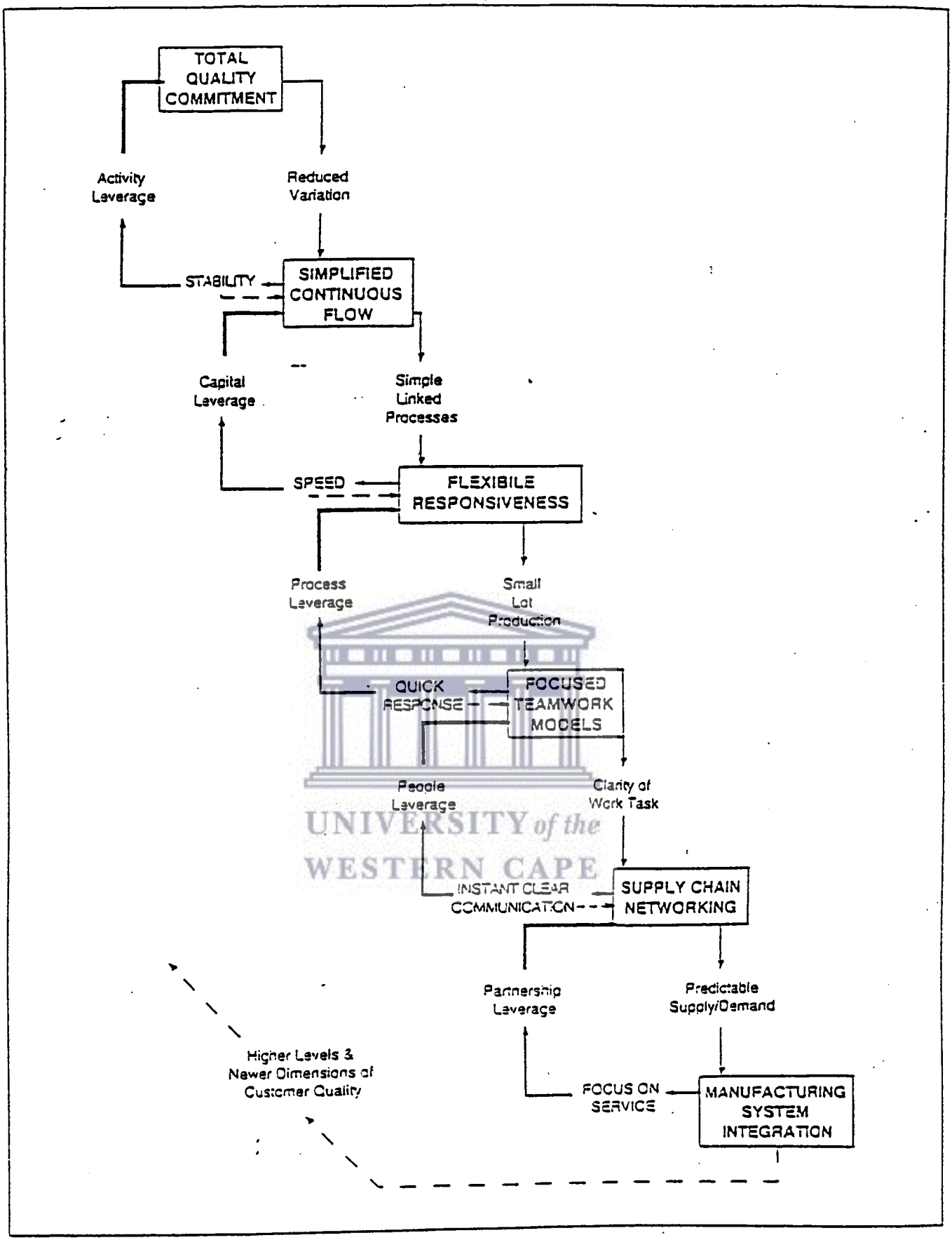
From Barnes, 2001 b

Table 21

The best performing South African and international firms (1999)

Measure	SA top 3 average	International top 3 avg.	Performance difference: %	SA best	International best	Performance difference: %
Total inventory	19.05	10.33	84.4	16.00	8.00	100
Raw material	7.63	4.24	79.9	6.89	3.00	129.7
Work in progress	2.47	1.70	45.3	2.00	1.06	88.7
Finished goods	1.88	1.27	48.0	1.63	0.50	226.0
Customer return rate	368	84	338.1	66	65	1.5
Internal scrap rate	1.05	0.58	81.0	0.41	0.35	17.1
Lead time	1.50	1.00	50.0	0.50	1.00	50.0
Customer delivery reliability	99.33	99.00	(0.03)	100.00	100.00	0
Supplier delivery reliability	99.00	97.33	(1.7)	99.00	99.00	0
Throughput time	33.00	2.00	1,550	3.00	1.00	200.0
Batch sizes	679	437	55.4	37	60	(38.3)
Machine utilisation rate	98.33	96.67	(1.2)	100.00	96.50	3.6
Training expenditure	2.55	2.70	5.6	2.66	3.40	21.8
Labour turnover rate	1.13	1.81	(37.6)	0.50	0.57	(12.3)
Absenteeism rate	2.97	1.22	143.4	2.20	0.80	175.00
R&D expenditure	4.13	6.70	38.4	4.63	8.10	42.8
Sales from products released in last year	48.67	35.00	39.1	65.00	65.00	0

From Barnes, 2001a



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