THE PLANNING IMPLICATIONS OF JUST-IN-TIME PRODUCTION SYSTEMS: A CASE STUDY OF THE AUTOMOTIVE COMPONENTS INDUSTRY

BY

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CHAPTER 1

RESEARCH FRAMEWORK

1.1 INTRODUCTION

Over the past two decades an increasing number of industrial organisations have adopted Japanese production management systems or Japanese Management Techniques (JMTs) as they are sometimes referred to. These systems are particularly well known in the motor industry where they have been successful in improving the quality, variety and reliability of products. The basic principles of JMTs are: the improved flow of products through the factory through the adoption of just-in-time production (JIT); integration of different functions within the enterprise; quality at source through total quality control; and, company-wide efforts towards the continuous improvement of products referred to as Kaizen (Humphrey and Kaplinsky 1995: 29).

Just-in-time production systems or just-in-sequence as they are sometimes called, are thought to have important spatial implications. The basic argument is that the JIT production system necessitates spatial agglomeration (Linge 1991). In order to ensure smooth production, lead firms and sub-contractors tend to locate in close proximity. Toyota City in Japan has been hailed as an example of such an agglomeration. In Durban, the Toyota manufacturing plant seems to have created a similar agglomeration of sub-contracting firms. However, as we enter this period of intensive globalisation it is not clear whether this agglomeration of industries will continue or whether these will show that the JIT system of production is more spatially flexible than has been suggested. According to Linge (1991), component manufacturers are now seeking locations from which they can maintain their JIT capacity but at the same time serve several customers. This will allow them to have a wider client base making them less vulnerable to the competitiveness of a single lead firm.

At the same time however, the spatial organisation of firms in Brazil suggest that firms are moving even further in the direction of agglomeration to one of "condominiums". These condominiums house not only the assembler but major component suppliers as well (although these are independently owned and run). Physical proximity however is only one of the reasons for this new form of organisation.

Considering that Brazil's motor industry is substantially more developed than South Africa's (Duncan 1997: 7), it is uncertain whether South African motor manufacturers will follow this trend towards condominium in the near future. However, it is important to assess what the trends in South Africa are and how these are affecting the spatial location of lead firms and sub-contractors.

1.2 RESEARCH PROBLEM

The world automobile industry is currently experiencing a profound restructuring encompassing both new production methods and new geographical patterns (Mair et al 1991). Manufacturing locations are being expressely selected to facilitate the transfer of the just-in-time manufacturing system. The Japanese "just-in-time" (JIT) manufacturing system differs markedly from the Fordist "just-in-case" system, which was the central model of industrial organisation for automobile manufacturers between the 1940s and the 1980s. A number of theorists (Kaplinsky 1995, Linge 1991) have argued that the adoption of JIT will result in a markedly different geographical organisation of production to the Fordist system. The basic premise is that JIT will result in the agglomeration of automotive component firms in close proximity to assemblers.

In order to assess the role of JIT in spatial location relative to other location factors, and the relative importance of spatial factors in planning for industrial development, a case study of automotive components has been selected. It forms part of a loose agglomeration of automotive industries associated with the Toyota Manufacturing complex in Durban's Southern Industrial Corridor.

The purpose of this study is to attempt to evaluate the extent to which JIT is indeed resulting in a change in the spatial location of industry, and if so, what the nature of this change is and the implications for planning.

A number of questions flow from this research problem. These constitute the analytical framework for the dissertation.

- What factors are central in determining appropriate automotive industry locations in a post-Fordist/flexible production era?
- What spatial, land use and transport implications has JIT agglomeration had in relation to the automotive industry?
- What is the nature of clustering under a JIT production system?
- How might an understanding of JIT as a locational force influence planning decisions eg. land use management, transport networks and the likelihood of new spatial concepts such as the "condominium" being implemented in South Africa?
- What lessons does the Toyota plant in Durban, and its component suppliers, offer in terms of the above questions?

In order to answer these the following subsidiary questions were used to guide the research:

- How is the automotive industry in metro Durban and KZN structured?
- To what extent are automotive component manufacturers engaging in JIT production systems?
- Where are automotive component firms located in relation to their suppliers and their markets; what are the main reasons for this; and what are the nature of the linkages?
- What future trends are becoming apparent?
- What implications do the prevailing and likely future production systems have for planning?

The central "hypothesis" against which the research problem will be tested is that given the changes in the nature of production traditional locational models are no longer sufficient to explain or predict industrial location. It is expected that JIT will result in spatial agglomeration but that this agglomeration may take different forms.

Traditionally Town Planning has been concerned with the provision of suitable land for a range of urban activities; and subsequently regulating the use of land. With the current change of emphasis to integrated development planning (IDP), the scope for Planners has widened to include more than just land use interventions. Inherent in the concept of integrated development is the need to gain a broader and deeper understanding about the dynamics of the myriad of social, economic and institutional activities that occur in any town, city or region.

At the outset, the intention was to focus the research on the planning and spatial implications of the trend to JIT in the automotive industry. However, as the fieldwork proceeded it became apparent that the development of the automotive components industry (including their decision where to locate) was being influenced more fundamentally by a-spatial factors. Accordingly, the focus has shifted to considering the implication of JIT on the automotive components industry in the wider context of integrated development.

An improved understanding of how a city functions (which itself is built from an understanding of each of its component parts) is a pre-requisite for identifying effective integrative planning interventions. These may be sector specific, institutional or spatial in nature. Such interventions may lie in the realm of public, and, or, private sectors; and may also occur at the level of the firm, the city or higher levels.

This dissertation seeks to investigate how JIT has been applied in one of these facets of Durban's economy - that of the automotive component industry. This provides a basis for identifying spatial implications and planning interventions which could promote the sub-sector, improve its competitiveness and thereby contribute to the development in Durban. For the reasons outlined above, the findings and recommendations of the dissertation cover a fairly broad spectrum including, but not confined to spatial and land use aspects.

1.3 RESEARCH METHODOLOGY

The research methodology involved both primary and secondary sources of data. The data collected is both quantitative and qualitative in nature.

Previous work done on the implications of JIT was undertaken some ten years ago and while not irrelevant this work can be considered to be somewhat outdated. Since 1989 JIT has been more widely adopted, South Africa has re-entered the international or global economy with substantial relaxation on trade controls and finally greater emphasis has been placed on networking and small and medium scale enterprises.

In order to obtain valid and reliable information pertaining to the research subject it was necessary to draw upon empirical evidence i.e. primary data. This was done by conducting interviews with automotive components suppliers, the main assembler, Toyota Manufacturing SA and the local authority responsible for the administration of the Southern Industrial Corridor and the Pinetown/New Germany complex.

Interviews

Interviews conducted were both structured and unstructured. In terms of structured interviews, a stratified sample of automotive component suppliers was selected from a list provided by Toyota Manufacturing SA and Justin Barnes who is currently co-ordinating the KwaZulu-Natal Benchmarking Initiative. Although Toyota has approximately 50 local component suppliers, 30 of these provide approximately 80% of their locally sourced components. As such, 14 of the "top 30" suppliers were included in this study.

In addition, selection was based on linkages with Toyota, size and tier of firm, present location, ownership structure and type of manufacturing process undertaken. The "structured" interviews took the form of an industrial survey which was used to interview the Managing Directors or Logistics Managers of the various firms (see Table 4.1). Contact was made with the Managing Directors or Logistics Managers of the firms via e-mail stating the nature of the study and requesting an interview. A questionnaire was then forwarded to respondents in preparation for the interview. Twenty eight firms were contacted but six firms declined to be part of the study considering themselves too small to make a contribution. A total of 22 automotive component suppliers were thus interviewed, the majority of which are located in KwaZulu-Natal. Telephonic interviews were held with those respondents located outside of KwaZulu-Natal.

The questions asked were aimed at obtaining the following firm details: background; locational decisions; manufacturing capacity; extent to which JIT had been implemented; relationship between suppliers and buyers; markets; human resources; inter-firm co-operation; institutional matters; and planning issues. The interviews took between one and a half and two hours each and were undertaken between August and November 1999 at the respondents firm.

All the firms interviewed were concerned about confidentiality. In order to provide anonymity to the firms, they are referred to as Firm 1, Firm 2, Firm 3, etc. It has also been necessary, in a number of cases, to use aggregate numbers of firms and percentages to prevent breach in confidentiality. Firms are numbered in the order in which they were interviewed. The numbering pattern does not correspond to the alphabetical listing of firms in Table 4.1 below.

Unstructured interviews were also held with staff at the Economic Development Department of the Durban Metropolitan Council (DMC), industrial property developers and a number of other specialists in the field in order to determine current trends in industrial development and their views on the implications for JIT for industrial development. These included:

- Mr Justin Barnes (Industrial Restructuring Project)
- Mr Glen Robins (Economic Development Department DMC)
- Mr Jan Van Coller (Economic consultant)
- Mr Mike Robertshaw (Commercial and Industrial Property Broker working in the Southern Industrial Corridor)

- Prof. Jeff McCarthy (Development Planner)
- The researcher also attended a presentation on the Theory of Constraints held in Durban on 30 September 1999 to assess its relevance in understanding the operation of the automotive components industry and its production systems.

1.4 SCOPE AND LIMITATIONS OF THIS STUDY

This dissertation seeks to add to the debate surrounding the spatial implications of JIT production systems. Although the study deals with a sectoral and geographical concentration of industries in a locality, it is limited in that the empirical analysis is based on a relatively small number of firms in a particular context. In addition, the focus of the dissertation on one particular sector does not allow for a comparative analysis with other sectors in which JIT is operational. The scope of the study was further limited by time and budgetary constraints.

1.5 REPORT OUTLINE

Chapter 1 sets the scene by identifying the research problem in the context of the automotive industry; translating it into a number of research questions and outlining the methodology adopted to address these questions. Against this background the following three chapters provide a conceptual and empirical base. Chapter 2 establishes a conceptual framework, discussing those theories that inform the case study (such as post-Fordism and just-in-time production). Chapter 3 provides a substantive context, tracing the evolution of the automotive industry in South Africa and Durban, and examining the extent to which JIT has been implemented in South Africa. Chapter 4 explains the detailed functioning of the automotive components industry in Durban based on surveys and interviews.

These three strands are drawn together in Chapter 5, which picks up a number of significant themes that emerge from the research, and makes proposals as to the planning interventions that will enable the fuller implementation of JIT and thereby improve the competitiveness of the automotive component sector. This chapter also takes a reflective look at the research findings in relation to the research problem.

CHAPTER 2

FLEXIBLE PRODUCTION AND JUST-IN-TIME PRODUCTION SYSTEMS

2.1 INTRODUCTION

The adoption of just-in-time production systems and other Japanese Management Techniques falls within the broad ambit of what is referred to as flexible production. Flexible production is a term used by many theorists to describe the reorganisation of industry and, by implication, the restructuring of the economy.

The purpose of this chapter is to assemble a body of theoretical material and international precedents in order to conceptualise the empirical problem of JIT production and its spatial outcomes. It is argued that the change to flexible production has given rise to a particular set of industrial requirements.

The first part of this chapter deals briefly with traditional location theories that were influential during the Fordist period. These include land use theory, the behavioural approach to land use, life, product and profit cycle models as well as the influence of the new industrial division of labour (NIDL). The second section deals with economic restructuring, focussing specifically on the Fordism and post-Fordism/flexible production debates. The third establishes the historical roots of the concepts of agglomeration and clustering which are emerging as important elements of spatial organisation for the automotive industry. The fourth section deals more specifically with just-in-time production setting out its basic principles, while the fifth considers the operation of JIT in detail in order to provide a basis for understanding the analysis in Chapter 4. The sixth section explores the spatial implications of JIT by considering the experiences of a number of countries around the world. The final section provides a brief overview of the operation of JIT in less developed countries.

2.2 TRADITIONAL LOCATION THEORIES

2.2.1 Land Use Theory

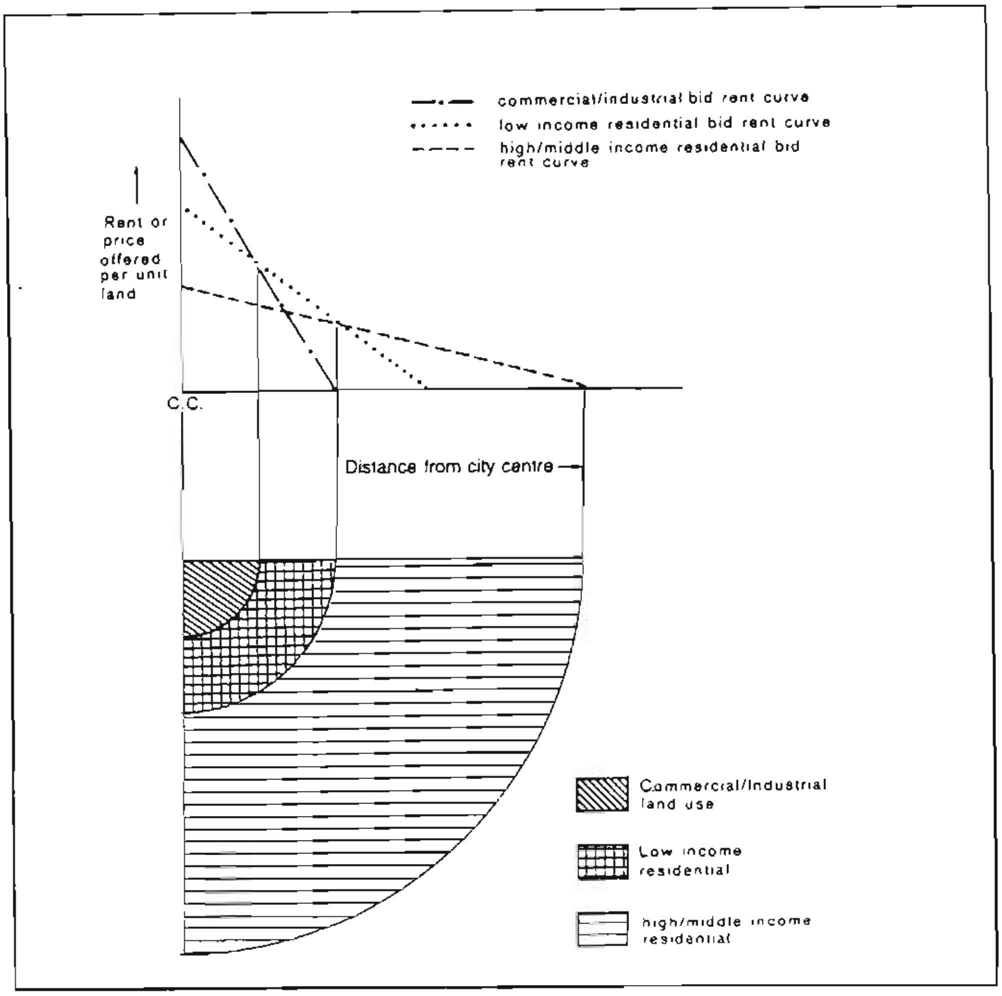
The neo-classical approach to land use dates back to the early 18th century. While the initial concern related to rural land use much of this early theory has been incorporated and expanded by neo-classical economists, and applied to the urban context. Although Von Thunen was concerned mostly with the circumstances and conditions of production, the neo-classicists shifted the focus onto the preferences, needs and actions of individual consumers (Mc Carthy and Smit 1984: 26). This theory makes use of a general equilibrium approach and thus takes cognisance of the important spatial interdependence of firms, households and other decision units.

The monocentric model developed by Von Thunen was adapted to the study of urban land use during the early 1960s by Alonso, Kain and others. The essence of the Alonso model is that activities can offset declining revenue and higher operating (including transport) costs by lower site rents at locations increasingly distant from the city centre. There will be some rent which an activity will be prepared to pay at each site. This is referred to as the bid rent which is defined as the rent which would allow the firm to maintain the same profit level. The equilibrium location for a firm is where its bid rent equals the actual rent ruling at a site.

Figure 2.1 illustrates the neoclassical model where commercial land uses are located closest to the city centre, with industrial land uses on the periphery and the majority of residential land uses on the outskirts of the city.

According to Cox (in McCarthy and Smit 1984: 54) one of the most important weakness in the neo-classical approach to land use is its emphasis on consensus as opposed to conflict. It assumed that the use of land is determined on the basis of a willing buyer and willing seller, and thus no conflict arises in the use of land. Mc Carthy and Smit (1984: 34) identify three main categories of criticisms of the neo-classical approach, namely the lack of attention given to the role of social stratification and social values in determining urban land use; problems with the assumption of universal equilibrium within the land market; and the depoliticization of urban development, land use and land rent. Further criticisms relate to the assumptions inherent in neo-classical theory such as that of perfect competition and perfect knowledge.

FIGURE 2.1 Neoclassical model of land use: Bid rent curve logic to the problem of urban land use (Source: McCarthy & Smit 1984: 31)



2.2.2 **Behavioural Approach**

By the 1960s it was realised that locational factors other than the conventional proximity to markets and, or, raw material affected the firm's decision to locate new plants (Platzky 1995: 20). While the fact that a firm might behave in a non-normative, imperfect way was of little concern to classical locational theorists, it became the starting point of the behavioural approach to locational analysis (Young 1972: 15). This approach focusses on management's decision to locate in a particular place and the factors that influence that decision, many of which are not automatically consistent with notions of economic rationality (Young 1972: 15).

Platzky (1995: 21) argues that it was from these tentative perceptions that the notion of corporate approaches to decision making, in which not only production and transportation costs, but the size or concentration of functions were found to affect locational choice. In line with this Young (1972) argued that the life cycle of a firm was the central dynamic influencing locational decisions.

2.2.3 **Young's Life Cycle Theory**

Young studied industrial locations in Durban during the 1970s and noted that sub-urbanisation trends were consistent with pressures for more space that were generated by firm expansion (McCarthy 1993: 15). He produced a model of intra-metropolitan location for the expanding firm with two alternative behaviour patterns, to illustrate the spatial implications of such firm expansion.

According to Young (1972: 183) industries generally started as "infant' enterprises with less than 10 people. These small industries located in cheap premises in the "frame of the CBD". Those firms that survive through infancy enter the early youthful stage where the need for additional space leads to a choice between expanding *in situ* or moving to larger premises in the inner zone. In either case, Young (1972: 183) argues that "to move too far would strain the linkages established and jeopardise the success of the firm".

As the firm continues to grow through "late youth" to maturity two choices are again available. The firm may choose to remain in the inner core and simply purchase the entire building for expansion purposes. Alternatively, the firm could move to tailor-made, single story premises allowing it to take advantage of new production line methods.

By the time the firm is competing at national level, with a labour component of about 500 workers, *in situ* expansion is unlikely, and the firm's decisions will tend to revolve around providing for expected expansion over the next 25-30 years. Young's model shows that the firm is likely to move to the outer peripheral zone.

According to McCarthy (1993: 14-15) Young's model identified a dominant market-related trend towards the sub-urbanisation of industry in Durban during the 1960s. This model helps to explain not only the location of Toyota's plant on Durban's periphery but also the location of a number of component manufacturers in the Pinetown/New Germany area.

Young's work has been built upon and relates closely to product cycle and profit cycle theories which attracted attention in the 1980s.

2.2.4 **Product Cycle Theories**

According to Storper and Walker (1989: 85) product cycle theories try to explain Leontief's paradox of the possible inverse relation of factor prices to location, focussing on maturation of production process technologies. Storper and Walker (1989: 120) contend that "a youthful industry makes small batches of its products using skilled labour, which is best found in industrial centres. As it matures, the industry standardizes its product, routinizes its activities, merchandises production, deskills the labour process, purchases in large stable quantities, and builds large self-contained factories. It thereby depends less and less on economies of agglomeration and can deagglomerate in search of cheaper labour and cheaper land". Since a new firm is labour-intensive and depends on skills for product and process innovation it tends to locate initially in developed cores. As the firm matures capital-intensive branch plants seek out underdeveloped peripheries because factor prices are cheaper there.

2.2.5 **Profit Cycle Theories**

Storper and Walker (1989: 86) argue that whereas the product cycle model appears to fit the behaviour of several major industries in the post-war period, it does not account adequately for the most important types of industry dispersal.

According to Storper and Walker (1989: 88) "the general principle of which the product cycle only captures a portion, is that spatial expansion depends upon growth - regardless of whether it derives from product innovation, process change, high exploitation of labour, or industry reorganisation". This is elaborated upon in Markusen's profit cycle theory, a variant of the product cycle theory, which explains how processes of spatial change are linked to the changing determinants of profitability and market power (Todes 1998: 111). According to this theory the halcyon days of product youth and rapid industry expansion are followed by slowing rates of growth, as production capacity approaches market demand, production techniques standardise, and market price/production cost margins begin to come down. This, in turn, results in increased sectoral competition, the break up of oligopolistic practices and a drop in profit rates toward economy-wide averages. As superprofits diminish, factor prices become more important to competition and location. Firms thus try to cut costs by building new plants at cheaper locations and with more efficient production methods (Storper and Walker 1989:88-89).

2.2.6 **New Industrial Division of Labour (NIDL)**

A further theory relating to industrial location in the Fordist era is that of the New Industrial Division of Labour (NIDL). According to Day (1989: 73) during the Fordist era of production "the trend towards increasing scale economies raised the minimum effective size of industrial plants. This was accompanied by an increase in the concentration of ownership of capital and as a consequence plant specialisation was extended to the global scale". These multi-national corporations (MNCs) tended to favour the location of plants at sites of least cost thus extending mass production into Third World countries. According to this theory, factor costs in terms of labour and the need to reinvest surplus capital were the driving force behind the location of industry. In the automotive industry, Ford of Europe showed the way, its spatial development dovetailing the Fordist production principles. Spain and Portugal were favoured as low wage locations in Europe; whilst in North America, Mexico and increasingly, Canada, were favoured for the same reason (Mair 1993: 209).

Between 1975 and 1985 the first wave of decentralisation swept through North America and Europe generating a bleak outlook for the future of both traditional automotive manufacturing centres and branch plant regions within traditional countries of automobile production.

2.2.7 **Transaction cost theory**

According to transaction cost theory the geography of transaction costs helps to explain agglomeration and spatial divisions of labour. According to Storper (1997: 9) the disintegration of production raises the transaction costs of input-output relations and increases the number of transactions external to the firm. These transactions are more frequent, less predictable and more complex. The more complex transactions are, the less feasible it is to carry out these transactions over extensive geographical distances. Agglomeration then is the outcome of the minimisation of these costs, where such minimisation outweighs other geographically dependent production cost differentials.

As such, Krugman (in Bloch 1999:42) states that because of the costs of transacting across distances, the preferred location for each individual producer is where demand is large or supply of inputs is particularly convenient - which in general are the locations chosen by other producers. Therefore concentrations of industry, once established, tend to be self-sustaining.

In line with this Henry (1992: 375), in his debate of the new industrial space thesis, states that the incorporation of transaction costs into location theory explains how processes of change in production have brought about a geographical reorganisation of production. According to Henry (1992: 377) the increased costs associated with increased external transactions will create a spatial pull whereby firms will tend to agglomerate to shorten the length, and thus the cost, of such external linkages.

From the above discussion it is evident that traditional theories of industrial location provide some broad guidance in understanding industrial location in the 1950s, 1960s and 1970s. While still relevant these theories are by no means sufficient to explain patterns that are emerging during the post-Fordist era.

2.3 ECONOMIC RESTRUCTURING

According to Hirst and Zeitlin (1991: 1) there is widespread agreement that the international economy underwent dramatic changes during the 1970s and 1980s. These include the "rapid and radical changes in production technology and industrial organisation; a major restructuring of world markets; and consequently, large scale changes in the policies of economic management at the international, national and regional levels".

In line with this, Amin and Thrift (1992: 574) contend that there has been a move from an international to a global economy with the following main characteristics:

- industries increasingly function on an integrated world scale through the medium of global corporate networks
- corporate power has continued to advance so that new global industries are increasingly oligopolistic, progressively cartelised
- global corporations have become more decentralised through increased 'hollowing out', new forms of sub-contracting, new types of joint ventures, strategic alliances and other new 'networked' forms of corporate organisation. This 'hollowing out' has led to forward integration by market leaders in order to secure control over markets and distribution networks.

However, the characterisation of these changes and the mechanisms at work are more contentious. For Hirst and Zeitlin (1991: 1) "one way to understand this change is to postulate a change of basic manufacturing organisation from a "Fordist" pattern that has prevailed since 1945 to a "post-Fordist" successor in the later 1970s and 1980s. Three approaches to industrial change are often combined under the heading: flexible specialisation, regulation theory and a more diverse body of explicitly 'post-Fordist' analysis". However, this amalgamation results in the differences between these approaches being overlooked.

In dealing with this problem, the following section will attempt to distinguish these different approaches while at the same time alluding to their similarities and subtle differences.

2.3.1 **Transition from Fordism to Post-Fordism**

According to Kaplinsky (1990: 2) it has become increasingly common to talk of the transition in modern capitalism as that from Fordism to post-Fordism. Fordism, which is sometimes referred to as the era of mass production, has three central features. First, Fordist methods of mass production were based on the notion of maximising economies of scale, and annexing market-share. This system was supply driven, with the Keynesian welfare state playing an important macro-economic role in creating an adequate demand for these mass produced goods by increasing incomes and, therefore, effective demand (Aniruth 1997: 22). Furthermore, the welfare state ensured the supply of a literate and healthy workforce which enabled production costs to be kept low (Kaplinsky 1990: 5).

Secondly, the pursuit of economies of scale and lower cost structures led to the specialised production of standardised goods with special purpose machinery. Competition was often intense in this Fordist phase of development with demand being stimulated through intense price competition and corporate strategies focused on reducing production costs (Kaplinsky 1990: 4). Finally, Fordism is associated with the deskilling of the workforce which meant that labour became highly replaceable and consequently regarded as a cost of production that had to be minimised (Aniruth 1997: 22).

In contrast post-Fordism refers to a new era in the history of capitalism which is characterised by a new system of production based on flexible technologies, flexible organisational structures and flexible use of labour (Harrison 1998: 55). Morris et al

(1998) identify a number of key requirements of industrial success under this new industrial paradigm (see Table 2.1):

- *High human resource requirements*: Process and product innovation require a workforce with good technical and creative skills
- *Networks of producers*: JIT production and simultaneous engineering require a strong network of producers and suppliers in close proximity to each other and connected by good transport and communication infrastructure
- *Smaller production units*: Flexible specialisation has resulted in a trend to smaller production units which require smaller premises and in some instances office-production premises
- *Export facilities*: The globalisation of trade has meant an increase in trade, requiring better export facilities for manufacturers.
- *Institutional arrangements*: In order to compete successfully industry requires favourable institutional arrangements, where trade and industrial policy, national, regional and local policy are co-ordinated to create an operating environment conducive to international competitiveness.

Table 2.1 Principles of Manufacturing Organisation

Mass Production
• Standardisation of products • Maximum machine utilisation • Functional layout • Process organisation • Long runs • Large batches • Production pushing • Quality and rectification at the end of the production process • Long throughput times • Long lead times • Large stocks (just-in-case) • Make to forecast • Complex controls • High proportion of indirect labour
Flexible form of Production
• Cellular layout and families of products • Product organisation • Make to order or with fewer finished goods inventories • Short lead times • Quick changeovers • Short runs • Small batches • Production pulling • Stocks minimised • Simple controls • Lower indirects

Source: adapted from Humphrey and Kaplinsky (1995)

2.3.2 **Post Fordism, Flexible Specialisation and Flexible Production**

According to Harrison (1998: 156) the terms post-Fordism and flexible specialisation are used interchangeably by some theorists. The term flexible specialisation was coined by Piore and Sabel (1984) in their book The Second Industrial Divide. However, despite their apparent similarities, flexible specialisation and post-Fordism represent different theoretical approaches to the analysis of industrial change. According to Hirst & Zeitlin (1991: 2) the essential difference between the two is that "where post-Fordism sees productive systems as integrated and coherent totalities, flexible specialisation identifies complex and variable connections between technology, institutions and politics; where post-Fordism sees industrial change as a mechanical outcome of impersonal processes, flexible specialisation emphasises contingency and scope of strategic choice".

Furthermore Rasmussen (in Harrison 1994: 10) states that the problem is the flexibility of the concept itself which has been widely and loosely used, referring to change at both the macro and micro levels. "At the macro level it refers to the shift from mass production to a system where markets are diversified and rapidly changing and where innovation rather than stability is required for competitiveness. At a micro level it has suggested new types of industrial organisation able to respond to the requirements of flexibility and rapid innovation" (ibid). However, Rasmussen (in Ramduny 1996) asserts that flexible specialisation has introduced a number of aspects to the understanding of industrial organisation. These are as follows:

- it gives emphasis to the importance of space, particularly in terms of the geographic proximity of firms
- it adds a non-economic dimension including factors such as trust, religious values and political networks
- it emphasizes the role of local institutions, and
- it suggests that small enterprises not only react to the economic environment but that they also act within it.

Harrison (1994: 14) argues further that "there are probably as many variants of flexible specialisation as there are proponents of the concept. However, an important divide in the literature is between the models that emerged in the "Third Italy" and in Japan. In Italy, flexible specialisation is evidenced by small firms linked through various co-operative arrangements while in Japan flexible specialisation is evident in giant corporations". However, in contrast, Best (in Harrison 1994: 14) argues that the industrial districts of Italy and Japan are simply different faces of flexible specialisation as both models are based on the same basic principles of organisation (see 2.4.3 below).

For purposes of this dissertation the focus will be on the Japanese model due to its relevance to the case study. The organisational structure of this model is based on what has become known as just-in-time (JIT) production.

However, before proceeding to a detailed discussion of JIT it is necessary to trace the antecedents of the concepts of agglomeration and to examine their contribution to an understanding of location in the contemporary automotive industry.

2.4 Growth poles, agglomeration, clustering and industrial districts

2.4.1 Growth pole theories

In order to understand the modern use of the terms agglomeration and clustering, it is useful to recall that their historical origins lie in the growth pole theories that attracted considerable attention in the late 1950s and early 1960s.

The concept was originally formulated by French economist Perroux in 1950 as a "propulsive unit which induces growth in other economic units when it grows or innovates". His ideas were taken up by authors such as Myrdal (1957), Hirschman (1958), Isard (1960), Boudeville (1966) and others, in an attempt to find explanations of polarised development. Growth poles came to be regarded as "a way of influencing the location of manufacturing, and a belief that 'growth impulses' would eventually spread from major centres of innovation to the remainder of the economy" (Friedmann and Weaver 1979: 114).

Initiated as growth poles in the 1950s, the concept was transformed so that by the 1960s, it was "no longer just economic space that was being polarised, but the entire space economy" (ibid:125). Friedmann introduced the notion of a core-periphery model in which the core "acts as the driving force from which innovations diffuse outwards, to affect economic activity ... in the periphery" (Fair 1982: 15) while Isard (1975) developed the concept of industrial complexes.

The subsequent debate about growth poles, growth centres and industrial complexes is not relevant to the present discussion. However, it was the early notion of a propulsive economic unit and its spatial implications that provide the context for understanding concepts of agglomeration.

2.4.2 **Concepts of agglomeration**

The terms clusters and agglomerations are used interchangeably by a number of theorists. For purposes of this research an agglomeration refers to the physical concentration of firms within a particular sector while clustering implies a high level of co-operation between firms within a given location. A cluster is made up of concentrations of competing, complementary and interdependent firms within a particular sector. These firms work together to identify obstacles to competitiveness and attempt to address these as a group (Bloch 1999:43). Clusters derive their comparative advantage by sharing common economic foundations, including specialised labour pools, innovative networks, readily available supplies and support services, access to capital and technology resources, economies of scale and ease of communication (Ilinois Department Commerce and Community Affairs in Bloch 1999: 43)

2.4.3 **Industrial districts**

The concept of clusters is closely related to that of industrial districts. Best (1990) describes an industrial district as a "dynamic constellation of mutually adjusting firms" . The three basic elements of an industrial district are:

- geographic proximity
- sectoral specialisation
- linkages between firms

Although earlier conceptions of industrial districts tended to regard large firms as a threat to the small firm industrial district, Storper (1991) sees no necessary incompatibility between large and small firms and the existence of industrial districts. Furthermore Schmitz (in Ramduny 1996) points out that small and medium sized firms are far from dominant in the Stuttgart region where the industries in this agglomeration comprise an average of just under 500 workers in the machine tools, vehicles and electronics industries. Ultimately interfirm linkages and sectoral specialisation play a greater role in the identification of the existing industrial districts. In line with this Trigilia (ibid) states that "there is growing consensus that the organisation synergies - the creation of networks - is assuming greater significance than mere size of the individual firms", He notes that the networks can take on different features and may be centred on large traditionally structured firms concentrated in certain areas or firms which are in the midst of restructuring. From this perspective it is evident that inter-firm networking may not necessarily be the sole domain of the canonical industrial district model and nor should the networking concept be ascribed a fixed meaning, since it can exist even in traditional industrial agglomerations based on Fordist forms of production organisation.

2.5 THE CHANGING NATURE OF COMPETITION

Best (1990) in his book New Competition attempts to explain the underlying causes of de-industrialisation in the West, rejecting the common explanations relating to government regulation, productivity and high labour costs. He contends that de-industrialisation was the result of a superior form of competition elsewhere in the world, based on new production and organisational concepts. Best focusses on the entrepreneurial firm which competes on the basis of continuous improvement, innovation, flexibility and superior product design rather than merely on the basis of price.

Best (1990) distinguishes between what he calls 'old' and 'new' competition and proceeds to identify the following distinctive features of this new competition:

- the entrepreneurial firm is central to achieving economic change
- co-ordination across the phases in the production process is crucial

- co-operation and competition exists within a sector
- supportive government policy is evident

In line with this, Humphrey and Kaplinsky (1995:14) argue that the biggest shift in the past 20 years has been from a *sellers' market*, in which enterprises could sell all they could produce, to a *buyers' market*, in which companies must compete for sales by satisfying the customer. As a result companies across the world are restructuring in response to increased competition and to the growing importance of non-price factors. Therefore, while price competition remains important, productivity improvement is essential necessitating a change in the way production is organised. Humphrey and Kaplinsky (1995: 23) thus argue that "unless the underlying manufacturing organisation is altered, it may well be foolhardy to try and move to meet the new competitive challenge which is sweeping through the global market". General Motors (GM) discovered this to their cost. In attempting to retain market share in the United States, GM decided to compete against the Japanese in terms of quality, design and flexibility as well as through price. However, they did not alter their manufacturing organisation which was designed to produce standardised products of relatively low quality. The consequence was that GM invested over $70 billion between 1976 and 1985, but instead of withstanding Japanese competition, its share of the American market fell from 44% to 33% (ibid).

As a consequence of this new form of competition and associated forms of production, competitive parameters have been revolutionised with price no longer being the major determinant of market share (Joffe et al 1995:14) . Instead new standards of quality, reliability, innovation and the ability to respond flexibly to customer requirements are pre-requisites for survival in the global market place (Kaplinsky & Morris 1998).

The focus of production has thus become a process of remaining competitive through continuous improvement and innovation. The implementation of JIT is regarded as one way of achieving this.

2.6 JUST-IN-TIME (JIT) PRODUCTION - WHAT IS IT?

JIT production is a Japanese management philosophy which has been applied in practice since the early 1970s in many Japanese manufacturing organisations. It was first developed and perfected within Toyota manufacturing plants in Japan by Taiichi Ohno as a means of meeting consumer demands with minimum delays.

Essentially, JIT is a statement of objectives that defines the manner in which a manufacturing system is to be managed. JIT has three key elements. First, the lowering of remedial and inspection costs by immediately detecting and correcting on-line faults referred to as "quality at source" or "total quality control (TQC)". In order to achieve this it is necessary to have a multi-skilled workforce who act as their own quality control inspectors. Second, the introduction of procedures designed to increase productivity by applying time and motion techniques to each task, including change-over and set-up times, and co-ordinating these with the flows of work and components. This is referred to as "continuous flow". Third, is the philosophy of continuous improvement or Kaizen (the Japanese word for continuous improvement). JIT involves a continual search for improvement. The shift to flexible specialisation requires continually rising targets and an obsession with quality and rising standards (Harrison 1994: 15). This is achieved through multi-skilling, team work and encouraging labour to make innovative suggestions concerning the design of products and the organisation of production.

JIT also involves substantial sub-contracting and requires a considerable change in traditional attitudes within a company and among its suppliers (Womack et al 1990). Close interaction between assemblers and their suppliers on a continuous basis is crucial to attaining improvements to product design and organisation of production (ibid). In addition, much attention has been given to the introduction of JIT in the context of the evolution of relationships between management and the workforce. On the one hand, the training required to allow for multi-skilling makes labour more flexible while on the other it is argued that increased sub-contracting is a way of fragmenting labour power (Linge 1991: 325).

Overall, just-in-time production is a concept of producing and conveying what is needed, when it is needed, in the amount needed. JIT is aimed at filtering out wastes in the production process, improving the quality of products and satisfying customer demands in an efficient and reliable manner (Cheng and Podolsky 1993: 9). JIT manufacturing has the capacity, when properly adapted to the organisation, to strengthen the organisation's competitiveness in the marketplace substantially by reducing wastes and improving product quality and efficiency of production (ibid).

The main elements of JIT are:

- Total Quality Control (TQC)/Quality at source
- Continuous flow processing
- Continuous improvement or Kaizen

2.6.1 **Total quality control (TQC)/Quality at source**

Two types of waste are associated with poor quality. First, quality is defined by the needs of the customer. A product that does not meet these needs leads to waste. Second, defective production is waste. Any product that is not produced correctly the first time causes waste through scrap materials, labour and machine time reworking and subsequent inspections. As such JIT aims to trace all defects back to their source in order to eliminate the causes. Simple devices are used to ensure that errors cannot be built into production, with more attention being paid to working conditions and automatic checking of quality (Humphrey and Kaplinsky 1995: 29). While quality checks are still made, increasing responsibility is put on workers to produce correctly the first time and monitor the results of their own work. This is reinforced through the use of cellular production units and reduced stocks which allows problems to be noticed more quickly and the source more readily identified.

In addition, the customer's need for a quality product takes on greater importance in the production process. Within the production process each successive stage becomes the customer of the proceeding stage. In this way each employee becomes responsible for quality control.

2.6.2 **Continuous flow**

As stated above JIT is aimed at producing the right quantity with the right quality at the precise moment it is required. In an ideal factory, a product undergoes a continual process of transformation from the moment its component elements enter the plant until the point at which it is dispatched to the customer. In this way, no time, effort or space is wasted.

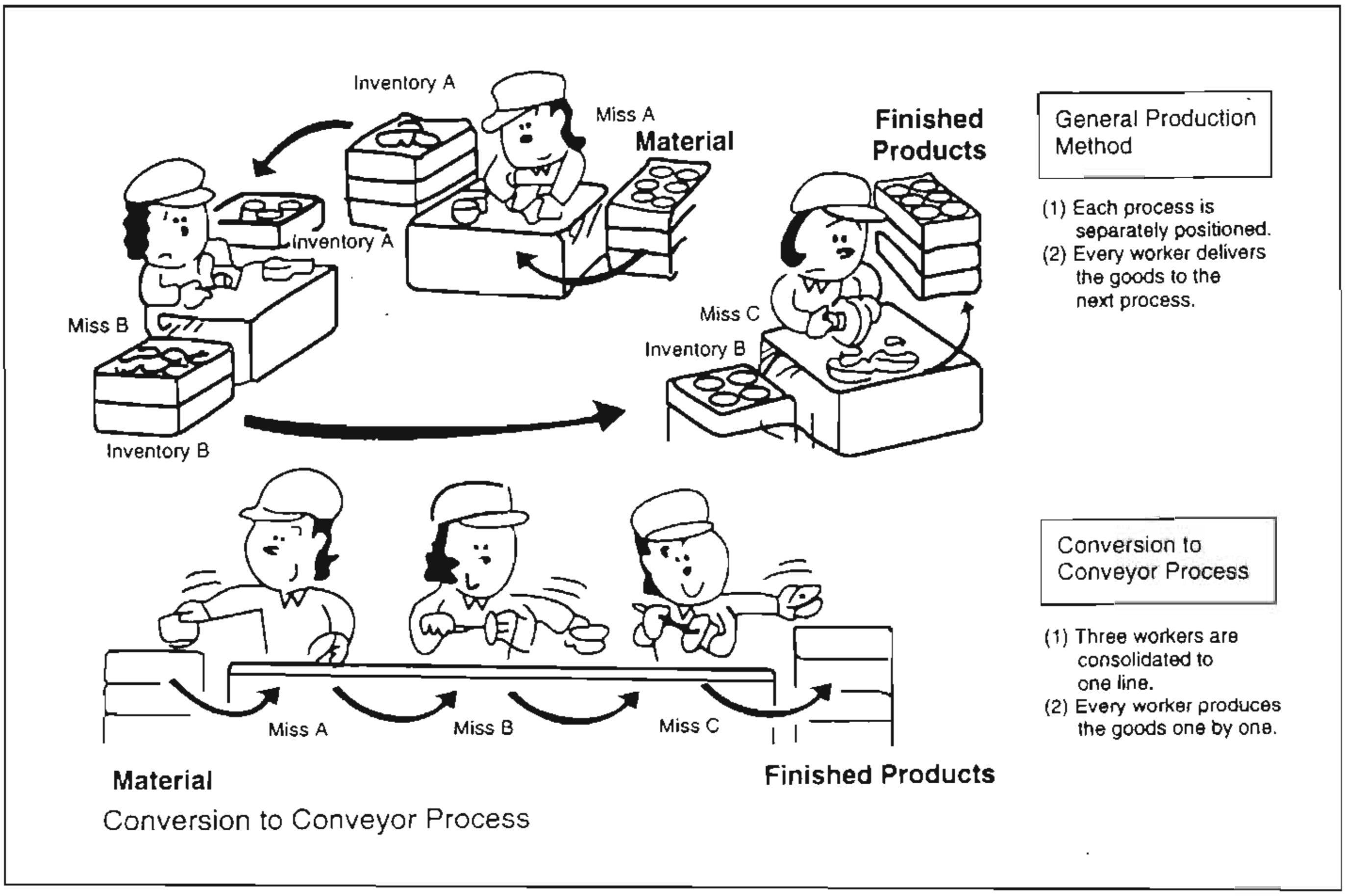
For manufacturing to be effective all three categories of inventories namely, incoming materials and components, work in progress, and finished goods need to be reduced. The reduction of inventories provides three sets of benefits to the enterprise. First, inventories generate costs - the cost (or opportunity cost) of working capital and the costs of space, labour and moving equipment needed to equip and store them. Second, products lose value by being held as inventory, where they can be damaged or become outdated. Third, inventories can hide manufacturing inefficiences. Therefore, inventory reduction forces a company to resolve underlying problems in its production lines.

Optimal flow is achieved when variations in production closely follow variations in final demand. This requires the reduction in both lot and batch sizes. Lot size refers to the number of parts which are transferred between stages of a production process. Large lots create large stocks and interrupt the flow of materials. In contrast, single piece flow involves passing a lot size of one unit between different processing functions. Batch size refers to a the number of parts produced before the set of a process is changed. Batch sizes, too, determine product flow. Rapid machine change-overs (single minute exchange of dies: SMED) address this problem.

As production shifts from a process-oriented basis to one based on products, production layouts shift from functional to cellular arrangements. In cellular layouts, machines performing sequences of operations are grouped together, and each part moves rapidly through the whole sequence of operations within each cell. This assists worker flexibility and contact with various machines and other workers as the distance between machines is reduced and movement is not hindered. The machines are arranged in a logical order according to the order of the task to be performed (see Figure 2.2).

Figure 2.2 Continuous production from one process to another

Historically, inventory was stored between team members manning sequential assembly processes. In a continuous flow system, inventory is eliminated and a "conveyor" method of processing goods one by one is adopted.



Source: Toyota Production Systems (1996: 21)

2.6.3 **Continuous improvement (Kaizen)**

A striking feature of the JIT production is the continuous effort to achieve improvements. It is assumed that one can always make improvement on the existing standards of work performance. These efforts are not confined to managerial or technical staff. Workers, too, are mobilised through suggestion schemes and quality circles. It is through this ongoing process of continual change that progress is made in further reducing inventories and the costs of poor quality.

Furthermore, the continual transformation of production and the activities of small groups may also put a premium on team working and job-rotation. Workers who are familiar with a range of jobs can adapt to changes in work practices and contribute better to small group activities.

2.7 TOOLS OF JIT

2.7.1 **Kanban**

Whereas JIT production is a concept, Kanban is a tool of just-in-time. It is an information system that controls the production and supply of the required parts, in the correct quantities, at the right time, in every process in the plant and at the suppliers (Toyota Manufacturing SA 1995). Kanban correctly translated means "signboard" and is a mechanism whereby the user drives the supplier. In this way, demand drives the reverse ordering of material in a closed loop so that the start and finish is always the same point. Production is thus "pulled" through the system rather than pushed. Production at one stage of a process is activated by demand for output from a subsequent stage, rather than being driven by the desire to maximise output at each and every work point. This operationalises the definition of JIT as "producing the right quantity with the right quality in the right place at the right time". Controlling production through "pull" means that parts are only produced when they are needed (ibid).

The functioning of the Kanban is best explained by the use of an example. This is provided by Hay and Suzaki (in Cheng and Podolsky 1993: 83) using a supermarket analolgy to illustrate the use of the Kanban. Producers determine the amount of goods the company will have to produce by the quantity they remove from the shelves. Withdrawal tags attached to the products are removed at the checkout and placed into a Kanban bin for holding the tags. The withdrawal tags are picked up and taken to a warehouse where new products used to fill the supermarket shelves are removed. Production-ordering tags attached to these goods are replaced with withdrawal tags. These goods are brought back to the supermarket shelves. The production tags are then placed into another Kanban bin which is picked up and transported to the manufacturing plant. Production of new products will occur in the quantities specified by the production tags. Once the production of new products is complete, production cards are attached and the goods are transported back to the warehouse shelves. The cycle is then complete and these actions are repeated on a continuous basis to meet consumer demands.

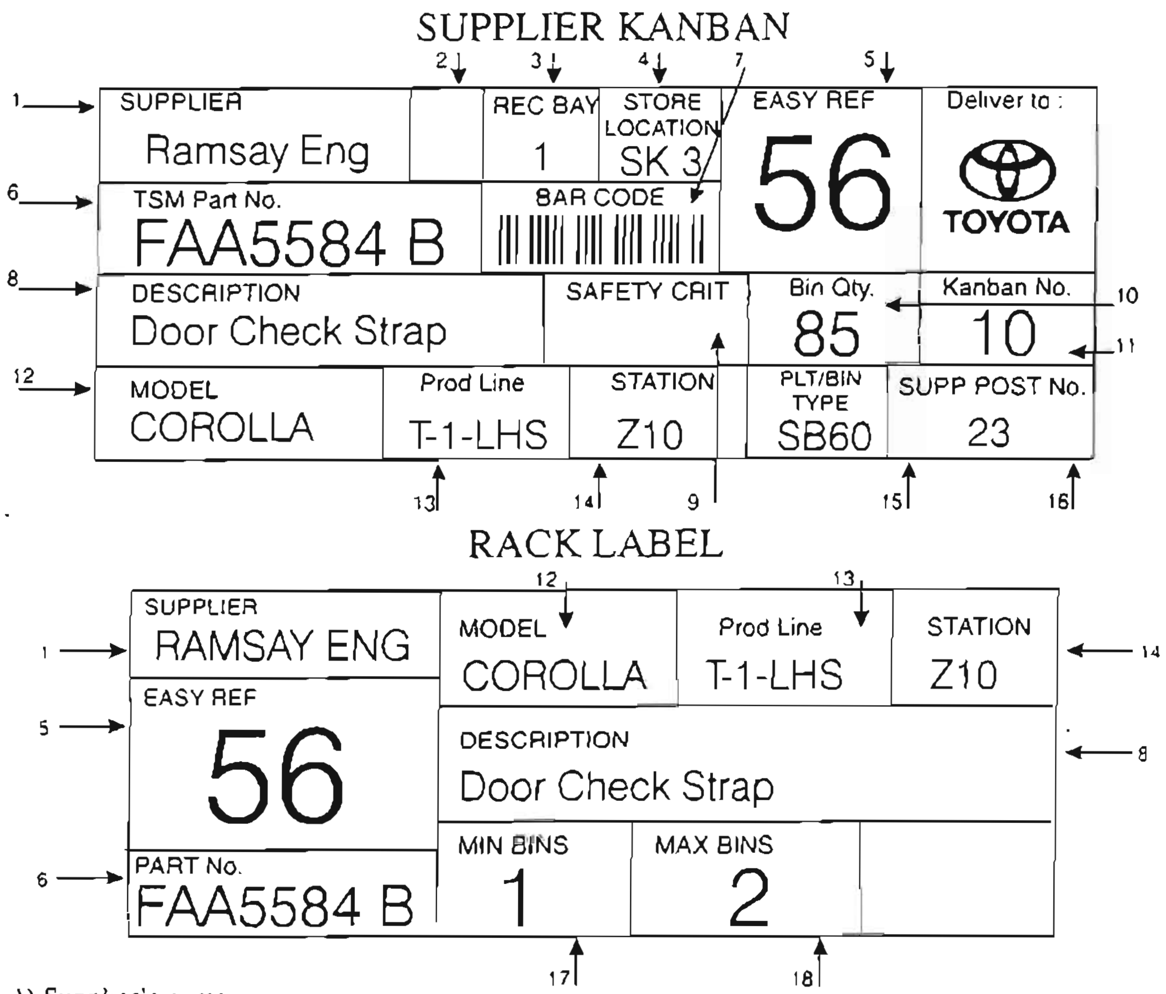
From the example it is evident that there are two main types of Kanban - production and withdrawal

- Production - This is known as the Production Instruction Kanban and is used to order the start of production at each production work site
- Withdrawal - This is known as the Parts Withdrawal Kanban and indicates the timing and quantity for a worker at one process to pick up a new supply of parts from a preceding process (see Plate 1).

These categories are broken down further into four functional Kanbans as follows:

- Parts Withdrawal Kanbans
  - Inter-process Kanban: This is used by work sites for picking up needed parts from preceding work sites.
  - Supplier Kanban: This Kanban is attached to parts containers coming from suppliers. They are used in the same way as inter-process Kanbans
- Production Instruction Kanbans
  - Intra-process Kanban: This Kanban is used to order the start of a particular job within a larger process such as within a machine or manufacturing plant. Its purpose is to make sure that the parts

Plate 1 Kanban Tag



1) Supplier's name.
2) Indicator "T" for temporary card with a red stripe diagonally across.
3) TSM Receiving Area
4) Store (Warehouse) Location.
5) Short reference number for quick visual lineside rack identification.
6) TSM Part Number
7) Bar coded format for Part Number, Quantity and Kanban Number.
8) Part Description
9) Safety Critical Indicator (Y=Yes; N=No) If Y then stamp S.
10) Specified Standard Quantity to be supplied.
11) Sequential number of Kanban.
12) Model type description.
13) Identification of production line where component is used. (T-1-LHS = Trim Line 1 on Left Hand Side)
14) Station on production line
15) Type of bin/dunnage specified for this component.
16) Identification of post box number where Kanbans are placed for collection by supplier
17) Min No of bins required on production line relative to production usage.
18) Max No of bins required on production line relative to production usage.

Source: Toyota Production Systems (1996)

- withdrawn by the following process are replaced by exactly the amount withdrawn, in the order withdrawn
- Signal Kanban: This Kanban is used on a lot production line where different items are processed and time is needed for changing processing of one item to another. Triangular in shape, it is used mainly for jobs relating to stamping, die casting and resin moulding processes (Toyota Manufacturing SA 1995).

An inter-process and a supplier Kanban both do the same thing, i.e. initiate conveyance. The former operates within Toyota and the latter outside to a supplier. The intra-process and signal Kanban are also similar in that they both initiate production. The former however, involves little or no change over time while the latter needs to be planned into production due to longer tool change-over times (ibid).

2.7.2 **Green areas and suggestion schemes**

Green areas are places where team members meet to discuss production matters. Information relating to production, absenteeism, quality, and safety is displayed in these areas (see Plate 2).

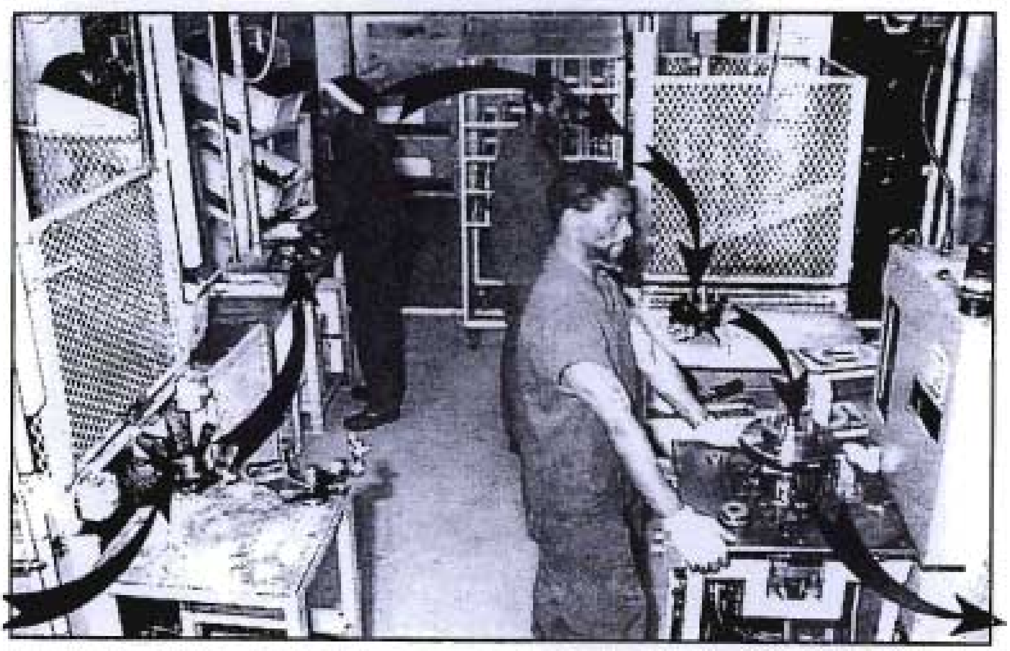
Suggestion schemes are aimed at drawing upon the ideas of all employees to improve production. These schemes also build loyalty and company pride by acknowledging the importance of each and every employee within the organisation.

2.7.3 **Work teams**

In a JIT production system employees are arranged into work teams to allow for greater flexibility. These work teams are arranged according to product line rather than function or department (Cheng and Podolsky 1993: 170) (see Plate 3). Each member of a work team is expected to be able to do all the jobs within that workgroup so that tasks can be rotated and workers can fill in for each other. Work teams are encouraged to be think pro-actively so that they can devise solutions before problems become serious (Womack et al 1990). This means that managerial responsibility becomes part of the everyday work of production and operations staff,

Plate 2 Green areas and information boards

Plate 3 Work teams



thereby substantially reducing the need for supervision by management. Thus JIT is associated with fewer layers of management. However, the ability of workers to take on increasing tasks and responsibility is however contingent upon their being adequately trained.

2.8 REQUIREMENTS OF JIT

2.8.1 **Heijunka (levelled production)**

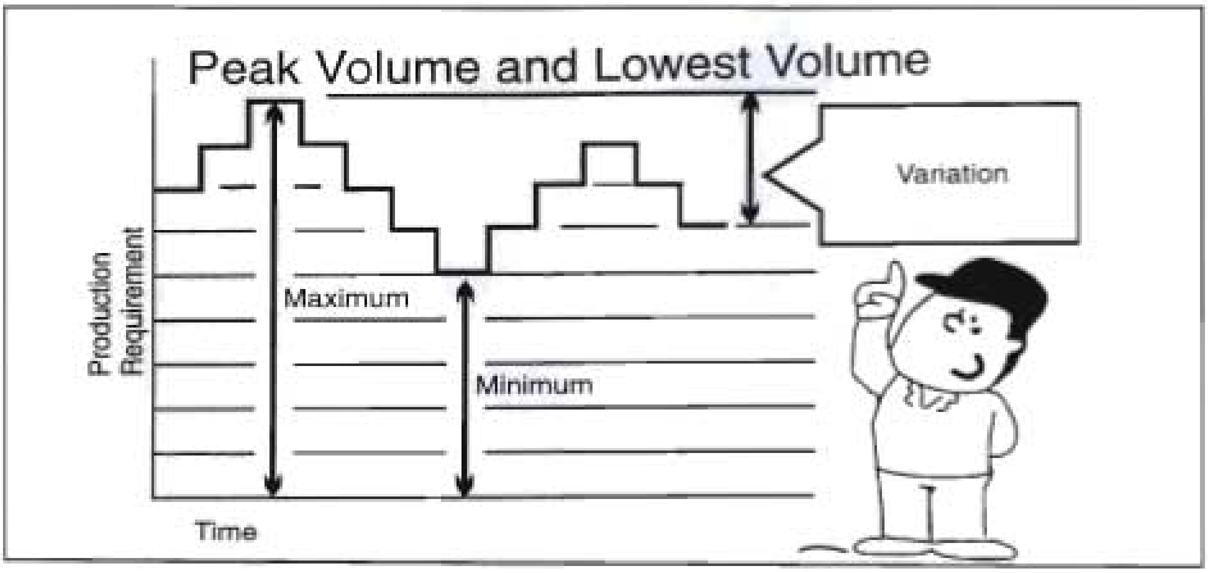
An important requirement for the operation of JIT is that of Heijunka. This is described as "sequenced production in cycles" and refers to the levelling of production.

The variability in product demand necessitates the production of a range of products in small quantities. However, in order to support the Kanban system and thus facilitate JIT, it is imperative that production is scheduled in such a way that something of everything is built everyday. Consequently, vehicles are built in a set sequence within a cycle with something of everything being built in that cycle. This cycle can repeat itself several times a day with the range of models within a car range being the controlling factor as to the size of the cycle.

Furthermore, Heijunka creates a regulated demand throughout the month permitting the component supplier to plan an efficient operation (Toyota Production Systems 1996). This is often referred to as having a "balanced" line or "balanced" production. Groups of work stations must balance their output of each item so that amounts taken from the preceding processes do not vary by more than about 10% per day as this would require standby reserves of inventory, labour and equipment. Seasonal variations in demand are allowed for when companies prepare their yearly "master" schedules and three-monthly "middle" schedules based on sales forecasts. These are then updated a month, week and even two or three days before manufacturing takes place (Linge 1991: 317). Toyota Motor Corporation takes this process further by providing suppliers with a daily release schedule. Heijunka posts are used to indicate what product needs to be produced when (see Figure 2.3 and Plate 4).

Figure 2.3 Heijunka

Heijunka is the overall averaging of the variety and volume mix of units produced in a given time. It refers to the striving to match the daily production sequence to the actual mixed model sales demand as experienced by assemblers.



Source: Toyota Production Systems (1996:21)

Plate 4 Heijunka Post

The heijunka post enables the component manufacturer to schedule production in a level manner to match the assembler demand. Production Instruction Kanbans are placed inside the heijunka post to pull production off the line.

2.8.2 **Human resource requirements**

"International case studies have shown that human resource capability is the most important weapon that any firm has in its armoury when confronting the demands of international competition, as it is the firm's human capacity that gives it the ability to innovate and continuously improve operations" (Barnes 1998).

Human resource development is increasingly seen as the key to achieving "world class" status. This rise in importance is due to the changing nature of production. JIT production has led to a need for a new forms of flexibility, both through intra firm reorganisation and inter-firm co-operation. New forms of work organisation involve multi-skilling, employee involvement as well as devolution of power from management to employees.

The principal human resource requirements of JIT production systems are:

- Commitment of management
- Commitment of the workforce and good industrial relations
- Flatter organisational structures
- Training and skills development
- Use of knowledge

Commitment of management

The commitment of management and industrial relations play a critical role in determining the successful adoption of JIT. According to Kaplinsky (1995: 66) successful western implementers of JIT are characterised by managerial commitments at all levels of the firm, but particularly at the highest level. Commitment of the CEO of a firm is critical to the success of a corporate-wide drive to adopt JIT.

But it is not only senior management that impact on the effective implementation of work organisation reform. The commitment of middle management and supervisors is also crucial. Middle management is in effect responsible for translating upper management abstract goals into concrete action plans as well as the co-ordination thereof. Unless middle management "buys in" to the process of reform little progress is likely to be made

The extent to which JIT is applied and the success thereof is thus directly related to managerial commitment at all levels of the enterprise.

Commitment of the workforce and good industrial relations

The commitment of management is, however, not the only requirement for the successful implementation of JIT. In addition, JIT production is associated with a fundamental change in perspective with regards to labour. Labour is no longer regarded as a cost to be minimised but rather as a resource to be maximised. Employees become "thinkers" rather than just "doers". Quality at source and continuous improvement depend upon the participation of labour at all levels. This is only possible where a close relationship of trust exists between management and labour. Trust between management and labour is strengthened through the development of communication linkages and the devolution of responsibility to labour. The amount of responsibility and individual control given to workers is one of the main factors distinguishing Fordist and post-Fordist work organisation systems such as JIT. JIT involves quality circles, green areas and suggestion schemes which are all aimed at achieving greater levels of communication and participation of labour. Trust is, however, a pre-requisite for harmonious industrial relations and is central to good economic performance under modern technological and market conditions. For firms to decentralise production decisions, management must trust workers not to misuse their increased discretion. At the same time if workers are to contribute to efficiency, they must trust management not to exclude them from the benefits of their efforts (Joffe et al 1995: 212). As such where harmonious relationships between management and labour exist, workers are more likely to put forward ideas for innovation and are also more likely to be open to suggestions for change put forward by management.

Flatter organisational structures and team working

JIT is characterised by flatter organisational structures than those associated with Fordist work organisation. Under Fordism management retains control over even the most basic operational decisions necessitating numerous layers of management (Duncan 1997: 64). In contrast, flexible production requires less hierarchial management structures, cross-functional work teams and increased worker participation (Barnes et al 1999: 14). Layers of management are reduced and in effect management responsibility is dispersed throughout all levels including production/operations staff (Brown 1996: 290).

A further characteristic of JIT is the arrangement of workers into teams (see 2.7.3 above) which permits greater labour flexibility but which necessitates higher levels of training and skills.

Training and skills development

International evidence suggests that the effectiveness of new organisational technologies is dependent upon the level of training and skills at all occupational levels. This training and enskilling is required to allow jobs to evolve from being narrow and task-oriented to being multi-dimensional in all levels of the corporate hierarchy (Joffe et al 1995: 186). Furthermore the emphasis on continuous improvement necessitates on-going training and skills development as well as the development of a participative culture through which the labour force can become involved in process and product improvement.

In addition to the emphasis on more training, there is also a change in the type of training needed. In the past most training was of a technical nature and workers were "trained" to perform a specific task. JIT production systems, however, require workers to be able to perform a number of tasks, take increasing responsibility for quality of their output and to have an understanding of wider production and organisational issues. This necessitates vocational and non-vocational training. Motivational and attitudinal training is increasingly being regarded as equally important to technical training. This is reflected in recruitment policies which attach more weight to potential employees attitudes, team working abilities, energy and ambition. As the Chief Executive Office of Premier Exhausts puts it "we believe that you can't change people's attitudes but that you can change their skills" (Management Today 1994). Training is also seen as essential to achieving higher levels of worker involvement. Workers need to understand the entire production process, be able to read production charts and perform a number of tasks. It is only with this level of understanding that workers can meaningfully participate in a process of continuous improvement. Training of the entire workforce needs to occur on a continuous basis with an emphasis on life-long learning so as to enable workers to keep apace with technological change and develop to their full potential.

Use of knowledge

A firm's employees are the most important developers, carriers and users of knowledge (Den Hertzog & Van Sluijs 1995). JIT production systems aim at not only making key information available to everyone but also to providing the necessary training and conversational skills to give people the context for that information and to encourage them to share their perspective with others (Senge et al 1999: 438).

Continuous development of new knowledge is needed to remain competitive and the best source of this knowledge is very often the workers themselves. Workers in Fordist organisations were thought to have very little to offer their companies apart from their labour input (Barnes et al 1999: 16). As such one-way information flows from the top to the bottom were evident with whole levels of management dedicated to managing information flows.

JIT's associated flatter organisational structures are vital for information and knowledge flows. "Open book management" is regarded as crucial to the success of the organisation with complete information and knowledge flowing freely between workers and management.

The benefits of listening to workers is illustrated by Land Rover who have successfully harnessed the knowledge of their workers. Their work discussion groups and suggestions schemes have saved the firm over $5 million since 1992 and contributed to on-going improvements and innovation (Management Today 1994).

2.9 IMPLICATIONS FOR INDUSTRIAL LOCATION

A number of theorists have argued that changes in the organisation of production are associated with spatial restructuring. Storper and Walker (1989: 99), for example, argue that "industrial technologies shape the patterns of geographical industrialisation and thereby play a central role in creating upheavals in the industrial system and in producing persistently uneven geographical development". Furthermore, Kaplinsky, Oman and Douglass (in Rogerson 1994: 3) state that in the transition towards flexible production a radical shift occurs in the logic of industrial location and scale. They argue that the adoption of more flexible product mixes and JIT inventory systems creates new patterns of inter-firm relations in which proximity and reliability of supply are of critical significance and which militates against the principles of geographically spread production. In line with this Day (1989: 4) states that the interactive relationship of JIT impacts on the spatial structure insofar as it gives rise to a particular set of industrial requirements which are generally associated with the concentration of production units around metropolitan agglomerations and markets. Thus geographical proximity is required in order for JIT to function effectively.

In terms of the automotive industry, Sadler (1994: 42) contends that the implementation of JIT carries some clear geographical connotations, namely spatial clustering of suppliers around major assembly plants. This is in contrast to patterns of dispersal and decentralisation which characterised previous searches for labour power. A number of theorists thus conclude that the adoption of JIT production systems entails a wholesale geographic shift in existing patterns of automotive component supply (ibid).

Linge (1991: 316), however, contends that recent experience is showing that JIT is more spatially flexible than has been suggested. He argues that component manufacturers are now seeking locations from which they can maintain their JIT capacity but at the same time serve several customers. This allows them to have a wider client base making them less vulnerable to the competitiveness of a single lead firm. Linge (ibid) argues further that the implementation of JIT leads to a reallocation of costs within and outside the particular manufacturing sub-system. JIT requires the frequent and precise delivery of products between lead firms and their sub-contractors. This, in turn, adds not only to the overheads of sub-contractors within the system but also to the costs of public authorities responsible for maintaining the transport infrastructure. Road congestion and changes in property values and land uses not only re-allocates costs between sectors but also between firms, households and individual users. An understanding of the implications of JIT for planning for industrial development is thus crucial if negative externalities are to be minimised.

At the same time Salerno et al (1998: 589) suggest that firms are moving even further in the direction agglomeration to one of "condominiums". Salerno et al (ibid) define the concept of the condominium as the location of independent suppliers' productive facilities inside, or on the same site, as the assembly plant. Salerno et al (ibid) contend that such a system gives rise to new logistical systems such as the "milk run" in which assemblers hire logistical operators to pick up components from the suppliers plants on a daily basis. A truck passes a vendor at a particular time each day at which time planned quantities of components should be available. This system seeks to optimise total logistical cost without incurring large inventories of the same component. Spatially the condominium concept will reinforce the tendency towards agglomeration but with higher levels of concentration.

Overall, it appears that JIT is resulting in a range of spatial outcomes. A review of international experience, particularly with regard to Japanese transplants, provides some interesting insights into the spatial implications of JIT. An overview of the automotive industries in the following countries is considered: Japan, USA, Europe, Brazil, and Spain.

2.10 INTERNATIONAL PRECEDENTS

2.10.1 Japan

The Japanese automobile industry occupies a central position in ideas about JIT and industrial location. Much of the discussion about the spatial impacts of JIT appears to have been swayed by Toyota's arrangements in Japan (Linge 1991: 326). The principles of JIT were first implemented by Toyota Motor Corporation in the 1950s. According to Mair (1992: 83) the "JIT=spatial concentration" argument is largely based on the Japanese case of Toyota City which displays a number of key characteristics.

First is the concentration of Toyota's major factories in one place. Twelve of Toyota's Japanese assembly and major components plants are located in, or on, the outskirts of Toyota City, which is a metropolitan area in its own right located 25 km from the major industrial metropolis Nagoya. Second, due to Toyota being the major employer the company has come to dominate not only employment but also consumption (housing) and local politics. In this way Toyota has been able to control the expansion of transportation infrastructures so as to facilitate movement of materials and components between production sites, which has in turn permitted JIT deliveries among factories within the urbanised area of Toyota City. Third, the spatial structure of production is relatively isolated. While Toyota City has since become a dense urban area, the site was originally a rural town separated from Japan's major cities. The selection of a "green-field" location facilitated the adoption of JIT through the employment of largely rural, unskilled workers. Fourth, *Toyota encouraged its component suppliers to locate within a short travel time of* Toyota plants, and a large number of located in or very close to Toyota City. 1st tier suppliers tended to locate closest to Toyota's plants, with the majority of 2nd tier suppliers (i.e. suppliers to 1st tier firms) located further away, although still within ± 30 km.

Mair (1992: 84) concludes that this geographical concentration of suppliers has enabled Toyota to implement JIT within its suppliers networks. The first independent firms to implement JIT were located in the same prefecture as Toyota

City (i.e. within a 50km radius). Those located in the Tokyo region were the last to implement JIT. This was partly due to their not being exclusive Toyota suppliers and partly because JIT required suppliers to make several deliveries per day to Toyota which was difficult for firms located outside of Toyota City. Despite this, Toyota sources 35% of its inputs from suppliers located outside Toyota City, in Nagoya (ibid). Moreover, most of Toyota's 2nd tier suppliers are located in the Nagoya area rather than Toyota City.

Notwithstanding the above characteristics, Mair (1992: 86) contends that the Toyota spatial model is by no means universal in Japan. He cites the experiences of other automobile manufacturers in Japan namely, Mitsubishi and Mazda, whose suppliers are not located within close proximity of their assembly plants. While Mazda's Hiroshima plant accounts for 10% of Japan's automobile assembly, only 2% of parts factories are located there. Over 50% of Mazda's components are transported to Hiroshima from other regions like Tokyo and Nagoya (ibid). In addition, the implementation of JIT within Nissan, Japan's second largest automobile manufacturer, has been curtailed by its metropolitan location. While Nissan's suppliers are located in close proximity to the plant, the traffic congestion within the metropolitan area makes the implementation of JIT extremely difficult. Thus, the apparent advantages of short distances disappear when traffic jams and poor road systems regularly disrupt deliveries. For this reason Nissan does not operate a Kanban system and prefers centralised computer-controlled methods of Materials Requirement Planning (MRP). Nissan thus reveals the problems that can arise in trying to implement JIT manufacturing under one set of unfavourable spatial conditions (ibid).

In summary, Mair (1992: 91) argues that the Japanese experience demonstrates that while the adoption of JIT may indeed imply some spatial concentration via industrial relocation, the existing spatial structures will significantly influence the diffusion of JIT, leading to adaptation as well as adoption. As such Japan displays an uneven geographical pattern to the adoption of JIT, which is strongly influenced by existing spatial structures of production. Therefore the diversity of firm strategies regarding location and manufacturing should be borne in mind (ibid).

2.10.2 United States of America (USA)

The spatial implications of JIT in North America are best demonstrated by considering the experiences of Japanese transplants there. When Japanese firms initially considered constructing transplants in North America, they recognised that location was a critical determinant in the success of transferring JIT techniques (Mair et al 1991: 363).

These firms recognised that while obtaining JIT deliveries represented a problem, importing components from Japan would seriously undermine the JIT inventory control system. To counter these problems, the transplant firms originally hoped to establish JIT relationships with a number of indigenous supplier firms. Locations in the Midwest and Southern Ontario Region were favoured due to the areas' history as the geographical heart of North American automobile production and the locus of automotive supplier firms (Mair et al 1991: 364). Honda, for example, selected an Ohio location precisely in order to establish JIT linkages with Midwestern supplier firms. Mazda, located its assembly plant in metropolitan Detroit in order to obtain easy access to suppliers.

However, poor quality of indigenous supplies and concerns over the extent to which suppliers were contracted to their American rivals resulted in Japanese assemblers encouraging many of their Japanese component suppliers to establish plants in North America (Sadler 1994: 44). The predominant geographical pattern of supplier transplants followed that of the assembly transplants with supplier plants clustering around the assembly plants but spread over 150 km radius. Several Japanese supplier firms constructed separate factories close to each assembly plant they supplied to instead of concentrating production at a single large plant. The end result of these location decisions by supplier firms is the pattern of regional-scale concentration around assembly plants with 80% of the 250 transplant suppliers being located in the same region (Mair et al 1991: 366).

Rubenstein (1991: 136) offers a further explanation for the above pattern and argues that government intervention has played an important role in determining Japanese supplier locations within the US. According to Rubenstein (ibid) Japanese government and banking officials directed suppliers to particular states within America. Japanese officials perceive each car manufacturer to have staked an exclusive claim to a different US state, and steer a car manufacturers's suppliers to the same state. This practice discourages a supplier from arranging contracts with more than one assembly plant. For example, South-western Ohio lies within 90 minutes of both the Honda plant at Marysville, Ohio, and the Toyota plant at Georgetown, Kentucky, yet Toyota suppliers are strongly discouraged from locating in Ohio, which is regarded in Japan as Honda's territory (ibid).

The selection of specific sites within the Midwest has been influenced in part by good transport links. Rubenstein (ibid) states that most sites are near one of three major interstate highways: I-70 which runs east-west, and I-65 and I-75, which run north-south. The I-75 between Michigan and Tennessee has attracted so many Japanese component suppliers that it is now frequently referred to as the Kanban Highway (ibid). In addition, Mair et al (1991: 367) state that "bidding wars" among state and local governments also had an influence on location. However, decisions on manufacturing locations were determined by the overriding strategic desire to transfer JIT methods to North America and as such the field of effective competition in the "bidding war" had already been reduced to the Midwest and Southern Ontario Region.

At the local-scale the selection of greenfield locations by most firms reflects a concern to avoid labour union organisation and to find production employees with a strong work ethic and little experience in Fordist industries. Local-scale dispersal of supplier transplants within rural regions is thus due to a desire to segregate their labour markets. As such Mair et al (1991: 370) argue that concentration of automotive manufacturing along the lines of Toyota City are not evident nor are they likely to emerge in North America. In the case of Japanese transplants in North America, geographical re-concentration of automotive manufacturing globally and regionally has been combined with local-scale dispersal (ibid).

2.10.3 **Western Europe**

Japanese investment in Europe built up slightly later and more gradually in comparison to what had occurred in America (Sadler 1994: 43). During the 1980s only 50 Japanese assembly companies were established in Western Europe, some of which were joint ventures. In contrast to America, Western Europe had a broad range of independent automotive component suppliers. Political pressure was placed on Japanese assemblers to attain high levels of local content before they could export freely across the European Community (Sadler 1994: 43). This pressure brought Japanese assemblers into close contact with the European automotive components industry.

In 1984 Nissan was the first to invest in the United Kingdom with the construction of its assembly plant in Sunderland, north-east England. Initial indications suggested that the established components industry exhibited only limited relocation to north-east England (ibid). Locally established plants supplying Nissan tended to fit into two categories: The first was that of low value-added and, or, high bulk components such as plastic mouldings, trimmings, seat covers, and seats, with substantial variation in production range. The second category consisted of those components not satisfactorily available elsewhere in Europe. Both categories of components were produced in newly established factories in the north-east.

According to Sadler (1994: 44) straightforward neoclassical views explain the spatial agglomeration that began to emerge for it made little sense to transport seat foams over vast distances due to their high bulk, low value nature. Furthermore, frequent variation in product specification - in the case of seats, for instance - provided a powerful incentive to reduce delivery times and near synchronise manufacture (ibid).

Nissan committed itself to working with the existing supply base in Europe and in 1988 established supplier development teams to work with component firms to improve their overall performance. By 1992 these teams were actively involved with over 50 companies (ibid). When Toyota and Honda established plants in the United Kingdom towards the end of 1992 neither asked any Japanese companies to set up in Europe. Toyota ordered prototype parts from 150 European companies while Honda's supply base was even smaller: just 136 companies (Sadler 1994: 46).

However, as leading component firms became increasingly internationalised, they sought to shift out of dependence upon a single national market and go beyond European-wide supply agreements to operate instead on the same global terrain as the assemblers. This had important implications and hinged upon a conception of the spatial organisation of production that favoured trans-European rationalisation over spatial proximity to the customer as a guiding principle (ibid). As Sadler (1994: 55) argues it posed vital questions about the interplay between the temporal demands of just-in-time delivery and the spatial arrangement of production resulting from corporate strategic decisions. This is illustrated by Bosch, a major component manufacturer, who opted to establish production plants in Miskin, South Wales and in Spain. These plants were to be the sole supply sources for a new generation alternator for the whole of Europe. From such bases contact with vehicle assemblers was strengthened through the use of warehouses that eased what first looked like JIT delivery, but was not JIT delivery as practised in Japan.

Sadler (1994: 56) states that the European automotive components industry shows no clear evidence of the wholesale adoption of Japanese-style JIT, nor of Japanese plants seeking such a development on a broad basis. In light of the European experience, Sadler thus concludes that the equation between JIT production and spatial proximity is clearly an oversimplification appropriate only in particular circumstances.

2.10.4 **Brazil**

According to Salerno et al (1998:600) the implementation of just-in-time production within Brazil is resulting in some very distinctive spatial outcomes, particularly with regards to new investments. New car plants have been designed and built, based on the so-called "industrial condominium" in which a series of suppliers are settled inside the assembler building or build facilities on the assembler's yard. Fiat. Ford, Renault, GM and Land-Rover have all either implemented or planned their new investments around such a concept.

Salerno et al (1998: 600) argue that the high logistical costs and risks make physical proximity crucial in reducing costs. The tendency for 1st tier suppliers to deliver complete subsets, and not individual components, increases logistical costs and risks making proximity even more important. In addition, assemblers have stressed the importance of proximity in providing high levels of service. More than distance, the conditions of delivery, problem solving, design adaptation, participation in the assembler's continuous improvement programmes, understanding the assembler strategies and operational policies are all of utmost importance (ibid).

The new Volkswagen plant in Sao Bernardo provides an excellent example with over 75% of its suppliers being located less than 50km from the plant. Salerno et al (1998: 600) argue that when suppliers are located next the assembler's plant it is easier for them to act when there is any quality problem on the assembly line, a change in the logistics system or in the production schedule. Therefore assembler's view proximity as a way to decrease risks, while from the supplier's point of view, proximity represents an opportunity to improve the relationship with their client. This may lead to their being involved in improving the design of components for local conditions which, in turn, could result cost reductions and, or, general process improvements for the supplier. In this way the suppliers are also able to increase their added value and profit margins.

However, it is not always viable for a supplier to locate a dedicated plant near every assembler's plant. This is particularly true where the supplier production process involves high fixed costs. In this case, suppliers are following a strategy of concentrating the production processes which demand more fixed capital in a main plant, while locating final processes such as components assembly, inventories and product delivery, in plants near the assemblers.

An example of this is the Magnetti Marelli (MM) who produce exhausts and other components. MM recently announced their intention to construct a new R$40million plant . The new plant is to be located in Contagem, in the state of Minas Gerais, near the Fiat assembler plant in Betim. The company is also participating in the Mercedez Benz's industrial condominium for the A-class project also located in Minas Gerais. As such MM will be opening a R$ 1 million plant there. The plant in Contagem will supply the Fiat plant in Betim and also the plant in the condominium. The condominium plant will probably only assemble the components produced at the main plant in Contagem. This strategy aims to invest as little capital as possible in the dedicated plant in the condominium, investing more in the main plant that has more customers (Salerno et al 1998: 601). Salerno et al (ibid) contend that the strategy adopted by Magnetti Marelli is fast becoming the general tendency amongst component suppliers.

A further strategy, but one which is aimed primarily at improving JIT supply, is that of the "milk run". This system has been adopted by both GM and Ford plants in Brazil. According to this system, a truck from a logistical operator goes to the suppliers on a daily (or hourly) basis, and takes the necessary parts according to the assembler's schedule. If the supplier does not have the necessary part at the right moment, it assumes responsibility to deliver the parts as soon as it can. And if the problem has caused an additional costs to the assembler, it will be charged to the supplier. To avoid such problems, sometimes the suppliers prefer to count on a significant inventory of finished products. While this runs against the principles of a JIT system, it costs less than an eventual fine or, what is worse, the loss of a contract.

The milk run is not used by all suppliers. Where a supplier fills a truck with his own deliveries, there is no need for the milk run. In the same way the industrial condominium is only viable for some very specific suppliers, those that carry high logistical costs, low fixed capital or lack economies of scale, and those whose parts are important for diversifying the models (eg. seats, bumpers and dashboards).

2.10.5 **Spain**

Beginning in the mid-1970s, Spain's automobile industry shifted from an inward to an export production model (Pallares-Barbera 1998: 349). In the 1970s, Spain's car exports represented 8% of total car production; by 1980 this figure had risen to almost 48% and by 1989 to 56% (ibid). Increases in efficiency were made possible by the introduction of JIT production methods in the mid-1980s.

According to Pallares-Barbera (1998: 355) the adoption of JIT practices in Spain brought about a change in the spatial arrangement of the automotive production network. This was accompanied by a reduction in the number of component producers per assembler as well as a decrease in the aggregate number of component producers, the latter dropping from 1417 to 1096 between 1983-1992. Spatially, the introduction of JIT distribution induced the emergence of intermediate warehouses as new nodes in the network. Warehouses function as a sink for components from different producers and as a source of components for assembly plants. Given the spatial inertia of component firms these "sink-and-source" warehouse nodes substitute some of the functions of the component firms, like JIT distribution.

Warehouses are located close to assemblers in order to facilitate short, timely, and sequential deliveries - on a daily or even hourly basis - so as to meet the requirements of JIT production. Warehouses are either independently owned or are subsidiaries of assembly firms. Independent warehouses are usually located in auto regions, with subsidiary warehouses located closer to their assembly plant i.e. within five or ten minutes driving distance.

Between 1983 and 1992 the number of warehouses in Spanish auto regions rose from 128 to 259, with the most dramatic changes occurring in Barcelona and Madrid.

By 1992 Barcelona hosted almost 40% of suppliers and Madrid 19% a slight decrease from that of 1983; Valladolid maintained 0.4% of total suppliers, Pontevedra increased to 1.3%, Zaragoza decreased to 4.1% and Valencia increased to 3.2% (ibid).

However, clusters did not develop in all regions, suggesting that the spatial agglomeration is not a direct response to the existence of assembly plants in a region. The new strategies adopted by Spanish assemblers did not involve a substantial change in the regional distribution of firms. Traditional auto regions maintained their relative position in the ranking of the distribution of suppliers. These traditional regions also hosted the highest proportion of new warehouses (ibid). Emerging auto regions, however, experienced little increase in the number of component firms. In these emerging regions, JIT practices were adopted from the beginning and distribution warehouse replaced the expected cluster of component firms around the assembler (ibid). The previous existence of a large assembler in a region did not necessarily imply the creation of a cluster of component firms unless other supporting factors, such as the lack of import substitution strategies by assembly firms, were present (ibid: 357).

Pallares-Barbera (1998: 358) thus concludes that the changes in the automobile industry had little immediate impact on the geographic distribution of firms within Spain. Space does not react as rapidly as do other structural variables. The relatively fast changes in the production system contrasts with the slowness of spatial restructuring.

Overall, the experiences of these countries offer some interesting examples of possible future trends in the automotive industry.

2.11 JIT IN LESS DEVELOPED COUNTRIES (LDCs)

The extent to which firms in LDCs have adopted JIT is debatable with a number of theorists claiming that this is indeed limited. Kaplinsky (1995) provides some useful insights into the possibilities of such production organisation being adopted in less developed countries (LDCs).

As many LDCs enter the export market they are finding it increasingly necessary to alter their previous patterns of production organisation to achieve higher levels of quality, to develop a more rapid response to changing market needs and greater customization of final product, and to lower production costs (ibid). At the same time LDCs are faced with decreasing levels of protection resulting in increased competition for domestic markets. A further factor driving the adoption of JIT is the requirements set by customers. Kaplinsky (1995: 61) states that a number of transnational corporations (TNCs) operating at a global level have demanded that their domestic suppliers achieve new levels of quality performance. Today all TNCs and domestic OEMs require their component suppliers to be ISO9000, ISO9002, and VDA6 compliant. Furthermore suppliers are required to deliver with greater frequency and in smaller batches. In addition, high rates of interest in LDCs are providing incentives for reducing stocks and organisational techniques which have facilitated JIT production have often been the gateway into the more extended utilisation of JIT (ibid). Finally, LDCs are characterised by high levels of instability in both factor and product markets. This has placed a premium on the flexibility facilitated through the utilisation of JIT.

2.12 CONCLUSIONS

The aim of this chapter was to assemble a set of theoretical perspectives, concepts and precedents that will inform the empirical research into the automotive components industry associated with the Toyota assembly plant in Durban.

Traditional theoretical approaches associated with Fordist production such as Von Thunen, Alonso, Behaviouralists and Young, provide a general understanding of industrial location but are not sufficient to explain contemporary forms. Theoretical approaches that span the Fordist:post-Fordist era such as product cycle, profit cycle, NIDL and transaction cost theories have greater relevance but again do not provide an adequate conceptual framework. For as Schoenberger (1987: 208), notes matching skill requirements in different segments of the production process to the lowest cost geographic source of labour supply for each skill category will have a relatively weak impact on the total cost structure of the firm. In fact, extensive decentralisation imposes additional costs by disrupting the flexibility and smooth functioning of the JIT system. The result is the reassertion of the role of external or agglomeration economies within industry that counter trends towards the decentralisation and dispersal of different segments of the manufacturing process.

Furthermore, contrary to the predictions of profit and product-cycle theories, clustering and dispersal are not only related to market demand and profitability but to the production process itself (Platzky 1995: 52).

Of far greater significance are thus the theoretical approaches which emerged in the post-Fordist era and which are associated with economic restructuring. The theories of flexible production, flexible specialisation and new competition are of particular and direct relevance to the case study. The spatial ordering concepts of importance are agglomeration, clustering and industrial districts. Although their origins (growth poles and industrial complexes) are no longer regarded as significant explanatory theories of industrial location, their historical roots have been identified so as to be consistent with the evolutionary approach adopted in this chapter.

A fundamental aspect of this conceptual framework is an understanding of JIT - what it involves and how this is manifested in practice. Examples of applications of JIT in the automotive industry in other countries from the developed and developing worlds, provided interesting precedents as to the type of functional and spatial forms that could emerge in Durban.

The historical approach taken in this chapter provides an understanding of the present spatial forms associated with the automotive industry, how these have evolved and what changes could be anticipated in the future. The relative contribution of particular strands of this conceptual framework for the case study will be assessed in Chapter 5.

CHAPTER 3

THE AUTOMOTIVE INDUSTRY AND THE ORGANISATION OF PRODUCTION IN SOUTH AFRICA AND KWAZULU-NATAL

3.1 INTRODUCTION

The purpose of this chapter is to provide an understanding of the automotive industry in South Africa and more specifically within KwaZulu-Natal. The chapter starts with a brief history of how the automotive industry in South Africa has evolved (including an overview of government policy). This is followed by an overview of the motor industry development programme (MIDP) and supply-side support measures currently offered by government. The next section discusses global trends affecting the automotive industry internationally and in South Africa. Against this background the automotive industry in KwaZulu-Natal is discussed with specific reference to the development of Toyota in Durban. The final section reviews the implementation of JIT production systems in South Africa.

3.2 HISTORY OF THE AUTOMOTIVE INDUSTRY IN SOUTH AFRICA

The development of the automotive industry in South Africa dates back some 70 years. Ford was the first to set up a manufacturing plant in Port Elizabeth in 1924, with General Motors following suite in 1926. The major reason for entry was the anticipation of tariff protection (Barnes and Kaplinsky 1998: 2). As part of a series of import substitution tariffs introduced in the mid-1920s, General Hertzog's National/Labour Party coalition government allowed imports of Completely Knocked Down (CKD) or unassembled kits at lower rates than Completely Built Up (CBU) or assembled units (Duncan 1997: 7).

In attempts to save foreign exchange, the government introduced import controls in the late 1940s (ibid). High tariffs were placed on CBUs, which when combined with a rapidly growing domestic market, acted as a magnet leading to the establishment of a number of large assembly plants in the country (Black 1994: 50). Three more locally owned assemblers set up and Chrysler invested in its own plant in 1949 with the British Motor Corporation following in the 1950s (Duncan 1997: 7).

While some basic components (batteries, glass, tyres) were sourced domestically, local content remained low at approximately 20%. With more than 80% of the components coming from overseas, motor vehicles were an increasing drain on the country's foreign exchange reserves (ibid). In 1960 the automotive sector accounted for 15% of total imports. The negative impact this had on the country's balance of payments led to government supporting greater usage of domestically produced components. In 1960, a report by the Department of Trade and Industry, recommended the creation of a components manufacturing sector to broaden South Africa's industrial base and save foreign exchange (ibid). As a result, the first in a series of local content programmes (six in total) was introduced in 1961. This required assemblers to source eleven peripheral items such as tyres, batteries and trim domestically. In return for higher levels of local content, these assemblers were given additional import permits.

In 1964 the government introduced Phase II of the local content programme which involved local content protection based on minimum percentages of South African-made parts (ibid). Assemblers could classify their vehicles either "manufactured" or "assembled". "Manufactured" models had to begin with a local content by weight of 45% and to increase this to 55% within 42 months. Import permits were freely issued to "Manufactured" models. "Assembled" models were subject to a sliding scale of excise duty, with bonus import permits depending on the level of local content achieved in each model in the previous year. Phase II ended in December 1969. By 1971 all "manufactured" models of passenger cars were expected to reach a net local content of 50%.

Local content programmes did not , however, reduce the number of assembly operations as was expected by government. Instead the proliferation of assemblers continued through the 1960s. By 1969 the National Association of Automobile Manufacturers of South Africa (NAAMSA) had 15 members, of whom four were major players. Ford and GM were still based in Port Elizabeth but Volkswagen, which had first been established in the late 1950s, moved to Uitenhage. In 1949 Austin, later known as the British Motor Corporation (BMC), established an assembly plant at Blackheath in Cape Town. This firm later merged with Leyland under Leyland's name. They maintained the assembly plant at Blackheath but had their headquarters in Elandsfontein. In the 1950s Nash Distributors Assembly (later changed to Car Distributors and Assemblers or CDA) set up locally-owned franchised operation in East London. By the 1960s they were producing a much broader range of vehicles, including models from Auto-Union, Mercedes-Benz, Jaguar, Alfa Romeo and Renault. However, ownership of this plant was later taken over by Daimler-Benz.

Other local plants included Datsun-Nissan at Rosslyn, Toyota at Durban, Peugeot, Renault and Citroen at Alberton. Chrysler, Daihatsu and Fiat had built their own plants at Pretoria, Brakpan and Alberton respectively (Duncan 1997: 27). By 1970 there were no less than 16 assembly operations in the country (Black 1998).

In 1971, Phase III of the local content programme, called for 66% local content by weight in "manufactured" models by 1977 (ibid). A secondary category of "semi-manufactured" models required 52% net local content. Other unassembled imports required ministerial approval while CBU units faced very high tariff penalities.

Phase IV was a consolidation period and did not involve any increases in local content. In 1980 Phase V was implemented. This applied a local content requirement of 50% to light commercial vehicles rising to 66% in 1982 (Black 1994: 51). Previously, the Board of Trade and Industry had thought that the commercial vehicle market was too small for local content, but the rising popularity of the "bakkie" had greatly increased the size of this market segment.

From the first programme in the early 1960s until the late 1980s local content was based on weight rather than by value. This pushed South African component firms into the use of heavy materials at a time when the global industry was moving to the use of energy-saving lightweight materials. Furthermore, Barnes and Kaplinsky (1998: 3) contend that this had the added perverse effect of reducing the share of local content by value (since the diffusion of electronics meant that some light weight materials were especially high in added value).

The 1980s saw a dramatic decrease in vehicle sales associated with the downturn in the South African economy. Problems inherent in the above approach to the promotion of local content had become obvious during these recessionary years. Furthermore, the imposition of sanctions from the late 1970s led to disinvestment by the two largest American assemblers, namely Ford and General Motors, who sold their holdings to local parties (Barnes and Kaplinsky 1998: 3).

The sharp decline in vehicle sales as well as disinvestment led to some rationalisation of the assembly operations in the mid 1980s. The assembly of Alfa Romeos and Renaults ceased. Amcar (assembling Mazda) and Ford merged to form Samcor, while the General Motors sell out to local management led to the establishment of the Delta Motor Corporation (Black 1994: 52). By late 1986, there were seven assemblers producing over 20 basic model variants for a market of 172 000 passenger cars. Exports were minimal (R105m in 1985) and with the increased introduction of highly sophisticated components, it became increasingly easy to meet mass based local content requirements while increasing the value of imported components (Black 1994: 52). According to Black (ibid) imports of vehicles and components amounted to R2095m during 1985.

Black (ibid) states that according to the Board of Trade and Industry, the local content programme, upto and including Phase V resulted in the following:

- *"a tendency to produce low cost, low technology components which were unremunerative to export and were produced in uneconomic volumes so locking the industry into a low volume, high cost production structure; and*

– *a very high import bill as source companies tended to load the price of components they supplied to local producers. As they were supplying largely high technology components which the local industry did not produce, this too tended to raise prices as there was no incentive to produce low mass, high cost components locally" (Black 1994: 52).*

Phase VI of the local content programme, introduced in 1989, was aimed at addressing these deficiencies. Phase VI marked the first attempt to address the problems of an inwardly oriented, overly fragmented industry with low volume output and associated high unit costs (Black 1998: 6). Local content was no longer measured by mass but rather by value. Importantly, local content value came to be measured not just by the value of domestically produced components fitted to locally assembled vehicles, but on a net foreign exchange usage basis. In other words, exports by an assembler counted as local content and enabled it to reduce actual local content in domestically produced vehicles to a minimum of 50% (ibid).

Phase VI was intended to encourage both local content and specialisation. However, it did not address the major factor inhibiting scale of production in the component sector i.e. the proliferation of makes and models in the domestic market. Black (1998: 6) contends that by increasing the flexibility of component sourcing while maintaining high nominal protection levels on CBUs, the effective rate of protection on CBUs increased sharply under Phase VI leading to an increase in the variety of models and makes being assembled locally.

Phase VI was heavily criticised by both assemblers and component manufacturers alike. The rapid introduction and frequent changes made to the programme added to the atmosphere of uncertainty. In late 1992, the Motor Industry Task Group was appointed to re-examine the programme and the future development of the automotive industry.

3.3 MOTOR INDUSTRY DEVELOPMENT PROGRAMME (MIDP)

As a result of work undertaken by the Motor Industry Task Group, the Motor Industry Development Programme (MIDP) was introduced in September 1995. The MIDP continued in the direction of the Phase VI and entrenched the principle of export complementation. However, it went a step further by abolishing local content requirements and introducing a tariff phase-down at a steeper rate than required by GATT. The MIDP has five main objectives:

- improve the internal competitiveness of OEMs and component firms
- improve vehicle affordability in real terms
- enhance the growth of assembly and components industries, particularly through increased exporting
- improve the industry's trade balance, and finally
- stabilise employment levels (Barnes 1999: 8)

The MIDP is it expected to run until 2007 and comprises the following sets of incentives:

- A tariff phase down schedule that reduces nominal rates of protection to 40% for completely knocked down components (CKD) by 2002.
- A duty free allowance for domestic OEMs of 27% of the wholesale value of the vehicles they manufacture
- A small vehicle incentive (SVI), which operates as a subsidy for the manufacture of more affordable vehicles. It operates via a duty drawback mechanism with the value of the drawback being contingent upon the ex-factory value of the motor-vehicle.
- The complete abolition of a minimum local content provision for domestic OEMs; and
- The introduction of an import-export complementation (IEC) scheme that allows both OEMs and component manufacturers to earn duty credits from exporting. These duty credits can then be used to offset import duties on cars, components or materials, or alternatively they can be sold on the open market (Barnes 1999: 9).

According to Barnes (1999: 9) the MIDP allows for continued protection of domestic OEMs. By 2002, 49.1% of cars will still face duties of more than 15%. While component manufactures appear to be protected, Barnes (ibid) claims this is deceptive. This is due to the ability of OEMs to bring in duty-free components through the SVI window, as well as through the IEC scheme. Alternatively, they can buy in duty credits from component suppliers who are exporting into the international aftermarket. Given the various mechanisms by which the OEMs can earn duty rebates it is extremely difficult to calculate the exact level of protection for the automotive components industry. According to Engineering News (June 28-July 2, 1998) the level of protection offered to the component sector is only about 3%.

Essentially, the various facets of the MIDP have opened up South Africa's highly insulated automotive industry to international competition extremely quickly (Morris et al 1998: 17). However, previous isolation has rendered the industry largely internationally uncompetitive, making it extremely difficult for automotive firms to turn a profit. There are currently seven passenger vehicle manufacturers in South Africa. These assemblers are located in throughout SA as follows: Volkswagen in Uitenhage, Delta in Port Elizabeth; BMW, Automake (Nissan) and Samcor in Pretoria; Toyota in Durban and Daimler Benz in East London.

Furthermore, a large number of OEMs and other automotive retailing companies are now importing vehicles directly. The sale of these imported vehicles in an already small domestic market is placing South African OEMs under enormous pressure.

In global terms, the South African market is extremely small (constituting less than 1% of global sales), with domestic production being even less significant with only about 5% of vehicles produced in South Africa being exported. Currently, SA's seven passenger vehicle manufacturers produce no less than 11 different makes with over 30 different basic models (Black 1994: 71). Given the small and stagnant market this results in low levels of production per model which in turn raises the costs in assembly both directly and indirectly through its impact on component production costs. These low levels of production are illustrated by platform volumes. In 1997 total car sales were only 268 000 of which 54 000 were imported. In 1997 only four platforms exceeded volumes of 20 000 p.a. and non reached 30 000 p.a. In the mid 1990s, the average platform run was only 11 500, which contrasts with 30 000 in Brazil and 50 000 in Australia (Black in Barnes 1998). In general for a plant to be competitive minimum plant sizes need to exceed 50 000 per annum for niche vehicles and more than 200 000 per annum for mass market vehicles. These figures illustrate the uncompetitive levels of production occurring within the SA automotive industry which results in higher car prices which, in turn, are uncompetitive in the international market.

The components industry has followed the trajectory of the OEMs with turnover having stagnated over the past few years (Morris et al 1998: 17). Morris et al (1998: 17) cite three main reasons for this stagnation:

- the poor performance of their most important market, the domestic OEMs;
- increased foreign sourcing by domestic OEMs; and
- the flood of imported components into the domestic parts and accessories aftermarket.

Despite the poor performance of the automotive industry as a whole, certain sub-sectors which have experienced significant increases in export growth, are performing well. Morris et al (1998: 13), however, argue that it is necessary to consider the extent to which these exports are made up of low value added components. As the export of these products increases it becomes easier to import higher value added components from foreign companies, thus eroding the technology base of the local industry.

3.4 SUPPORT MEASURES FOR THE AUTOMOTIVE INDUSTRY IN SOUTH AFRICA AND KWAZULU-NATAL

3.4.1 **Industrial Restructuring Project (IRP)**

The Industrial Restructuring Project comprises a series of research and dissemination activities designed to assist the Department of Trade and Industry (DTI) overcome major gaps in its knowledge which hinders its ability to design and implement effective industrial strategies. Industrial policy on international competitiveness is hampered by limited firm-specific knowledge on the determinants of competitiveness in the new era of trade liberalisation.

The projects aims to improve the knowledge base on competitiveness and world class manufacturing in selected sectors, including the automotive components sector, in order to inform and build capacity amongst Department of Trade and Industry (DTI) officials and stakeholders within each sector. In addition, the project aims to build research capacity both internal and external to the DTI. Finally it aims to utilise European expertise with a knowledge of South African manufacturing conditions to assist in the fulfilment of these objectives. Specifically, the project will create and update a data base, undertake analyses of value chains of these sectors, conduct pipeline studies focussing on the key areas of sectoral inputs and outputs, investigate exporting success, and conduct workshops and presentations.

3.4.2 **Benchmarking Club**

The Benchmarking Club uses key measurements or bench-marks to make comparisons between local firms and international firms with an aim to improving firm-level levels of competitiveness through inter-firm co-operation. The club is facilitated by an independent consultant and funded by both the DTI through its Sector Partnership Fund and club members who contribute 35% of the budget.

Firms receive a range of services including a detailed analysis of how each firm compares with an international firm competing in the same or similar market. The information is compiled by the consultants on an annual basis. Workshops are also held to discuss common problems and possible solutions related to competitiveness. The performance enables them to pinpoint and discuss where and why they are lagging or are ahead of average performance levels.

3.4.3 **Workplace Challenge**

The Workplace Challenge initiative is aimed at stimulating dialogue between industrial partners, achieving firm level and sectoral improvements in industrial relations and production organisation, and facilitating the sourcing of external expertise by introducing firms to the concept of employing consultants (Reid 1998: 10).

The project is currently administered by NEDLAC and funded by the DTI. The DTI subsidises consultant fees by 75% with the participating firms being responsible for the remaining 25%. The project management of the Workplace Challenge is carried out by a specialised private consultancy. The independent consultant is separated from both DTI and NEDLAC and thus does not carry the political baggage of either institution.

3.4.4 **Supply chain management and support**

Kaplinsky and Morris (1998) state that one of the most important trends internationally is the movement towards identifying Supply Chain Management (SCM) as an integral part of attempting to improve manufacturing performance. This is particularly true in terms of the implementation of JIT production systems where the extent to which suppliers adopt JIT is often dependant upon the level of support provided by assemblers. Within the automotive industry SCM involves assemblers assisting major component producers to upgrade themselves, co-operating on R & D and developing long term relationships whereby the benefits of technological and productivity advances are shared (Black 1994).

Barnes (1998) however, states that not only have attempts at supply chain development been modest among automotive assemblers but that the scale of these activities has declined at some assemblers over recent years. In one case a supplier development team was closed down and staff in the purchasing department was reduced from 97 to 48 people (ibid). For the most part supplier chain activities are extremely limited with little or not attention being given to supplier chain development.

Within KwaZulu-Natal, however, this challenge has been taken up by Toyota Manufacturing SA who has recognised that their ability to achieve world class manufacturing status depends not only on their internal competitiveness but also on the competitiveness of their top suppliers. Accordingly, Toyota has therefore begun to develop a supplier support programme for its key domestic suppliers.

Ultimately, the ability to operate according to JIT production systems depends on the efficiency of supplier networks. However, the lack of such networks among South African manufacturers is constraining the adoption of JIT and contributing to poor levels of competitiveness amongst automotive component manufacturers.

3.4.5 **Incentives**

In addition, to the above support measures, national government also offers a range of industrial incentives which the automotive sector can take advantage of. The following are the most important:

- World Player Scheme: This incentive is available to manufacturers for acquisition of fixed assets (machinery and equipment) to improve their competitiveness following changes in tariff protection. It is especially suited to the motor vehicle, manufacturing and textile industries and takes the form of low interest rate finance. The incentive is offered by the Industrial Development Corporation of South Africa (IDC).
- Export Marketing Assistance (EMA): This incentive is available to all exporters, but with special terms of SMMEs. The scheme consists of four

parts: a) primary market research; b) outward selling trade missions; c) inward buying trade missions; and d) exhibitions assistance. This scheme is offered by the Department of Trade and Industry.

In addition to the above, there are a number of other incentives which firms within the automotive industry can take advantage. These include: The Manufacturing Development Programme, Small Manufacturers Development Programme, Support Programme for Industrial Innovation as well as other incentives aimed specifically at SMMEs and large scale enterprises wishing to expand.

3.5 GLOBAL TRENDS AFFECTING THE AUTOMOTIVE INDUSTRY

According to Morris et al (1998: 15) automotive assembly companies are presently suffering from massive overcapacity at the global scale. Most of the developed world's markets are relatively stagnant with only marginal levels of growth being experienced in even the best performing markets (ibid). Despite this stagnation, a number of assemblers have recently invested heavily in new operations particularly in Central Europe. This overcapacity is resulting in increased competitiveness within the industry and assemblers continuously looking for ways to cut costs and get new products onto the market sooner.

Vehicle production life spans have thus been reduced significantly over the past decade with most models presently having a life span of four years. In order to increase the scale of production for such models, there is an increasing move towards global sourcing of particular models from one or two assembly plants world wide (ibid). Global sourcing requires that component manufacturers have significant design and technological capability to facilitate "simultaneous engineering" which, in turn, cut costs and lessen the lead times. Most OEMs are thus transferring responsibility for the design and development of certain parts of their vehicles to component manufacturers. An example of this is Johnson Controls, a large USA-based multi-national which designs, develops and manufactures all the seating requirements for a number of OEMs. In return for their development activities they are assured of long-term sole supplier contracts with OEMs. The competitive pressures faced by OEMs are thus filtered down to their automotive component suppliers. The world's leading automotive component manufacturers are consolidating their positions by acquiring their smaller competitors whilst at the same time moving to modular production (ibid). The tendency towards modular manufacturing is leading to a distinctive tiering of the automotive industry. OEMs no longer have 2000 component suppliers, they now have 200. These suppliers are responsible for the production of particular modules (or sub-assemblies) and draw on components from the other 1800 component suppliers. The 200 suppliers that supply directly to the OEM are referred to as 1st tier suppliers while the remaining suppliers are referred to as 2nd or 3rd tier suppliers.

Despite the upheavals brought about by the rapid re-entry of the South Africa Automotive Industry into the global economy the following positive implications have emerged. Firstly, domestic vehicles have decreased in price, since the introduction of the MIDP, thus making them more affordable. Secondly, domestic firms (both OEMs and component manufacturers) have generally improved their internal performance thus improving their competitiveness. Thirdly, firms are selling equity to foreign multi-nationals, thus linking themselves into the global networks. For example, T&N plastics has been purchased by Federal Mogul, giving them controlling interest in T&N Holdings, the largest Durban-based component manufacturer and the second largest component manufacturer in South Africa (ibid).

Finally, some OEMs have been successfully reintegrated into the global economy with significant implications for other domestic OEMs. This is particularly true of the German-owned OEMs which have been able to negotiate significant export contracts with their parent companies. BMW SA, for example, will be increasing production of the three series model in SA from 60 to 200 units per day, because of its new export contract for right hand drive models. Given the duty credits it will earn, as well as the economies of scale benefits that it and its component suppliers will reap, the export order will place BMW SA in a very strong strategic position both domestically and internationally. A further example is Volkswagen AG which has been contracted to manufacture the new Golf 4 for export to Europe. Both German OEMs have facilitated export contracts for their domestic component manufactures - mostly so as to generate duty rebates via the IEC scheme.

The procurement of export contracts has had a significant impact on investment in the automotive sector within Port Elizabeth. Assemblers and automotive component manufacturers in the Port Elizabeth metropole are making major investments in order to meet the technological and plant capacity requirements of export contracts (see Table 3.1). For example VWSA will invest about R1 billion during the next 5 years, Delta R1.2 billion during the next five years and Samcor about R100 million over the next year (Hosking 1999: 12).

Table 3.1 Investments by assemblers and component manufacturers within the Port Elizabeth metropole (Source: Hosking 1999: 12)

Investor	**Value of investment**
Delta's 5 year project	R1.2 bn
Delta Motor Corporation	R617 million
Volkswagen	R200 million
Samcor (new facilities for engine export programme)	R146 million (Phase 1) R100 million (Phase 2)
Ford Motor Company	R126 million
Hyundai - local component sourcing	R3 million
Goodyear - Contred buy-in	R568 million
Bridgestone-Firestone buy-in	R290 million
Alloy Wheels	R120 million
Industex - double dipping tyrecord plant	R50 million
Industex - tyrecord	R25 million
Precision Exhaust Systems	R49 million
Shatterprufe (automotive glass)	R43 million
Engelhard Environmental Technologies	R34 million
Autocat catalytic converters	R24 million
Leonishe Drahtwerke - harnesses	R20 million
Newton Toyota	R7 million
Delphi Autocable	R1.1 million
Bearing Man	R2 million

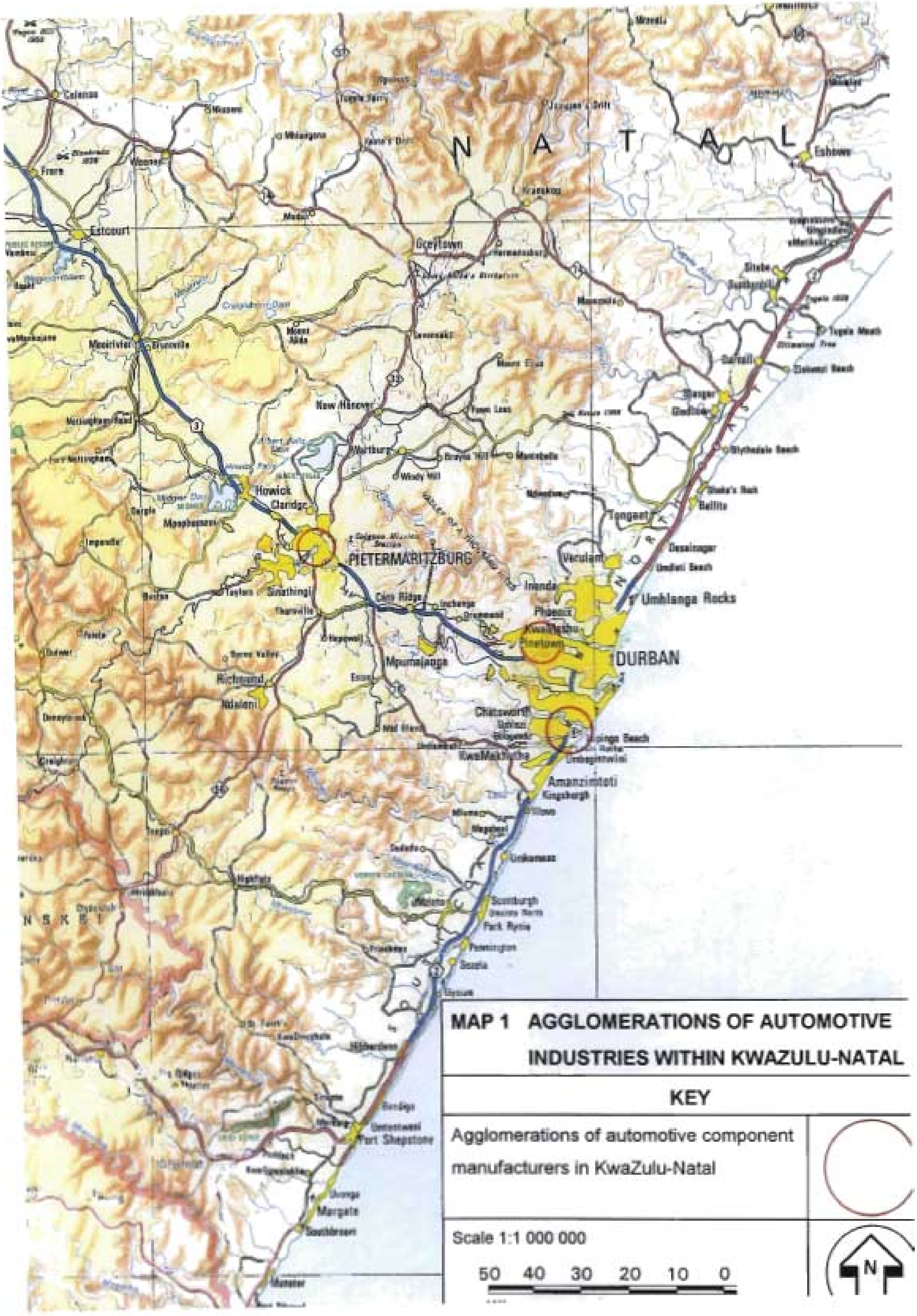
3.6 THE AUTOMOTIVE INDUSTRY IN KWAZULU-NATAL

The automotive industry in KwaZulu-Natal is dominated by Toyota Manufacturing SA's activities. Two agglomerations are evident within the DMA, one in the southern industrial corridor and the other in the Pinetown/New Germany area. A further, albeit smaller agglomeration is found in Pietermaritzburg (see Table 3.2 and Map 1).

Table 3.2 Geographical concentration of KwaZulu-Natal's automotive components industry, based on KZN IRP automotive study

Location	% of KZN automotive component manufacturing facilities	Largest companies
Southern Industrial Corridor (SIC)	35	GUD filters, Federal Mogul, Toyota Automotive Components, Toyota Stamping Division, Feltex, Venture
Pinetown/New Germany	33	Smiths Manufacturing SA, FHE automotive technologies, Glacier Vandervell
Central Durban	9	Conlog, Aunde-TAP
Pietermaritzburg	16	Ramsay Engineering, Shurlock automotive systems
Other areas	7	Hesto Harnesses

Source: Adapted from Morris et al (1998: 15)



MAP 1 AGGLOMERATIONS OF AUTOMOTIVE INDUSTRIES WITHIN KWAZULU-NATAL

KEY

Agglomerations of automotive component manufacturers in KwaZulu-Natal

Scale 1:1 000 000

50 40 30 20 10 0

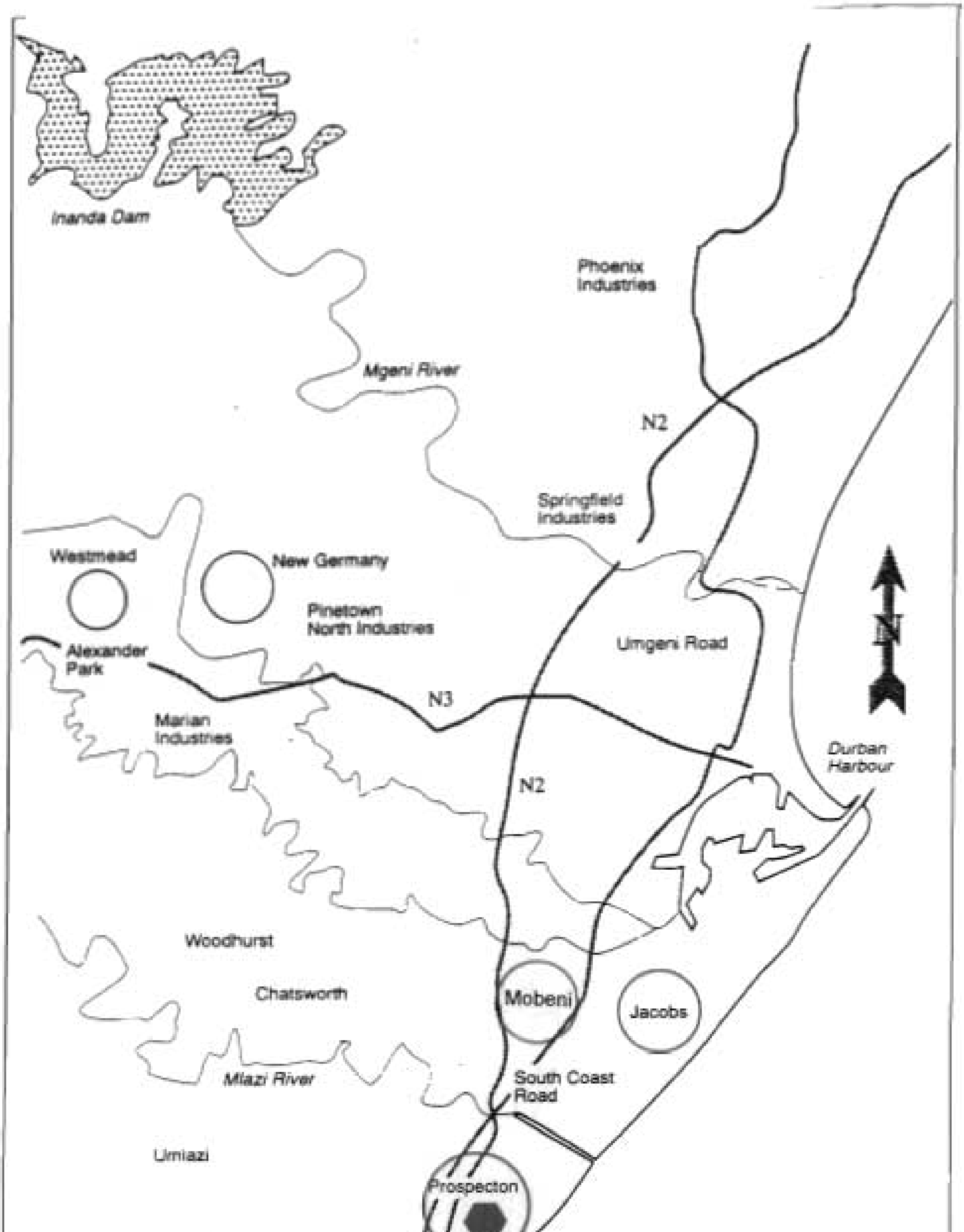
N

3.6.1 **Toyota Manufacturing SA**

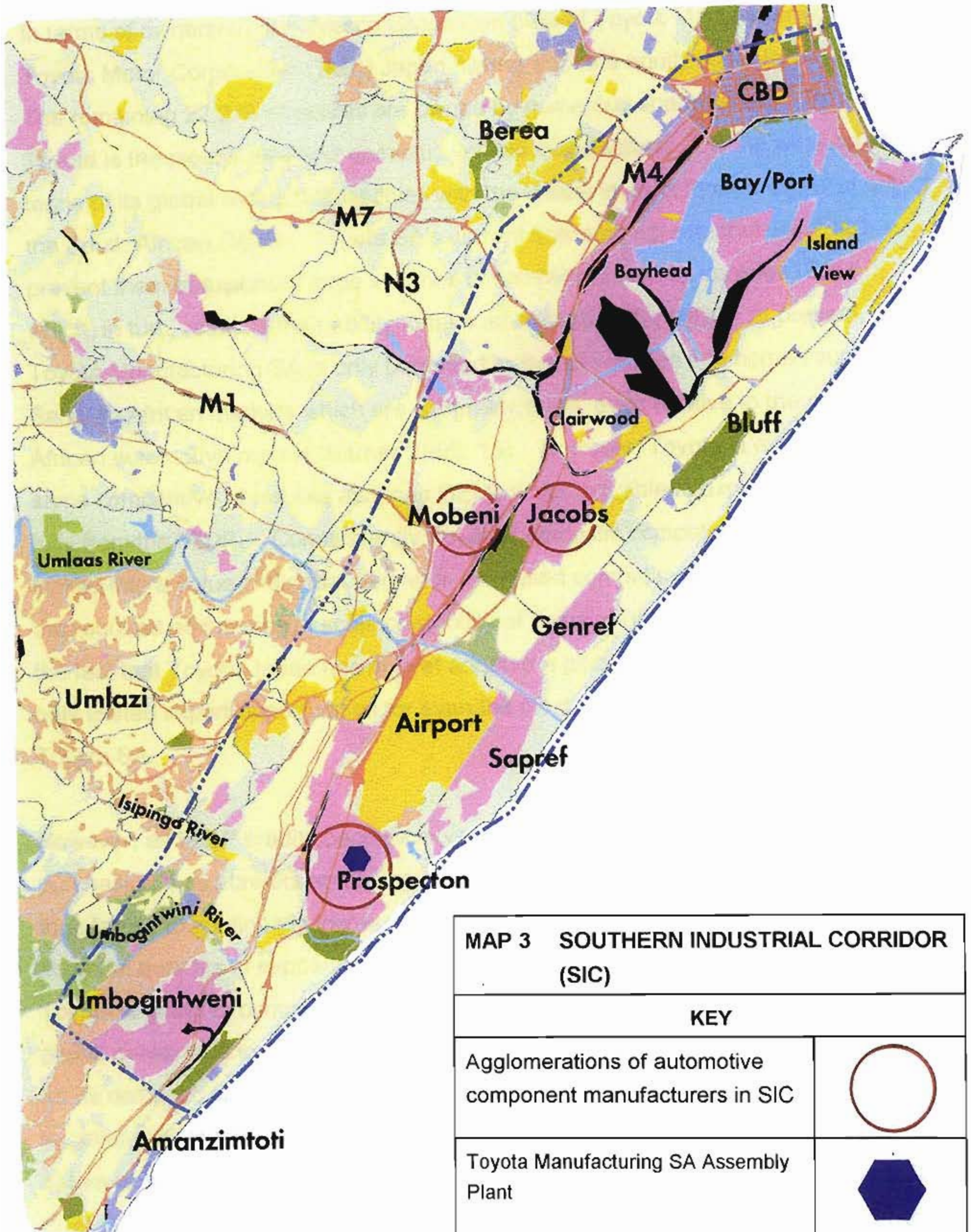
Toyota Manufacturing SA (TSA) was established in 1961 and, as noted above, its activities have grown to dominate the automotive industry within KwaZulu-Natal. As the leading domestic vehicle manufacturer (capturing 27% of the domestic market in 1997), Toyota holds an important position in the South African automotive industry (Morris et al 1998). While Pretoria and Port Elizabeth/Uitenhage are more important localities for automotive production in terms of both vehicle and component manufacture, Toyota is critically important to metropolitan Durban as both a wealth and employment generator (Morris et al 1998: 15). In fact, the automotive sector is considered to be by far the most important employer in the Durban Metropolitan Area (DMA) (Von Coller 1998: 20)

Toyota's assembly plant is located in Prospecton, which forms part of the Southern Industrial Corridor (SIC). The assembly plant covers an area of 42,47 ha and was constructed in 1972 at a cost of R15 million. Many of the component firms that supply to Toyota are located within the SIC, however, the importance of the industry extends well beyond these firms, with a number of engineering firms, fabricated metal producers and steel merchants located in close proximity to the automotive component firms (Morris et al 1998: 15). The SIC is considered to be the most important automotive locality in the province followed by the Pinetown/New Germany complex, also within the DMA (see Maps 2 and 3). There are strong linkages between firms within the Pinetown/New Germany area and those in the SIC.

Toyota has over 50 local component suppliers in KwaZulu-Natal and between 200 and 300 organisations providing it with various types of services. The multiplier effects of Toyota Manufacturing are thus substantial (ibid). Toyota has strong linkages to other manufacturing sectors such as textiles, plastics, ferrous and non-ferrous metal fabrication and electronics.



MAP 2	AGGLOMERATIONS OF AUTOMOTIVE FIRMS WITHIN THE DURBAN METROPOLITAN AREA (DMA)
KEY	
Agglomerations of automotive component manufacturers in DMA	○
Toyota Manufacturing SA	⬢
Not to scale	



MAP 3 SOUTHERN INDUSTRIAL CORRIDOR (SIC)

KEY	
Agglomerations of automotive component manufacturers in SIC	
Toyota Manufacturing SA Assembly Plant	
Scale 0 km 2 km 4 km 6 km	N
December 1999	J. Ellingson

In terms of ownership, the Wesco Group own 50% of Toyota Manufacturing SA with Toyota Motor Corporation (TMC) Japan having a 27.8% equity stake in Toyota SA. The remaining 22,2 % of shares are owned by numerous shareholders. While Toyota is the most successful domestic vehicle manufacturer, it is the weakest in terms of its global networking abilities with the lowest level of foreign equity of any of the South African OEMs. Toyota SA's current licensing agreements with TMC prevent them of exporting large volumes of completely built up vehicles (CBU) which, in turn, restricts their ability to take advantage of the MIDP. At present, Toyota Manufacturing SA is only permitted to export vehicles into certain sub-Saharan African markets which are extremely small, even relative to the small South African automotive market (Barnes 1999: 15). However, Toyota is exposed to the same competitive pressures as those OEMs which are able to export and benefit fully from the MIDP. Consequently Toyota's domestic component suppliers are locked into a value chain that demands increased competitiveness but does not offer the required economies of scale or stability of demand (ibid). Furthermore, given the fact that Toyota Japan has not yet adopted a global sourcing strategy, there are only limited export opportunities for even the most competitive firms supplying Toyota SA.

However, as MIDP credits become more available, Toyota will have the option of purchasing these credits and using them to import components. Their suppliers are thus forced to continually increase their operational competitiveness, but without the potential benefits of exposure to global markets. According to Barnes (1999:16) if Toyota is going to compete in the long term it needs better access to Toyota Japan's global networks and it simultaneously needs to facilitate significant export contracts for its domestic suppliers. Considering that the majority of Toyota's top thirty suppliers are located in close proximity to its vehicle manufacturing plant in Durban, failure to secure exports could have a significant impact on the local economy. This is particularly true for those firms which do not have significant linkages with other OEMs.

3.6.2 Toyota's component supplier networks

Between 70% and 80% of a vehicle's value added takes place at component manufacturers. As such the competitiveness of component suppliers has a significant impact on the competitiveness of the OEM as a whole.

While Toyota has approximately 50 local automotive component suppliers, 80% of its value added comes from just thirty 1st tier suppliers. Toyota refers to these suppliers as their "top 30" suppliers. A large percentage, although not all, of these suppliers are located in close proximity to Toyota's assembly plant in Prospecton.

In the mid-1990s Toyota recognised the need to increase the competitiveness of their component suppliers. Accordingly, they developed a supplier support programme to assist component manufacturers with the implement of a JIT. The support programme provided training for suppliers and included visits to Toyota in Japan. A number of Toyota's suppliers have in fact implemented a JIT system but the extent to which this has been done varies significantly between component suppliers. However, firms which have taken advantage of this Toyota's support and implemented JIT have experienced significant improvements in efficiency and productivity. Toyota has required almost all of their top 30 suppliers to supply to them on a JIT basis, i.e. according to a Kanban system.

Unfortunately this level of co-operation and support has not been available to 2nd and 3rd tier component suppliers. As a result stock levels remain high at the 2nd and 3rd tier level diminishing the efficiency of the entire supply chain.

3.6.3 Toyota and its future intentions

Toyota is well aware of the need to increase volumes by substantially increasing vehicle exports. The company is presently involved in negotiations with Toyota Japan to secure possible export contracts for their new Corolla which is due to be released in 2003. However, these negotiations are still in the preliminary stages and no commitments have been given by Toyota Japan.

In addition to its attempts to secure exports, Toyota is committed to the fuller implementation of just-in-time production systems (or Toyota Production Systems as they refer to it). This will involve the standardisation of all part lot sizes for its top 30 suppliers. Furthermore, Toyota intends to increase their delivery frequencies. At a minimum, component suppliers will be expected to deliver on a daily basis to the assembly plant, and at a maximum, component suppliers will be expected to deliver upto to 8 times a day (i.e. hourly).

To facilitate this Toyota is investigating the possibility of introducing route-groupings (a system similar to that of the milk-run discussed in Chapter 2 above). This would involve the collection of automotive component parts from a group of component suppliers along a specific route. The aim of route-groupings is to achieve cost savings not only in terms of transport costs but also in terms of turn-around times. Toyota has identified three component manufacturers on which to base a pilot route-group and are currently involved in negotiations with these manufacturers. If this system works, one could see wider implementation within the short term. Toyota is also to establish Supplier Improvement Programme for its Top 30 local suppliers, aimed at improving their relationship with these suppliers.

3.7 JUST-IN-TIME (JIT) PRODUCTION IN SOUTH AFRICA

Just-in-time production first reached South Africa through Toyota South Africa (TSA) in the early 1980s (Duncan and Payne 1993: 14). Although Toyota Motor Corporation of Japan (TMC) showed no interest in extending its international investments to South Africa, it became more willing to assist TSA in applying the principles of JIT. The fact that Toyota like any other motor assembler in South Africa, was dependent on hundreds of suppliers for both original equipment (OE) and facilities and general services, meant that there was enormous scope for applying JIT. From about 1981 onwards Toyota began to demand that suppliers deliver according to a schedule determined by Toyota production management. To encourage integration TSA decreased the number of original equipment (OE) suppliers from 240 in 1983 to 120 in 1988 (Day 1989: 114). The number of OE suppliers was further reduced to approximately 50 between 1988 and 1999 (Toyota SA 1999).

Toyota introduced longer term contracts for key component suppliers and sent teams of production engineers to the suppliers' factories to promote JIT production (Adcock in Duncan and Payne 1993: 15). Attempts were also made to persuade suppliers to locate close to Toyota's assembly plant in Prospecton.

By applying JIT, Toyota SA saved on labour, production area, storage space and inventory costs. The success of Toyota SA was the driving force behind the adoption of JIT by other South African motor assemblers. Assemblers in the Pretoria area, namely Nissan, BMW and Samcor, all source components from the Pretoria-Witwatersrand-Vereeniging (PWV) area, where 70% of components manufacturers are concentrated (Duncan and Payne 1993: 15). Nissan established a number of in-house component firms in close proximity to its assembly plant. Orders are dispatched electronically and goods brought in many times a day (Duncan 1997: 121). BMW constructed an engine assembly plant very close to its main factory and Samcor persuaded brake and trim components firms and a company that paints plastics to set up adjacent to it in Samcor Park on the east side of Pretoria (ibid). All vehicle assemblers seem to be moving away from multi-sourcing of components, at least for OE, and placing more emphasis on the continuity of supply and quality through focussing on supplier development.

Toyota was the first company to recognise the important role of labour in the implementation of JIT. In 1981, the company created quality circle forums for workers to share ideas on how to improve quality and overcome problems. Each assembly worker has the authority to stop the line if he or she spots a fault. Following the Kanban system, workers are responsible for ensuring the flow of parts to their section of the assembly line. A further element, begun in 1984, are the *Jisjuken* teams. These teams combine the expertise of quality inspectors, stock handlers, maintenance engineers, foremen and groups leaders; together, they present suggestions on how to improve the flow of production.

More recently, other assemblers have worked strenuously to adapt JIT production methods to their own operations. Since 1986, Nissan (SA) has reorganised worker/management relations under the term *genba Kanri*. The key to this is the use of quality circles which Nissan calls "green areas". These are literally green painted areas on the side of the line where workers on a particular line section gather with the foreman each morning to discuss production objectives for the day. The foreman uses a pre-set agenda to discuss quality, targets, housekeeping, safety and absenteeism. All such information is displayed on boards around the green areas.

According to Duncan and Payne (1993: 17) aspects of JIT production methods are now a reality in most South African car assembly plants, although they take a different form in each company. BMW for example, introduced the Crosbie approach to Total Quality Management - a scheme aimed at self-inspection of quality, as opposed to relying on a team of quality inspectors. Samcor has borrowed the green areas concept from Nissan, but prefers to evolve its own worker-management forums. In the Eastern Cape, the promotion of worker-participation in improving productivity and quality has met with much stronger opposition from a more highly politicised and better organised labour force. Productivity levels at Volkswagen and Mercedes Benz are notoriously poor compared with other plants, though Volkswagen has tried to overcome this through the introduction of their "Towards Excellence" programme (Duncan 1997: 124).

Overall a combination of factors, including increased competition, powerful trade unions, political instability and economic recession, underpin the increasing application of selected aspects of JIT in the local motor industry (Rogerson 1994: 11). By the mid 1990s Bell (in Rogerson 1994: 9) noted that "progress has been made in applying JIT production principles in South Africa". At the leading edge of innovations towards flexible production are the South African subsidiaries of multi-nationals, such as Nissan, Toyota, John Deere and General Electric. In particular, South African firms with Japanese licensing agreements have been at the forefront of new flexible work practices (Rogerson 1994: 9).

In the wake of indigenization of JIT production methods, most South Africa motor plants today manifest a combination of old Fordist production methods with only selected aspects of new flexible systems. However, Rogerson (ibid: 12) notes that the advance of JIT is presently being arrested by a host of factors. In line with this, Duncan (1997: 124) states that there are a host of logistical and quality problems preventing the development of JIT methods in South Africa. Among the most important of these are lack of managerial expertise, a legacy of racist managerial practices, opposition from trade unions and workers, high levels of illiteracy among industrial employees, the weakly developed nature of small-scale industrial enterprise sub-contracting, and the absence of any history of collaborative relationships between small and large firms in local manufacturing (Rogerson 1994: 12). Furthermore, many managers are unwilling to spend large amounts of money and effort to achieve higher productivity while capacity continues to exceed demand (Duncan 1997: 125).

3.8 CONCLUSIONS

The preceding sections have attempted to contextualise the automotive industry in South Africa and more specifically within KwaZulu-Natal. It is clear that macro-economic factors have greatly influenced the growth and general productivity of the industry. With greater exposure to international competition, the South Africa automotive industry is hard-pressed to meet the challenge of globally competitive standards in terms of both product quality and reliability.

Toyota SA's role in the introduction of JIT production systems is significant to understanding the way in which component suppliers have responded. At the same time the emergence of an agglomeration of automotive industries within the SIC, and to a lesser extent in the Pinetown/New Germany and Pietermartizburg areas provide the setting for the case study which follows.

CHAPTER 4

TOYOTA AND ITS AUTOMOTIVE COMPONENT SUPPLIERS

4.1 INTRODUCTION

The purpose of this chapter is to analyse the economic and non-economic issues pertinent to the automotive industry in order to determine whether just-in-time production systems are, in fact, resulting in an agglomeration of automotive component suppliers in close proximity to Toyota. This will help to assess the role played by JIT in determining spatial location relative to other location factors and the implication this spatial outcome may have for planning for industrial development.

In seeking to address this question following issues are discussed:

- Profile of firms surveyed
- JIT production
- Inputs, outputs and exports
- Human resources
- Location in relation to JIT
- Spatial and functional agglomeration tendencies
- Linkages, co-operation and institutional support structures
- Physical planning

4.2 PROFILE OF THE AUTOMOTIVE COMPONENT FIRMS SURVEYED

4.2.1 Basis for sampling

As stated in section 1.3 above, firms were selected on the basis of a number of criteria. It was not the intention of the researcher to survey a broad range of firms supplying Toyota but rather to focus on those firms most likely to have implemented a just-in-time production system and, or, to be supplying on a just-in-time basis i.e. according to a Kanban. The surveys were thus aimed at getting good quality information from a sample of firms. 14 of the firms surveyed are in Toyota's "top 30" supplier category. This category accounts for ± 80% of the value of locally sourced components. As stated in Chapter 1, the anonymity of firms has been provided by referring to firms as Firm 1, Firm 2, Firm 3, etc.

The firms interviewed were involved in a range of automotive manufacturing activities. These firms were divided into 1st and 2nd tier suppliers. 1st tier suppliers refer to those suppliers which manufacture and sell their products directly to Toyota Manufacturing SA. 2nd tier suppliers are those which supply to Toyota indirectly through one or more of Toyota's 1st tier suppliers. For example, if Firm A sold their products to Firm B, who used these products to manufacture a component for Toyota Manufacturing SA, then Firm A would be considered a 2nd tier supplier while Firm B would be regarded as a 1st tier supplier (see Figure 4.1).

A further distinction is made between those firms whose main business is with assemblers such as Toyota Manufacturing SA and those which manufacture primarily for the aftermarket. The aftermarket refers to products which are put onto cars after they have left the assemblers. Examples are spare parts and accessories such as bull-bars and tow hitches.

All of these factors have important bearing on the perceptions firms have with regard to optimum locations.

4.2.2 **The automotive component firms surveyed**

Table 4.1 provides an alphabetical listing, the tier, main activity and location of the automotive component firms surveyed.

Figure 4.1 SOUTH AFRICAN AUTOMOTIVE VALUE CHAIN

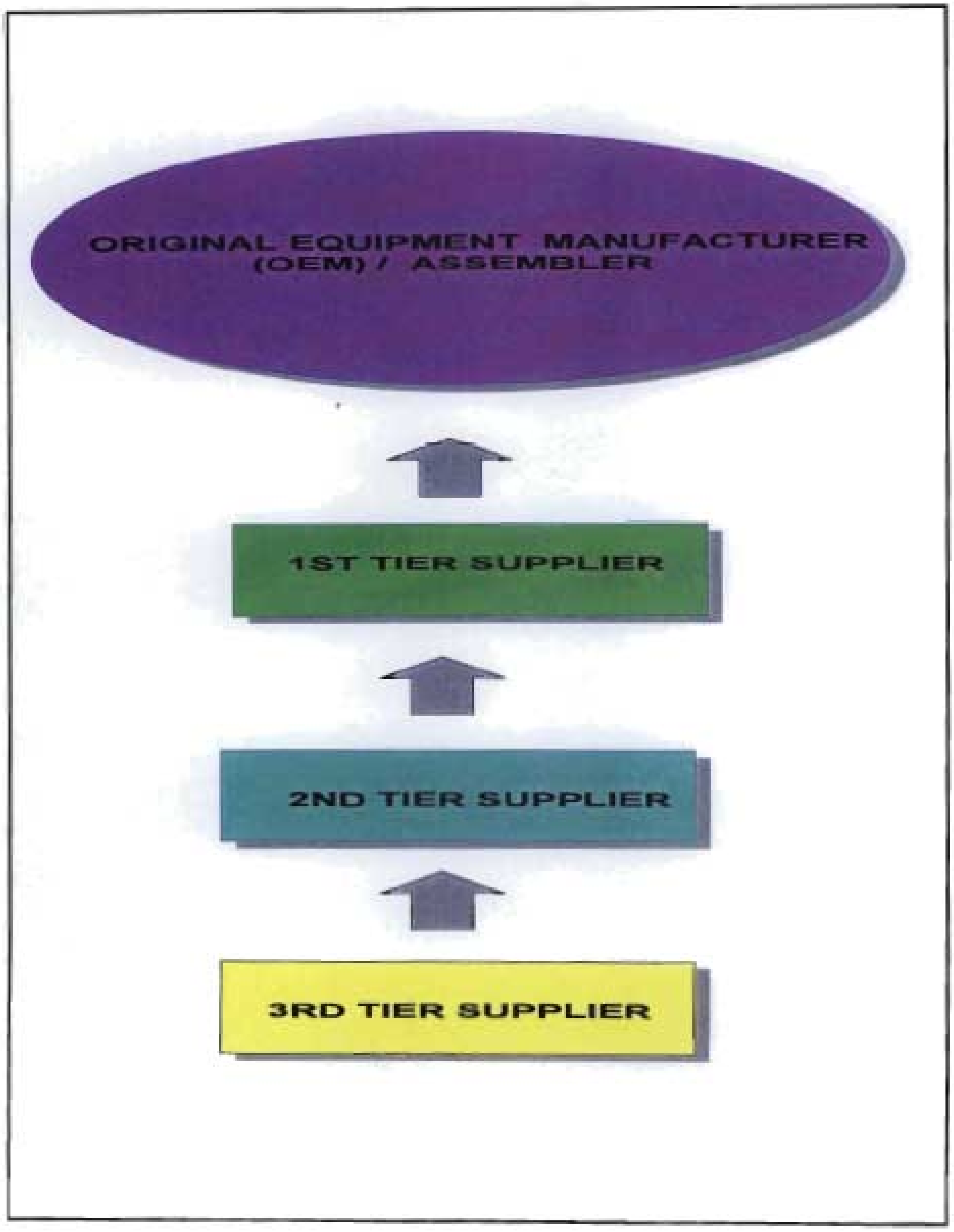


Table 4.1 Alphabetical list of automotive component firms interviewed

Name	Tier of Supplier	Activity	Location
Autoliv Southern Africa (Pty) Ltd	1^{st}	Car safety belts, airbags	Krugersdorp
Aunde Tap	1^{st}	Auto finishes, apparel textiles	Umbilo
Autoplastics (Pty) Ltd	1^{st}	Head-linings, sun-visors, moulded PVC mats, door panels,	Umbogintwini
Brace Able Manufacturers	1^{st} and 2^{nd}	Metal pressings	Pinetown
Conlog	1^{st}	Electric control modules, central locking actuators	Mayville
Duys Component Manufacturers	1^{st}	Bull bars, roll bars, side steps, basketry, fuel tanks	New Germany
Feltex Automotive Trim	1^{st}	Automotive carpets, underfelts, dash insulators, boot trim, moulded sound insulators	Jacobs
Federal Mogul Friction Products	1^{st} *	Disc brake pads, CV linings, rail blocks, moulded roll	Prospecton
Gud Filters (Pty) Ltd	1^{st} *	Auto filters	Prospecton
Hesto Harnesses	1^{st}	Harnesses, wiring	Stanger
L&J Tools & Engineering Works (Pty) Ltd	1^{st} and 2^{nd}	Metal pressings, tools	Prospecton
LUK Africa (Pty) Ltd	1^{st}	Clutches	Estadeal - Port Elizabeth
MotoTech (Pty) Ltd	1^{st} and 2^{nd}	Wheel arch liners, engine under covers, interior garnishes, air ducts	Wynberg - Johannesburg
Ramsay Engineering (Pty) Ltd	1^{st}	Wheel spanners, gear locks, U bolts, spare wheel carriers	Willowton - Pietermaritzburg
Shatterprufe (Pty) Ltd	1^{st}	JIT facility (Glass)- only fit lifter tabs and lifter rails	Prospecton
Shurlok Automotive Systems	1^{st}	Security and comfort electronics	Pietermaritzburg
Smiths Manufacturing	1^{st}	Airconditioning systems, heat exchanges, radiators	New Germany
Toyota Automotive Components (TAC)	1^{st}	Fabricated components, seat frames, exhausts, fuel tanks, chassis, skin panels	Prospecton
Toyota Stamping Division (TSD)	1^{st}	Metal pressings	Jacobs
Triple C Productions c.c.	1^{st} and 2^{nd}	Metal castings and aluminium extrusion	New Germany
Venture (Pty) Ltd	1^{st}	Plastic injection moulded parts and spray painted parts	Prospecton
Webroy (Pty) Ltd	2^{nd}	Springs, wire forms, seat frames	Pietermaritzburg

4.2.3 **Operating status**

The operating status of the automotive component firms is important, as it very often determines where the decision-making authority lies (see Table 4.2). While some branch plants have more autonomy than others, decisions regarding the organisation of production and location are generally made in the head office of such firms. Autonomous subsidiaries are firms which are part of larger holding companies but which are operated as independent entities. Independent firms are those firms which are privately owned and operated with no linkages to holding companies.

Table 4.2 Status of firm

Status of Firm	Number
Branch plant	7
Autonomous subsidiary	8
Independent	7
Total	**22**

Fifteen of the firms surveyed were part of larger organisations. Eight of these firms (53%) had parent companies which were part of multi-national firms, four (27%) were listed on the Johannesburg Stock Exchange (JSE) while three (20%) were large private firms (see Table 4.3).

Table 4.3 Status of Parent Company

Status of Parent Company	Number
Part of Multi-national	8
JSE listed	4
Large private firm	3
Total	**15**

* rounded

Seven firms have less than 100 employees. Six of these are independent firms and one is a branch plant. Eight firms have between 101-300 employees. Three of these are branch plants, four are autonomous subsidiaries and one is an independent firm. All three firms that have between 501 and 700 employees as well as the three firms that have more than 700 employees are autonomous subsidiaries linked to multi-national companies (see Table 4.4).

Table 4.4 Size of firm by employment

No. of Employees	Number of firms
1 - 100	7
101 - 300	8
301 - 500	1
501 - 700	3
> 700	3
Total	**22**

This data reveals a strong correlation between the size of a firm and the status of ownership. 85% of small firms (<100 employees) are independent firms while 100% of large firms (>500 employees) are linked to multi-national companies. These linkages have important export implications (see section 4.4.3 and 5.3.1 below).

4.3 JUST-IN-TIME PRODUCTION

In assessing the planning and spatial implications of JIT, it is necessary to start by considering the extent to which just-in-time production systems have been implemented. A distinction is made between manufacturing according to JIT and supplying on a JIT basis i.e. to a Kanban (see Table 4.5 and Table 4.6).

4.3.1 **Manufacturing according to JIT**

Four out of twenty two firms surveyed stated they had not implemented a JIT production system. However, despite attempts to provide a clear definition of Just-in-time production, the interpretation and understanding of what JIT is, varied widely between firms. A number of firms equated JIT with the Kanban system and were thus not *manufacturing* according to JIT but rather *supplying* on a JIT basis i.e.

supplying to a Kanban system. Table 4.5 sets out the main attributes of just-in-time production system and indicates the extent to which particular firms meet these requirements.

If one equates JIT manufacturing with meeting eight or more of the listed criteria it is evident that twelve of the twenty two firms can be considered to be manufacturing according to JIT. The implementation of JIT is, however, an on-going and incremental process. In addition to the 12 firms currently manufacturing to JIT, a further 6 are well on their way to fuller implementation.

Of the 18 firms that claimed to have implemented JIT, all except two, stated that this was done partially. A number of respondents claimed that the nature of JIT was such that it was an on-going process.

The main reasons given for not implementing JIT, or doing so partially, are as follows:

- high level of fluctuations in demand
- low volumes
- high variability of components produced by single firms
- incompatibility with certain production processes
- lack of commitment from assemblers
- poor levels of skills

The difference between the number of firms who consider themselves to have implemented a JIT system, and those who actually meet the minimum number of criteria, points to the different firm's interpretations of what it means to manufacture according to JIT. Furthermore, those firms which manufacture to JIT are more likely to put pressure on their suppliers to deliver on a JIT basis which may have implications for 2nd and 3rd tier suppliers.

Table 4.5 Assessment of the implementation of JIT

Attributes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Continuous flow	✓	✓	✓	✓	X	✓	✓	✓	X	X	X	X	✓	✓	✓	✓	✓	✓	X	✓	X	✓
Cellular production units	✓	✓	✓	✓	✓	X	✓	✓	X	✓	X	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓
Kanban triggering production	✓	✓	✓	✓	✓	✓	✓	X	✓	X	X	X	X	X	X	X	✓	X	X	✓	X	✓
Supplying to Kanban	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	X	X	✓	X	X	✓	✓	✓
Quality at source	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓
Green areas/ suggestion schemes	✓	✓	X	✓	X	X	✓	X	✓	X	X	X	X	✓	X	X	X	✓	X	✓	X	✓
Work teams	✓	✓	✓	✓	✓	X	✓	✓	X	✓	X	X	X	✓	✓	✓	✓	✓	X	✓	X	✓
Levelled or balanced production	✓	X	X	X	X	X	X	✓	✓	X	X	X	X	X	X	X	X	X	X	✓	X	X
Implemented throughout the plant	✓	X	X	X	X	X	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Close interaction with assembler/s	✓	✓	✓	✓	✓	X	✓	✓	✓	X	X	✓	✓	✓	X	✓	✓	✓	X	✓	✓	✓
Close interaction with suppliers	✓	✓	✓	X	X	✓	X	✓	X	✓	X	✓	X	✓	✓	✓	✓	✓	X	✓	✓	✓
Training	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total No. of criteria met	12	10	9	9	6	6	10	9	7	6	2	4	5	9	6	8	9	8	1	11	6	10

lote: Firms 1, 2, 3, 4, 7, 8, 14, 17, 20 and 22 are manufacturing and supplying according to JIT (10 firms in total)
Firms 16 & 18 are *only* manufacturing according to JIT (2 firms in total)
Firms 5, 6, 9, 10, 11, 12 and 21 are *only* supplying according to JIT (7 firms in total)
Firms 13, 15 and 19 are *not* supplying or manufacturing according to JIT (3 firms in total)
Shaded columns show firms that are considered to have implemented a JIT production system

Only one firm stated that they had implemented JIT throughout their entire supply chain. A number of other firms, however, were in the process of doing this with their local suppliers.

4.3.2 **Supplying according to JIT**

Seventeen firms currently supplying to Toyota on a JIT basis (i.e. Kanban), eight are located in the SIC, one in New Germany, one in Westmead, one in Mayville, three in Pietermaritzburg, one in Stanger , one in Krugersdorp and one in Wynberg (see Table 4.5 and 4.6)

Table 4.6 Firms manufacturing and, or, supplying according to JIT

JIT Implementation	**No. of firms**
Supplying and manufacturing to JIT	10
Only suppling to JIT	7
Only manufacturing to JIT	2
Not supplying or manufacturing to JIT	3
Total	22

4.3.3 **Manufacturing and supplying according to JIT**

Of the seventeen firms supplying according to JIT, ten are *manufacturing* and *supplying* according to JIT with the remaining seven only supplying on a JIT basis. Two firms are manufacturing but not supplying according to JIT. However, one of these firms will be going onto a Kanban supply system in January 2000 (see Table 4.6).

Of the three firms that are not supplying or manufacturing to JIT, two are 2nd tier suppliers and one a 1st tier supplier. The 1st tier supplier is, however, in the process of implementing JIT on a fuller basis. Neither 2nd tier supplier has any intention of implementing JIT as they do not believe it would benefit them.

Component suppliers who supply according to JIT but do not manufacture according to JIT end up holding high levels of stocks on their premises. Previously, some of this stock would have been held by the assembler. But the shift onto Kanbans means that the assembler only takes exactly what they need. The components produced, but not taken by the assembler, therefore have to be held by the component manufacturer. A large percentage of firms complained that the implementation of Kanbans had resulted in their having to carry higher levels of stocks and bear the associated costs. The large fluctuations in assembler demand aggravates this problem. From one month to the next component suppliers could be in a situation where they either have too much stock or too little stock.

4.4 INPUTS AND OUTPUTS

4.4.1 Source of inputs

In order to assess where the automotive component manufacturers source their inputs from a figure 65% has been adopted as a bench mark. It assumes that this gives an indication of the origin of a significant proportion of inputs. A further distinction is made between the 19 firms located within KwaZulu-Natal (KZN) and the three firms located outside of KZN. Table 4.7 sets out the findings for those firms within KZN.

Table 4.7 Source of inputs

Distance from component manufactures major suppliers	No. of firms (KZN) (*)
0- 20 km	4
21 - 50 km	3
51 - 160 km	0
Over 160 km but within KZN	0
Nationally	6
Internationally	6
Total	19

Note: (*) Refers to 65% of inputs

Four firms source 65% of their inputs from within 20km, while seven firms source 65% of their inputs from within 50km. Five of these firms are located within the Southern Industrial Corridor and two are located in the Pinetown/New Germany area.

Six firms source 65% of their inputs nationally and a further six internationally. In terms of the KwaZulu-Natal (KZN) firms, an average of 36% of all inputs are sourced within a 50km radius. This is quite substantial and provides an indication of the multiplier effects of the automotive components industry within a locality.

Of the remaining three firms two are located in Gauteng and one in the Eastern Cape. One of the Gauteng firms is currently sourcing 100% of its inputs within 20km. The other firm sources 50% within 160km and imports 50%. The firm in the Eastern Cape sources 30% of their inputs nationally and 70% internationally.

Looking at individual survey returns as opposed to the 65% benchmark, 45% of all inputs were sourced within 50km; 5% between 51 - 160km; 25% from elsewhere in KZN and South Africa and 25% internationally. Based on these findings it would appear that the local multiplier effects of component manufacturers are significant. At the same time, the relatively high percentage of imported inputs may point to some local economic development opportunities. Furthermore, the long lead times associated with imported inputs has serious implications for the implementation of JIT throughout the supply chain.

4.4.2 **Toyota as major market for output**

Respondents were asked to indicate what percentage of their total production was assigned to Toyota. One firm declined to divulge this information, stating that such information was confidential to the company. The analysis is, therefore, based on the remaining 21 firms which provided the necessary information.

Fifteen of the twenty one firms (72%) indicated that Toyota Manufacturing SA (assembler) was their major client. Of the remaining six firms, three are primarily involved in the aftermarket with only about 40% of their total business allocated to assemblers and one produces primarily for the export market.

Table 4.8 below provides a percentage breakdown of the output allocated to Toyota. Nine firms assign *over* 50% of their production to Toyota. Of these firms, six are located in the Southern Industrial Corridor, two in New Germany and one outside of the Durban Metropolitan Area.

Table 4.8 Percentage of production assigned to Toyota

% of production assigned to Toyota	No. of firms
0 - 25	8
26 - 50	4
51 - 75	4
76 - 90	3
> 90	2
Total	21

A number of respondents indicated that they resisted becoming too dependant upon one automotive assembler and preferred to spread their business over at least two or three assemblers. This reduces the risks associated with large fluctuations in demand.

The geographical spread of South Africa's seven assemblers, however, suggests that there may not be an optimum location for those manufactures wishing to serve a range of assemblers. As such those manufacturers wishing to serve more than one assembler would require JIT facilities/warehouses to provide a JIT service to their "out of town" assemblers (see 4.7.3 below).

4.4.3 **Exports**

Eleven of the firms surveyed are currently exporting automotive components. As illustrated in Table 4.9 below, all except two of these firms are exporting for the aftermarket. All firms surveyed remarked on how difficult it was to export to assemblers outside of South Africa. At the same time, all component manufacturers were of the opinion that they could not survive on the domestic market alone and that failure to secure export contracts would result in their closure.

However, the ability of local firms to entre the export market is extremely limited. Firms either have to have a link with a 1st tier MNC component manufacturer or, use local assemblers as a conduit. Even those firms in which multi-nationals have some level of equity, are constrained by licensing agreements which prevent them from exporting to most developed countries. At present the two German car manufacturers in SA, Volkswagen and BMW, are acting as important conduits for automotive component exports.

Table 4.9 Exports

EXPORT	FIRM	COUNTRY	MARKET	MIDP CREDITS
Directly	Firm 1	Germany, France	Aftermarket	Yes, but cede to assembler
	Firm 2	USA, UK, Brazil, Germany	Aftermarket and OEM (local)	Yes, but cede to assembler
	Firm 9	Mexico, Australia, UK, Other	Assembler Aftermarket	Yes, cede 20% keep 80%
	Firm 10	Australia, UK	Aftermarket	Yes, keep what they can
	Firm 15	Australia	Aftermarket	Yes
	Firm 18	Germany, USA, Hungary	Aftermarket	Yes, but cede through assemblers
	Firm 19	Germany, Brazil, Europe	1st tier MNC Aftermarket	Yes, cede most to assemblers
	Firm 20	Africa, Europe, North & South, America, Austral-Asia	Aftermarket	Yes, cede all to assemblers
Indirectly through an assembler or 1st tier supplier	Firm 10	Germany	Assembler	Yes, but cede to assembler
	Firm 13	Brazil, USA, Europe	Aftermarket	No
	Firm 16	Australia	Aftermarket	No (don't qualify)

The ability of firms to export also increases their ability to implement JIT as it enables them to increase their volumes. A number of firms stated they were compromised as they are less competitive if they do not implement some form of JIT but at the same time the low volumes make a fuller implementation of JIT extremely difficult.

Furthermore those firms that are not exporting are unable to benefit from the MIDP IEC scheme yet their protection from imports has been diminished substantially. According to respondents a number of manufacturers have already closed down as a result of the increased imports.

4.5 HUMAN RESOURCES

There is considerable debate surrounding the human resource requirements of JIT production systems and its impact on labour. It is not the intention to enter into this debate here, but rather to consider what impact these new human resource requirements may have on the implementation of just-in-time production systems and the location of industry.

4.5.1 **Employment**

The twenty two firms accounted for a total of 6398 jobs, with an average of 290 employees per firm. Overall, 25% of the workforce is skilled, 66% semi-skilled and 9% unskilled. Very few firms employed unskilled labour and there was a tendency amongst all firms to require relatively high levels of education from prospective employees. Seventy five per cent of firms stated that they would require the minimum of a Standard Eight Certificate, but all of the firms interviewed expressed a preference to employ only those with a Matric Certificate. Firms that had implemented a JIT production system were more concerned about education levels that those that had not. These firms stated that a JIT production system can only be effective if it is understood by all employees. This necessitates, at a minimum, relatively high levels of literacy and some numeracy skills.

Those firms that did have unskilled labour stated this was due primarily to historical factors. When unskilled employees within these firms left the firm, they were generally replaced by people with higher levels of education.

4.5.2 Changes in employment

Twelve (55%) of the twenty two firms surveyed indicated that they had reduced their number of employees over the past year. The two most commonly cited reasons were increased productivity of labour and automation. Over the past five years, fourteen firms (64%) indicated that they had experienced a decrease in the number of employees. The three most commonly cited reasons were natural attrition, downsizing and increased productivity of labour. Between these firms an overall total of approximately 2500 jobs have been lost over the past five years. Table 4.10 sets out the changes in employee numbers over the past year and over the past 5 years.

Table 4.10 Changes in employee numbers

CHANGES	No. OF FIRMS	MAIN REASONS
Changes over past year		
No change	6	
Increased	4	Change in structure of organisation , expansion, increase in exports
Decreased	12	Increased productivity of labour, changes in technology, automation, consolidation, replaced with contract staff through labour broker, downturn in demand, downsizing
Total over past year	**22**	
Changes over past five years		
No change	2	
Increased	6	Expansion
Decreased	14	Increased productivity of labour, natural attrition, downsizing
Total over past 5 years	**22**	

4.5.3 **Training and skills**

All firms, except one, offered some form of training for employees, but the level of training differed markedly between firms. On average, 70% of all training occurs on-line, that is, as part of the production process. Only 30% of training takes place off-line i.e. in a classroom situation or outside of the organisation. 70% of the firms indicated that they did not have dedicated time set aside for training. Training generally occurred periodically when the need arose. Half of the firms spent less than 1% of their remuneration costs on training; 40% of firms spent between 1 and 2 percent while the less than 10% spent between 4 and 5 percent on training. Overall a relatively small amount is being spent on training, particularly if this is compared with international standards of between 4 % and 7%.

Eighty per cent of firms had a human resource strategy in place. All these firms indicated that the training needs of each individual staff member was reviewed on an annual basis as part of their annual staff review. Those firms that did not have an overall human resource strategy in place indicated that they were in the process of drawing one up, so as to be in line with current labour legislation. Sixty per cent of firms stated that they were not involved in any joint training schemes. Of the 40% that were involved in joint training schemes, most were with the Motor Industry Training Board (MITB). However, firms were generally critical of the training offered by the MITB. Overall 80% of respondents were extremely critical of the Motor Industry Training Board, reporting that it offered little to benefit the component suppliers as the training offered was too general, outdated and inappropriate to their needs.

Other joint training initiatives were with industry specific associations such as the Plastics Institute and the Textile Institute. In addition, four firms stated that they had undertaken training through Toyota Manufacturing SA. All, but two firms, indicated that they would be most supportive of joint training schemes for the automotive components industry. All these firms felt that the high cost of training and the lack of appropriate training facilities could be addressed by greater collaboration between firms (see 4.8 below). There is currently an initiative by automotive component manufactures, in response to the new Skills Development Bill, to develop a set of recognised automotive industry qualifications for employees. This initiative is still in its infancy. One of the firms interviewed is currently running a pilot programme based on the core competencies identified.

Respondents noted that one of the fundamental constraints in implementing JIT was the difficulty in changing the mindset of employees. Accordingly, a number of respondents considered motivational and attitudinal training to be as important as technical training.

4.6 LOCATION IN RELATION TO JIT

In order to test the possible influence JIT may have on the location of automotive component manufacturers, manufacturers from a number of different locations were selected. Table 4.11 sets out the location of the firms surveyed. Whilst the majority of firms are located within close proximity of Toyota, suppliers located outside the Durban Metropolitan Area as well as outside of KwaZulu-Natal were purposefully selected to determine the extent to which JIT can operate across longer distances.

Table 4.11 Location of firms surveyed

Location			
Metropolitan Area	**Complex**	**Area**	**Number**
Durban Metro	Southern Industrial corridor	Prospecton	6
		Mobeni	1
		Jacobs	1
		Umbogintwini	1
	Pinetown complex	Westmead	1
		New Germany	3
	Other	Mayville	1
		Rossburgh	1
KwaDukuza	Stanger		1
Pietermaritzburg	Pietermaritzburg		3
Johannesburg		Wynberg	1
		Krugersdorp	1
Port Elizabeth		Estadeal	1
Total			[illegible]

4.6.1 History of location

Five firms have been located in their current premises for up to 5 years (see Table 4.12). Three of these firms moved from other areas, one is an entirely new establishment and one represents an expansion. In terms of the three firms that moved from other areas, all three moved within 10km of their original premises.

Two firms have been located in their current premises for between 6 and 10 years. Neither of these were relocations but rather represented expansions to existing firms. One firm is located within 2 km of its original premises while the other is located some 30 km away. The location of their original plants thus played an important role in determining an appropriate location for the new plants, albeit to a lesser extent in the case of the firm located 30 km away from its original premises.

Four firms have been located in their current premises for between 11 and 15 years with only one of these firms receiving some form of incentives. Four firms have been located in their premises for between 16 and 21 years, one of which received decentralisation incentives.

A total of seven firms have been located in their current premises for longer than 21 years. All these firms, except one, received some form of decentralisation incentive at the time of establishment.

Table 4.12 Length of time in present location

Period	No. of firms
0 - 5 years	5
6 - 10 years	2
11 - 15 years	4
16 - 20 years	4
More than 21 years	7
Total	**22**

4.6.2 **Locational decisions of the firms**

Respondents were given a list of seven criteria and asked to rank what they considered to be the most important criteria in determining their current location. Criteria were ranked from 1 to 7 with 1 being the most important and 7 the least important criterion. Some firms did not rank all criteria. Where firms regarded a particular criterion to be insignificant they did not rank it.

Two firms stated historical reasons for their present location. These firms did not rank the criteria as the respondents were not aware of the main criteria informing the original location decisions.

For purposes of this report the four most important criteria are synthesized in Table 4.13 below.

Table 4.13 Summary of four most important criteria

Criteria	Level of importance				Total
	1st	2nd	3rd	4th	
Proximity to major client	12	2	2	1	17
Proximity to input suppliers	1	3	2	2	8
Labour	4	3	4	1	12
Land prices	-	4	2	5	11
Suitable premises	2	4	6	3	15
Transport linkages	-	4	2	7	13
Management homes	1	-	2	1	3
Total	20	20	20	20	

Twelve firms (60%) considered proximity to their major clients to be their most important locational determinant. Four firms (20%) indicated labour was the most important while two firms stated suitable premises was the most important. One firm stated proximity to input suppliers was the most important while another considered proximity to management homes to be the most important consideration.

Land prices, suitable premises and transport linkages all ranked equally as the second most important factor determining location. Four firms identified each of the respective categories as the second most important locational determinant. Three firms ranked proximity to input suppliers as the second most important criterion while three firms ranked labour as the second most important determinant.

Six firms ranked suitable premises and four firms ranked labour as the third most important locational determinant. Proximity to major client, input suppliers, land prices, transport linkages and proximity to management homes were ranked as the third most important criterion by two firms respectively. Seven firms ranked transport linkages as the fourth most important criterion while five firms considered land prices to be the fourth most locational determinant. Overall, proximity to major clients was considered to be the most important determinant, followed by suitable premises, transport linkages, labour and land prices.

4.6.3 **Relationship between JIT and ranking of locational determinants**

By cross-tabulating the number of firms that have implemented JIT with those firms that considered proximity to client to be the most important locational factor it possible to identify a relationship between the two.

Of the ten firms manufacturing and supplying to JIT, seven thought proximity to client was the most important criterion, six of which are located in the SIC and one in New Germany. One thought proximity was the 2^{nd} most important criterion although this firm is located outside the DMA . One firm thought proximity was unimportant but this firm is manufacturing predominantly for the aftermarket. The remaining firm did not rank the criterion.

Of the remaining seven firms which are supplying on a JIT basis, two ranked proximity to client to be the most important criterion; two regarded proximity to client to be the 3^{rd} most important criterion; and two regarded proximity to be unimportant. The remaining firm did not rank the criteria.

From the above it would appear that as firms move towards manufacturing and supplying on JIT basis, proximity to their major clients becomes more important.

The exceptions are firms who manufacture predominantly for the aftermarket. Furthermore, the excellent road transport networks facilitate the operation of JIT across longer distances.

4.6.4 Proximity of automotive component suppliers to their major customers

The distance between component manufacturers and their major clients was used to assess how important proximity is in the implementation of JIT.

Seven of the nine firms located within 0-21km of their major clients are located within the Southern Industrial Corridor (SIC). The remaining two firms are located within the Durban Metropolitan Area. Three of the four firms located between 21-50 km from their major customer are located in the New Germany area while the remaining firm is located within the Pinetown area. Both firms located between 51-100 km from their major clients are located in the Pietermaritzburg area. The one firm located between 101-200 km from its major client is located in Stanger (see Table 4.14).

Three of the five of the firms that are located over 200 km from their major clients are involved primarily in the aftermarket (one of which is exporting approximately 45% of their products to the USA). Two of these firms are located in the SIC, one in Pietermaritzburg, one in Port Elizabeth and one in Krugersdorp.

Table 4.14 Proximity of suppliers to their main customer

Distance from major customer (1)	**No. of firms**
0-20km	9
21-50	4
51-100	2
101-200	1
over 200	5
Total (2)	**21**

Notes: 1. This does not necessarily infer that Toyota Manufacturing SA is the major client

2. One firm failed to provide this information citing reasons of confidentiality

4.6.5 Frequency of deliveries to Toyota

Ten firms are delivering two or more times a day to Toyota, seven of which are located within the Southern Industrial Corridor, two in New Germany and one in Stanger. All of these firms have implemented a JIT production system either partially or fully (see Table 4.15).

All the firms that claimed to have implemented JIT (19 firms) stated that their present location enabled them to supply Toyota on a JIT basis. This is an interesting finding given that three of these firms are located outside of KwaZulu-Natal. However, none of these firms are delivering to Toyota *more* than once a day. Two firms deliver on a daily basis while the other firm is delivering three times a week. The firms located within Gauteng and the firm located in the Eastern Cape deliver to Toyota depots in the respective provinces. Deliveries from these depots are made to the Toyota plant in Prospecton on a daily basis.

Those firms that had not implemented a JIT system were all of the opinion that if they had to deliver in smaller batches more frequently, they could do so. However, these firms did not feel that they would be able to manufacture according to a JIT system as they considered their manufacturing process to be incompatible with JIT. However, as noted above, firms which do not manufacture to JIT but supply on a JIT basis run the risk of high levels of stockholdings.

Table 4.15 Frequency of deliveries to Toyota

Frequency	**No. of firms**
Once a day	8
Two or more times a day	10
Once a week	1
Two or more times a week	2
Once a month	1
Total	**22**

4.6.6 **Possible changes in location**

Two of the twenty two firms indicated that they were considering changing their firm's location in the near future. Both these firms indicated that they were likely to remain within the Durban Metropolitan Area. One firm was consolidating its three operations on a single site and intended to remain in the Prospecton area. The other firm was in the process of unbundling and once this had been completed, stated they would consider a location closer to Toyota.

4.7 SPATIAL AND FUNCTIONAL AGGLOMERATION TENDENCIES

4.7.1 **Proximity of other automotive component suppliers**

Only three of the twenty two firms indicated that there were no other automotive component suppliers in close proximity to their firms (i.e. within 10 km). When asked whether they considered this to be beneficial or problematic, nine firms stated this was potentially beneficial. These firms stated that although there were potential benefits such as the establishment of networks, shared learning, quick problem-solving and shorter turn around times, none of these were currently being realised due to the lack of trust and co-operation between component firms.

Ten firms were indifferent, stating that their proximity to other automotive component suppliers was neither problematic or beneficial. Interestingly only one of the eighteen firms had direct competitors in close proximity to it.

4.7.2 **Agglomeration vs clustering**

For purposes of this research a distinction has been made between agglomeration and clustering. Agglomeration refers physical proximity of firms within a particular sector while clustering implies a high level of co-operation between firms within a given locality.

Fifteen firms did not consider themselves to be part of a cluster of automotive component suppliers while seven firms did. Four of the seven firms are located within the Southern Industrial Corridor, one in New Germany, one in central DMA and one in Wynberg.

Seventeen firms stated they would be supportive of the development of a cluster as this would create opportunities for greater levels of co-operation and synergy between firms. Opportunities identified include shared transport, joint training schemes, joint purchasing (raw materials), better utilisation of machinery, joint learning (in terms of production processes) and joint marketing (at the global scale).

A number of firms did, however, raise concerns about labour contamination [1]. Of the firms that stated they would not support the development of a cluster, labour contamination was cited as the main reason. Other reasons included the fear that such a cluster would result in suppliers becoming dependant upon one assembler and that suppliers would be able to "steal" contracts away from one another. These reasons again pointed to a lack of trust between firms.

4.7.3 **Warehouse facilities**

Nine firms are currently operating warehouses within close proximity to one or more of the assemblers. Only one of these warehouse facilities is located in the Durban Metropolitan area serving Toyota. Two of the nine firms have warehouse facilities within an assembler's site although in both cases this occurs outside of South Africa and for different assemblers. All respondents stated that the reason for operating such a facility was to be able to supply on JIT basis and provide their clients with a high standard of customer care. Six of the remaining thirteen firms have branches outside of KwaZulu-Natal serving assemblers within their respective areas. As such it is not necessary for these firms to operate warehouses. Having said this, however, two of these firms stated that branches of their respective firms carried a certain amount of stock on their behalf and were in effect acting as mini-warehouse facilities.

Three firms, two of which are currently not operating warehouses, indicated that they were considering setting up a joint JIT facility in Pretoria to supply Samcor on a two-hourly basis. Samcor has, in fact, offered these suppliers space on their site for the construction of such a facility.

[1] Labour contamination refers to the possibility of labour within a particular firm being influenced by what is occurring in surrounding firms. For example, strike action within a particular firm could spread to other firms within the same sector and within close proximity to one another.

4.7.4 **Condominiums**

The condominium concept refers to the location of independent suppliers' productive facilities within or on the same site as the assembly plant.

Nineteen of the twenty two firms had heard of the condominium concept. Seven of these firms thought it was not possible to implement such a concept within the South African context in the medium to long term due to the following constraints:

- lack of trust amongst automotive components manufacturers;
- lack of trust between manufacturers and assemblers;
- problems of labour poaching and labour contamination;
- reluctance of manufacturers to be dependent upon a single assembler; and
- concerns that it would result in a loss of independence.

Fifteen firms, however, stated that such a concept would be possible under the following conditions:

- drastic reduction in the variety of models produced in South Africa;
- substantial increases in production volumes so as to achieve economies of scale which, in turn, will only be possible if global sourcing occurred;
- significant reduction in demand fluctuations; and
- greater commitment from assemblers to component manufacturers.

4.8 LINKAGES, CO-OPERATION AND INSTITUTIONAL SUPPORT STRUCTURES

4.8.1 **Co-operation between component firms**

Sixteen firms indicated that there was some level of co-operation between their firm and other automotive component suppliers but that this co-operation took place mainly through their affiliation to the National Association of Automotive Component and Allied Manufacturers (NAACAM). Fifteen firms are members of NAACAM which is aimed at providing manufacturing companies with a forum through which to formulate policies for the benefit of the industry as a whole (see Table 4.16). However, ten of these firms were critical of the support provided by NAACAM and considered the organisation to be relatively ineffectual. Despite this, the majority of firms felt that NAACAM had improved its support substantially over the past two years and had adopted a far more pro-active approach. Several members attributed this improvement to the work of the current Chief Executive Officer. One firm, however, was glowing in its account of NAACAM stating that the organisation had secured some work for the company and paid for an overseas marketing trip.

The seven firms that were not members of NAACAM stated that they did not see any benefit to joining the Association and were unlikely to do so in the future. One of these firms is a member of the Textile Federation which may explain their not needing NAACAM networks and support.

Further co-operation takes place through the Benchmarking Club and Work Place Challenge. Seven firms are members of the KwaZulu-Natal Benchmarking Club. Four firms are members of the Work Place Challenge (see 3.4.2 and 3.4.3 above).

Table 4.16 Institutional structures

Association	No. of firms
NAACAM	15
Bench marking Club	7
Work Place Challenge	4

4.8.2 Sub-contracting

Fifteen firms indicated that they sub-contracted out some part of production (see Table 4.17). However, all of these firms stated that sub-contracting occurred on a very limited scale and amounted to less than 5% of production. Although sub-contracting is occurring on a limited scale the location of sub-contractors is of interest. Sixty seven per cent of all sub-contractors are located within 20km of the respective automotive component suppliers with only 13% located outside of the component manufacturer's province.

Table 4.17 Sub-contracting

Location of sub-contractors in relation to manufacturer	No. of firms
Within 20 km	10
21 - 50 km	1
51- 160 km	2
Outside of province	2
Total	**15**

4.8.3 Department of Trade and Industry (DTI) and Local Authority

With the exception of the decentralisation incentives firms received as part of the previous dispensation, only two firms have received direct support from the DTI[1]. In both cases this was in the form of funding for overseas marketing trips. One of these firms went overseas as part of a DTI trade mission. However, this firm was critical of the DTI trade missions stating that they lacked focus and needed to be directed at firms within particular sub-sectors of the automotive components industry. In addition, trade missions took place over a period of two weeks and very few firms could allow personnel to be away for such an extended period of time. Overall firms were of the opinion that the DTI trade missions were not suited to the requirements of component firms. However, firms were supportive of overseas trips to market their products as long as these were for short periods of time and were specifically related to the component they manufactured. In addition, firms stated that these trips could be used to learn about the latest technology, production and organisation techniques.

Two other firms stated that they had been promised funding for overseas trips but that when they applied for such funding they were refused. This experience has led to a distrust of DTI initiatives on the part of these firms.

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1 This does not include the import-export complementation scheme offered as part of the MIDP. See 4.8.4 below for a discussion on this

The DTI does provide indirect support to component firms through their joint funding of the Benchmarking Club and Work Place Challenge initiative. All the firms involved in these initiatives were very positive in their assessment and claim that this would not have been possible without the support of the DTI.

None of the firms stated they received any support from their respective local authorities. Several firms, however, were critical of their local authorities particularly those firms located in SIC and the New Germany area. These firms complained about the state of the internal access roads within New Germany and claimed that the local authority failed to clean out storm water drains which resulted in flooding every rainy season.

Firms in the SIC, particularly those in Jacobs/Mobeni, complained about the poor state of the internal roads, electricity fluctuations, and the general lack of maintenance in the area. Furthermore, a respondent in Prospecton claimed that the inappropriateness of existing planning legislation was inhibiting the redevelopment of the area. The "red tape" involved in getting planning approval had also delayed the extension of their current premises.

Overall, firms felt that local authorities were more obstructive than supportive. Respondents called for better maintenance of the areas and incentives to encourage the redevelopment of certain areas, particularly those within the SIC.

4.8.4 **The Motor Industry Development Programme (MIDP): Import-export complementation scheme**

The import-export complementation scheme was introduced in 1995 as part of the Motor Industry Development Programme (MIDP) (see 3.3 above). This scheme allows both OEMs and component manufacturers to earn duty credits from exporting. These duty credits can then be used to offset import duties on cars, components or materials, or alternatively they can be sold on the open market.

Nine firms are currently taking advantage of the MIDP import-export complementation (IEC) scheme. Five of the nine firms are ceding all their credits to one or more of the assemblers. The remaining four firms split their credits between themselves and the assemblers with the majority going to assemblers. Overall firms felt that the assemblers rather than component manufacturers were benefiting from the IEC scheme.

4.8.5 Assembler support for component manufacturers

Sixteen of the twenty two firms surveyed stated that they received little or no support from the assemblers. Four firms (excluding the two Toyota-owned component firms) stated that they received support from Toyota Manufacturing SA. Two of these are part of the Metair group which is affiliated to Toyota. The assistance offered was mostly related to the implementation of the Kanban system. This support, however, was not on-going. A large percentage of firms complained that Toyota and other assemblers made substantial demands without providing corresponding support.

Eighteen of the twenty two firms stated that they would approve of greater levels of support from assemblers. The majority of firms complained about the lack of commitment on the part of assemblers. Firms stated that they were expected to produce according to a JIT system but that the large fluctuations between the figures released by assemblers and the number of components they actually require made the implementation of a JIT system very difficult. Furthermore, these fluctuations result in component suppliers having to carry stock and ultimately running "just-in-case" system as opposed to a "just-in-time" system.

4.9 PHYSICAL PLANNING REQUIREMENTS

4.9.1 Availability of land and suitable premises

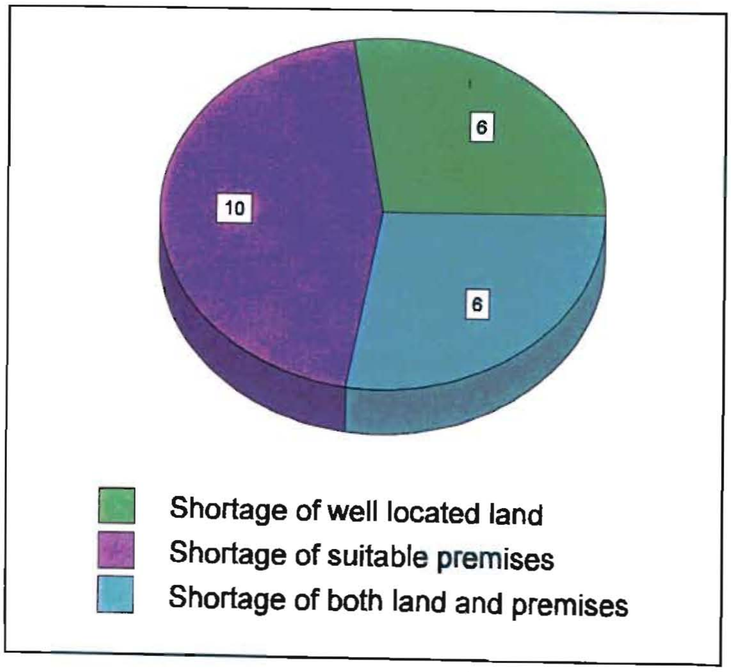
Bearing in mind the requirements of just-in-time production, firms were asked whether or not they thought there was a shortage of well located industrial land. Six firms felt that there was a shortage of well located industrial land (see Figure 4.2). Of these firms three are located in KwaZulu-Natal but outside of the Durban Metropolitan Area, while a further three were located outside the province.

Ten firms stated that rather than a shortage of well-located industrial land there was a shortage of suitable industrial premises, particularly within the SIC. Respondents complained that the current building stock within the SIC and more particularly

Jacobs/Mobeni did not lend itself to the adoption of JIT which requires the free flow of production from one process to the next. The main restrictions are the large number of columns, low ceilings and lack of ventilation, which is typical of industrial buildings in Jacobs/Mobeni and to a lesser extent Prospecton. Four firms located in Prospecton stated that there was a shortage of land and suitable premises about five years ago. One firm, in fact, had to build a distribution centre in Mahogany Ridge (Pinetown) as there was no suitable land available in Prospecton at that time. However, due to the movement of a number of industries out of Prospecton, the release of some Airports Company land for industrial development, and the development of Southgate Industrial Park at Umbogintwini over the past two to three years, there is no longer a shortage of industrial land within the SIC.
All of these firms were of the opinion that the demand for industrial development in the medium term could be met by the redevelopment of industrial buildings within the Jacobs/Mobeni area and to a lesser extent Prospecton, along with other new industrial developments.

Six firms thought there was a shortage of both well located industrial land and suitable premises. Two of these firms were located within the SIC, one in New Germany, one in Westmead and two outside of the Durban Metropolitan Area (within KwaZulu-Natal).

Figure 4.2 Shortages of well located industrial land and, or, suitable premises



4.9.2 **JIT and changes in space requirements**

Sixteen firms stated that the implementation of JIT had resulted in space savings. These space savings ranged from between 10% and 35% of the respective firms floor space. Space savings were attributed to the reduction in stockholdings in terms of raw materials, work-in-progress and finished goods. In all of these instances firms reported being able to take on additional work due to this space becoming available. Three firms who had recently expanded their manufacturing operations stated that this would not have been possible had they not implemented JIT.

The reduction in stockholdings also has enormous cash flow implications. One firm stated they had been able to reduce their raw material holdings from R25m to R2.5m. This in turn, had freed up capital for investment in new technology and training.

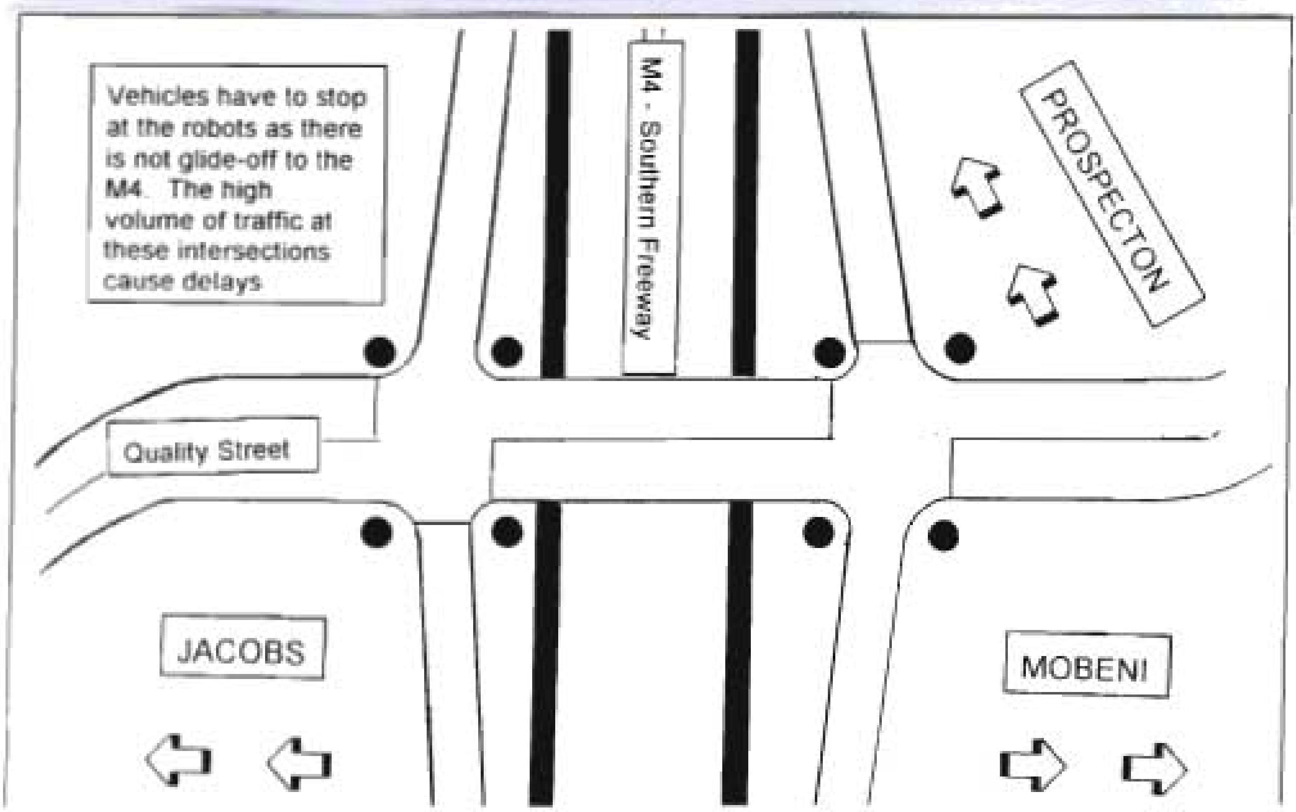
4.9.3 **Transport infrastructure**

a) *Roads*

All twenty two firms stated that the implementation of JIT (both production and supply) had made access to transport networks more important. The research revealed that roads were the dominant networks used by manufacturers due to their high speed capabilities and high levels of flexibility. The national road networks were considered by respondents to be adequate for the operation of JIT with most firms being located within easy access of highways.

However, concerns were expressed with regard to the internal road networks within particular localities. Internal road networks within the Southern Industrial Corridor and New Germany were considered by firms to be problematic. Apart from the lack of maintenance and potholes experienced in these areas, the most urgent need was for improved access onto and off the highways. This is particularly true in the Jacobs/Mobeni area where access onto the highway from Quality Street is restricted by the absence of a glide off, requiring trucks stop at the robot (see Figure 4.3).

Figure 4.3 Quality Street intersection with M4 (Southern Freeway)



One respondent stated it took his trucks longer to get onto the highway, which was approximately one kilometre away, than it did to get to Toyota which was approximately 10km away. A number of firms raised concerns about the maintenance of the national roads and stated if these were not kept to a high standard it would have detrimental impact on their ability to manufacture and supply on a JIT basis.

Those firms using transport companies to courier their products to their main customers complained of the high costs and the lack of understanding of JIT amongst transport operators. Firms reported instances where transport operators failed to deliver products to Toyota at the specific times allocated to the component manufacturer. In addition, transport operators lacked flexibility in terms of pricing for more frequent deliveries of smaller quantities.

Three firms mentioned that they had changed the size of the trucks they used since implementing JIT. All of these firms now used smaller trucks (between 5 and 10 ton) allowing for more frequent deliveries at a lower cost per trip. However, these firms stated they still needed big yards as their raw materials were being delivered by large pantechnicons. This situation would continue until JIT is implemented throughout the supply chain.

b) *Rail*

Respondents indicated that they did not and were unlikely in the future, to utilize rail transport due the associated high rates of theft and its inflexibility.

c) Air

The transport of high value low bulk components is well suited to air transport. Air transport is fast, efficient and facilitates the operation of JIT over long distances. At present, it is possible to deliver into Europe on a daily basis. In this way, South African firms have been able to supply on a JIT basis to international OEMs. However, the cost of this mode of transport is high. Only two respondents, both of which manufacture high value low bulk goods, indicated that they were using air transport on a regular basis. While other firms do use air transport, the only do so in emergencies due to the high costs. The firms using this mode of transport were generally satisfied with level of service offered by airport authorities and customs.

d) Shipping

All respondents currently utilizing this network complained about the long delays in clearing containers. One firm stated that they had used Port Elizabeth harbour in the past in an attempt to overcome the long delays experienced at the Durban harbour. Overall, firms considered the port authorities to be ineffective and bureaucratic in their approach with little attention given to the needs of firms.

Respondents indicated that the situation at Durban's harbour had deteriorated over the past few months. These firms acknowledged the teething problems associated with the new computerised system but stated that the main constraint was not the computer system but rather the attitude of the port authorities. Firms claimed that a more business-like approach to customer service was needed. All respondents considered the inefficient operation of the port to be a major stumbling block to increasing exports.

d) *Gas pipeline*

Only one respondent indicated that they utilised this network in their production process. The delay in the completion of the gas pipeline in Jacobs has prevented a particular plant from relocating from Johannesburg. The pipeline is currently under construction and is expected to be completed by May 2000. Once the pipeline is complete this firm will consolidate all its production functions on one site.

4.10 CONCLUSIONS

One of the most striking conclusions is that more firms consider themselves to be manufacturing according to JIT than is actually the case. Another is that location decisions and spatial requirements are influenced by a complex array of operational factors. An important distinction that emerged is that between firms *manufacturing* according to JIT and those that are *supplying* according to JIT. Only 10 of the 22 firms surveyed do both. Another distinguishing characteristic is the operating status of firms. Eight of those interviewed are part of MNCs of which seven have implemented JIT. These firms also account for a substantial amount of

The fact that 45% of all inputs are sourced within 50 km suggests that component firms within a given locality have significant multiplier effects. Some firms are also importing a high percentage of inputs which constrains their ability to run an efficient JIT system. These imports may, however, point to opportunities for new firms. A number of firms are currently exporting their components but the majority of these are for the aftermarket. Paradoxically, Toyota's inability to secure significant exporting contracts is preventing them from acting as a conduit for exports for their component suppliers. This, in turn, prevents these firms from being able to increase their volumes which would facilitate the implementation of JIT. The survey, however, revealed that not all component firms in KwaZulu-Natal rely on Toyota as their major client. Most firms stated they preferred to serve a number of assemblers in order to spread their risks. As a result the optimum location for these firms is not determined by proximity to a single assembler. However, the strategic decision to supply to multiple assemblers is likely to increase the need for JIT facilities.

Higher skills are required for the operation of JIT and as such, firms are unlikely to be drawn to low-wage, low skill locations. For those firms implementing JIT or intending to do so, the importance of training is increasingly being recognised.

As firms move to manufacturing and supplying according to JIT, proximity to the main client becomes more important. However, in the case of Durban, the efficient road network enables JIT to operate over longer distances. Ten firms are currently making two or more daily deliveries to Toyota. The majority of these firms are located in the SIC and New Germany. Their proximity to Toyota allows them to maintain this delivery rate but still keep their transaction costs low.

There is an agglomeration of automotive component firms in the SIC and to a lesser extent, New Germany and Westmead. However, the lack of co-operation between firms prevents them from gaining any real benefit from their proximity to one another.

A number of firms are currently operating warehouses to enable them to fulfill their JIT commitments. As the frequency of deliveries increases, firms are likely to develop JIT facilities closer to their main clients. In terms of physical planning, the implementation of JIT is resulting in the reduction in space needs.

Both internal and external road networks are important for the operation of JIT with firms requiring easy access to both systems. Air transport is less important. The use of shipping is likely to increase with rising exports and imports.

The implications for Planners of these and other findings will be taken up in the next chapter.

CHAPTER 5

JIT - WHAT DOES IT MEAN FOR PLANNERS?

5.1 INTRODUCTION

Planners are increasingly recognising the need for better information about new models and strategies, for more thorough investigation of success stories, and above all, for more knowledge about the functioning of the world economy and the changing role of their localities and regions (Mair 1993: 208).

Accordingly, this chapter aims to take up some of the important and interesting themes that have emerged from the literature review (chapter 2); the evolution of the automotive industry (chapter 3); and the survey findings (chapter 4) in order to determine the implications for Planners. Recommendations are made as to what interventions are necessary to facilitate the fuller implementation of JIT and, in turn, contribute to the development of the automotive industry within KwaZulu-Natal and more specifically within Durban. These recommendations do not only deal with physical planning and land use issues but with a variety of possible development interventions. This is in line with the post-apartheid shift in planning from a strong spatial orientation to integrated development planning.

5.2 EXTENT TO WHICH JIT HAS BEEN IMPLEMENTED

The discussion above has shown that there is fairly widespread but somewhat varied implementation of JIT at the 1st tier level. The fact that more firms are supplying on a JIT basis than manufacturing according to JIT, implies that the supplying to JIT is often the first step toward implementation. The pressure to supply according to JIT has come from Toyota. This, in turn, has forced firms to re-evaluate the way in which they manufacture their products. An assessment of the 2nd and 3rd tier manufacturers reveals little or no implementation of JIT. However, as 1st tier suppliers move toward fuller implementation of JIT, they are likely to put pressure on 2nd tier suppliers to supply them on a JIT basis. In this way, it is expected that JIT will be diffused throughout the entire supply chain.

At present only a limited number of firms have implemented JIT throughout their entire supply chain, but where this has happened, firms have reported significant savings. These savings have provided the necessary capital for investments in new technology, equipment and training which, in turn, has enabled firms to achieve higher levels of competitiveness.

It is unlikely, however, that JIT will be adopted by *every* supplier throughout the supply chain. Just as Toyota has identified 30 component manufacturers who supply crucial inputs to the production process, so too will 1st and 2nd tier suppliers. Those inputs which are insignificant in the greater scheme of things will not be sourced on a JIT basis and the manufacturers of those parts are unlikely to implement JIT.

Therefore, the demand for new kinds of industrial developments such as JIT facilities, is likely to come from 1st and 2nd tier manufacturers which are critical to the smooth running of the particular assembly plant as well as their main material suppliers.

5.3 FACTORS INHIBITING THE IMPLEMENTATION OF JIT

Whilst the pressure to implement JIT is growing, component suppliers face a number of fundamental constraints to fuller implementation. The most significant of these are low volumes and high variety of components produced by individual firms as well as low levels of employee skills. The problem of low volumes (i.e. poor economies of scale) can only be addressed by increasing exports. The solution to the variety of components produced would be for assemblers to reduce the number of models they manufacture while a significant increase in training is needed to improve the skills base. None of these solutions can be addressed at the firm level alone, but require parallel intervention at the micro, meso and macro levels.

5.3.1 **Ability to increase exports**

The ownership patterns of both assemblers and component manufacturers have significant implications for achieving economies of scale. Component manufacturers can no longer rely on domestic OEMs for survival. They have to increase their exports significantly. However, as noted by Barnes (1999: 11) multi-national control of international marketing networks makes independent exporting extremely difficult.

To penetrate the export market automotive component firms have to use the domestic OEMs as a conduit for their exports and, or, generate a close relationship with a 1st tier MNC component supplier (ibid). To gain support of a MNC component supplier, domestic component suppliers would either have to sell a major equity shareholding to the MNC or alternatively set up a sub-contracting relationship. Both these options have significant implications. Firstly, the decision-making power shifts from domestic suppliers to either the OEM or the lead source MNC component supplier, depending on the nature of the product and whether it is a lead source or OEM proprietary design. This in turn has implications for where decisions are made about location and operating practices. Secondly, the domestic boundaries of the previous value chain are broken which has a knock-on effect for those firms serving that particular component manufacturer (ibid).

5.3.2 **Global sourcing**

Economies of scale can only be achieved if domestic OEMs manufacture fewer models but for the world market. This would result in the reduction in the variety of components demanded and also increase economies of scale which, in turn, would facilitate the implementation of JIT. However, global sourcing requires that component manufacturers have significant design and technology capabilities which the majority of local firms do not have.

5.4 INSTITUTIONS AS A MEANS TO PROMOTE GREATER CO-OPERATION AND INCREASE COMPETITIVENESS

The case study revealed that while there are linkages between firms, there is limited co-operation between automotive component manufacturers despite the fact that most were located in close proximity to one another. The primary reason for this was a lack of trust between firms. However, the fact that the majority of firms indicated that they would be supportive of increased levels of co-operation with other automotive component manufacturers, suggests a change in attitudes and opens the way for interventions to promote greater levels of co-operation.

Institutions have an important role to play in achieving higher levels of co-operation between firms. This is illustrated by the role played by the Benchmarking Club and Work Place Challenge. While the aim of these initiatives is to assist firms with restructuring and achieving world competitiveness, they have played an important role in building relationships between firms. All those firms involved were highly complimentary about the work done as part of these initiatives stating that they had opened the door for greater co-operation between firms. The availability of a neutral facilitator has, according to members, helped to break down barriers between firms. Some members had adopted an "open-door" policy and welcomed fellow members to visit their factories. It is important that initiatives like these and others are supported and expanded.

5.5 CHANGES IN LAND USE

5.5.1 JIT facilities

The research has shown that firms are unlikely to relocate their manufacturing plants for two main reasons. Firstly, the costs of relocation are considered to be prohibitive, particularly in this period of economic uncertainty. Secondly, component manufacturers are reluctant to become dependant upon one assembler. They would, in fact, prefer to be located where they can serve a number of assemblers. If these firms are to supply to a number of OEMs on a JIT basis, as is being demanded, it will necessitate their operating JIT facilities in close proximity to each of their major OEMs.

The size of a JIT facility will depend on a number of factors. Firstly, it will depend on the size and scale of the particular component to be held in the JIT facility. Secondly, it will depend on the amount of assembly work to be undertaken within the facility. Thirdly, the likelihood that component manufacturers will enter into joint ventures with one another for the operation of JIT facilities, may necessitate the development of large scale operations. An example of this is the possible joint venture between three automotive component firms in KwaZulu-Natal to operate a JIT facility on the Samcor plant in Pretoria.

Overall, it is expected that the space requirements of JIT facilities will be considerably less than that of manufacturing plants. At the same time the kind of space needed is different. JIT facilities generally have the same basic requirements as warehousing. The demand is likely to be for flat land with easy access to the highways but in close proximity to the assembler, if not on the same site.

However, the current shortage of warehouse type facilities within the SIC and the likely increase in demand for such facilities, could result in the development of warehouse type facilities in an area characterised by heavy industry. Those areas most likely to be affected are Jacobs, Mobeni and Prospecton as well as areas outside the SIC such as Westmead.

5.5.2 **Building requirements**

As noted in section 4.9.1 above, the current building stock, particularly in the older industrial areas, is inappropriate to the operation of JIT. The high number of columns, low ceilings, lack of ventilation, limited loading and off-loading space all hamper the effective operation of JIT. These areas are, however, prime locations in terms of supplying to Toyota on a JIT basis.

While the level of vacancies within the SIC corridor reveals a tendency for firms to move to better environments, the research findings indicate that there are good reasons for staying in the SIC such as the desire to remain close to established networks. These networks include not only suppliers and markets but also social networks within a given area. The need to retain the firm's labour force was also considered to be important and therefore new locations that offer the least disruption are preferred.

As the operation of JIT makes the maintenance of these networks even more important, public spending aimed at improving the area's environment and the introduction of incentives could well encourage firms to upgrade their premises and, or redevelop premises within the SIC.

5.6 TRANSPORT NETWORKS

The efficiency of transport networks facilitate the implementation of JIT and thus improves the competitiveness of component manufacturers. The location of component manufacturers in relation to national and international transport networks is therefore important. Firms generally considered the national roads to be adequate but raised concerns about the continued maintenance of these roads.

Internal road networks within New Germany, Jacobs and Mobeni were considered to be problematic. Firms within the Jacobs area stated that the existence of the old railway tracks placed the road system under severe strain. These firms argued that the required re-alignment of roads, which would facilitate the movement of traffic through the area, could not take place while the rail lines were still in place. Given the urgent need to upgrade the road network in the Southern Industrial Corridor, the extent to which these lines are being used and the possibility of removing them needs to be taken up by the Metropolitan Planners.

As exports increase so the dependence on shipping is likely to increase. Urgent attention needs to be given at national as well as local level to improving the efficiency of the port authorities, particularly with regard to improving the speed of container clearance and developing more business-like attitudes. Decisions with regards to future container expansion also need to be finalised.

5.7 RECOMMENDATIONS AND POSSIBLE INTERVENTIONS

5.7.1 Regeneration of the Southern Industrial Corridor

From the above discussion it is evident that the Durban Metropolitan Council has an important part to play with regard to the regeneration of the SIC. It will need to play the role of initiator or catalyst to the regeneration process. Some kind of incentives will have to be offered to encourage firms to redevelop the area. These could take the form of rates rebates, lower services charges or the like. In addition, the fast-tracking or streamlining of planning approval for new developments and extensions would facilitate redevelopment. This has recently been advocated by the city's Best Practices Commission.

5.7.2 IDZs and their potential to attract foreign investment

Industrial Development Zones (IDZs) are purpose built industrial estates linked to an international port or airport and designated for specialised industrial development focussing on new investment. IDZs are designed to take advantage of locational factors that influence global patterns of production and contribute to providing sites to facilitate growth and development and thus realise the country's new outward orientation (DTI 1999). The demarcation of the Southern Industrial Corridor into an Industrial Development Zone with special customs facilities would greatly improve the operation of JIT and provide firms with a competitive edge. In addition, the IDZ could be used to attract foreign investment by 1st tier MNCs into local component firms which would provide local firms with the international linkages needed to break into exports.

However, the success of an IDZ within the SIC would depend on the simultaneous upgrading of the area's infrastructure and environment.

5.7.3 Cluster initiative

A cluster initiative involves processes whereby industry roleplayers identify challenges and opportunities that can be addressed more effectively through working as a team rather than individually. Industry clusters can be successful at local, regional or national level (DTI 1997).

The existence of an agglomeration of automotive component firms within the DMA, and to a lesser extent Pietermaritzburg, provides the basis on which to form such a cluster within KwaZulu-Natal. Given the current levels of mistrust and lack of co-operation amongst component suppliers, the development of a cluster initiative may provide the institutional framework for increased co-operation

The difficulties currently facing these firms are more likely to be overcome through increased co-operation and shared problem solving. As such the development of an automotive cluster within KZN could facilitate the much needed development of supplier networks and training facilities, particular to the automotive industry. In addition, the cluster initiative could lead to the more efficient usage of transport infrastructure through the identification of possible route-groups and other logistical improvements. Clusters, also make the identification of gaps within the local supplier value chains easier which could point to opportunities for SMME development. Ultimately, clusters can lead to cost savings and thus increase the competitiveness of firms, which is crucial to the continued survival of the automotive component firms within KZN. Durban Metropolitan Planners in association with DTI officials could initiate the development of such a cluster by bringing business interests together and creating an enabling environment for such a cluster to develop.

Firms within the automotive cluster could co-operate with local authorities as well as provincial and national governments to develop policies which would assist in improving firm level competitiveness.

5.7.4 **Dig-out port**

Prominent economists and urban development specialists such as Van Coller and McCarthy, have recently come out in support of the development of a new dig-out port on the existing airport site (Highroad for KZN: November 1999). This would provide a significant boost to the metropolitan, provincial and national economies.

Not only would this provide Durban with an internationally sought after strategic asset but it would also provide a long term solution to the problems of the existing harbour i.e. inability of post-panamax ships to berth in Durban harbour and inadequate container facilities.

The dig-out port would consist of approximately 12 berths with significant container facilities. One of these berths could be allocated to the automotive industry which, in conjunction with the demarcation of the SIC as an IDZ, could make Durban an internationally sought after automotive manufacturing centre. The dig-out port would serve as a catalyst for direct foreign investment into the assembly and automotive components industry. This, in turn, would provide the international linkages needed for increased exports as well as providing a conduit for bringing in new technology into the region. Such a development may also influence Toyota Japan's decision to allow increased exports from South Africa. The importance of this assembler to the local economy should not be dismissed and every effort needs to be made to ensure its continued success.

Durban is well located in terms of serving both the Asian and Australian markets. An efficient port designed with the needs of the automotive industry in mind, could well result in Durban becoming South Africa's premier automotive centre. As noted in Chapter 3 the multiplier effects of the automotive industry are large and as such any improvement in this industry could would make a significant contribution to the local, provincial and national economy.

A decision with regard to this development as well as the relocation of Durban's international airport needs to be taken in the short-term if South Africa is not to lose out on this window of opportunity.

5.7.5 **JIT as a tool for Local Economic Development (LED)**

Internationally, JIT has been used by a number of local authorities to attract business into depressed areas. Local authorities have focussed on attracting "magnet" assembly plants and associated automotive suppliers by marketing their areas as "just-in-time regions".

The Durban Metropolitan Council could target specific companies that have, or might have, definite manufacturing relations with a "magnet" company such as Toyota. In turn, Toyota could help Planners by supplying a list of its suppliers and by arranging formal introductions. The DMC could then approach those firms they consider to offer the most spin-offs for the local economy. This strategy was adopted by officials in Pamplona in Navarra, Spain, where the relocation of all Volkswagen's Polo Production to Pamplona was regarded as a golden opportunity to boost local economic growth. A delegation visited Wolfsburg to meet with a group of German supplier companies to persuade them to relocate to Navarra. Officials soon confirmed that at least three suppliers would be following the Polo to Navarra. Among the attractions offered by the Navarra officials, was a new German language college, for the benefit of a growing German community and Spanish employees alike (Mair 1992: 212).

Other strategies have included earmarking particular sites for new industrial growth around particular firms. Local governments in several municipalities around Mazda's Michigan factory invested funds in new industrial parks and prepared for strong competition to attract new automotive suppliers. In north-east England, the Sunderland local authority built factory shells in expectation that they would be occupied by Nissan suppliers. In Swindon in southern England - site of Honda's European assembly plant - Planners proposed a re-think of land use planning to ensure that adequate local sites were earmarked for expected incoming supplier companies. This included changing land use designations for some land parcels to manufacturing and warehouse uses. Given the likely increase in demand for warehouses, such a strategy could be adopted by the DMC particularly in planning for the SIC Industrial Development Zone (IDZ) and attracting potential foreign investment for the new dig-out port.

As noted above the JIT manufacturing methods revolutionise the kinds of extra-company training required by employers. The DMC could assist in establishing links been manufacturers and training institutions as well as market the DMA in terms of its wide range of educational institutions. This strategy was adopted by local Planners at Swindon who emphasized Honda's potential links to vocational training there (ibid).

5.8 CONCLUSIONS

The analysis of JIT production systems and their implementation within the automotive industry has shown that there is a relationship between JIT manufacturing and the spatial structure of automobile production. However, the findings revealed that location decisions and spatial patterns arising from a move to JIT production are the outcome of a number of complex factors including ownership patterns, operating status, market strategies and the extent and nature of JIT implementation. The resultant spatial patterns are correspondingly varied. The uneven rate of diffusion of JIT reveals that JIT is much easier for those suppliers located close to Toyota as evidenced by the fact that more suppliers located within the SIC having implemented JIT than elsewhere.

Furthermore inherited geographies influence the adoption of JIT. As Mair (1992: 89) notes in the case of Japan, the weight of past investments was not simply wiped out overnight to facilitate the implementation of JIT. Thus, rather than a causal relationship starting from the adoption of JIT and leading to new concentrated spatial structures, the reverse is indicated.

The tier of supplier and their relative market power is also significant. On the one hand small firms which depend on Toyota for the bulk of their business are more likely to be influenced by Toyota's demands to relocate closer to the assembly plant.

While on the other, firms which sell only part of their output to Toyota are likely to be able to resist this pressure. Most firms prefer to serve a number of assemblers to balance market power.

What is also apparent is that spatial concentration is not a sufficient condition to allow JIT production. The intervention of other non-spatial variables are crucial in determining whether JIT is adopted. These variables intervene in both the labour process and assembler-supplier relations. The availability of a skilled and flexible labour force is crucial to the operation of JIT. Workers have to be prepared to work overtime at short notice as well as to perform a range of tasks on request. Suppliers require long term commitments from assemblers before they are prepared to make significant changes to the way they manufacture their products. This is illustrated by a number of Toyota's automotive component suppliers who stated they would only be prepared to make significant changes in their manufacturing operation and new investments in technology and equipment if they received long term commitments from Toyota and other OEMs.

Furthermore JIT depends on both transport and logistical infrastructure and it is the interplay of these two elements that determines what spatial scale of proximity is required in order to operate JIT. The research revealed that as in the case of North America, the efficient and un-congested road infrastructure within South Africa and more specifically Durban, enables the operation of JIT over longer distances. At the same time, the research pointed to a need to consider both internal and external roads. This is particularly true in the case of Jacobs and to a lesser extent Mobeni where the poor internal road systems disrupt deliveries and make JIT planning difficult. Ultimately, as Mair (1992: 90) found in Japan, and as has been corroborated in the present study, there is an outer limit for the efficient operation of JIT but that the specification of this limit is very much context-dependent.

As such, alternatives to spatial agglomeration would seem to depend upon high quality infrastructures and on logistical solutions which could markedly reduce the disadvantages of distance between automotive component firms and assemblers. However, there is more to agglomeration then just spatial distance. The networks which are established and the logistical arrangements which agglomerations facilitate suggests that while dispersal at the local scale may be possible clustering is more beneficial.

While it is incumbent on Planners to understand these processes, they cannot, and should not, attempt to model the spatial consequences too closely. What can be anticipated is that there will be an increased demand for land suitable for JIT facilities (involving some type of sub-assembly operation and warehousing) in close proximity to the Toyota plant. This demand could be in Prospecton itself or in the adjacent areas of Mobeni and Jacobs as well as Westmead. The relative attractiveness of the SIC locations for new JIT facilities will depend largely on whether the physical infrastructure and public environment is upgraded in the short-term. Once a new JIT facility has established elsewhere it is unlikely to move to the SIC later on account of high relocation costs. Interestingly, a competing location for these facilities is being promoted in Cato Manor where new industrial parks are being marketed as potential sites for automotive component suppliers. This area is well suited to JIT type facilities due to its access to the port, the metro freeway system and SIC.

To sum up this research set out to investigate the spatial and locational implications of JIT in the automotive component industries associated with Toyota in Durban. The exploration of a wide array of theoretical perspectives, concepts, and precedents was useful in explaining the overall parameters that influence industrial location. Far more valuable, however, were theories on flexible production and the changing nature of competition and the concepts of agglomeration, clustering and industrial districts. The discussion of the fundamental elements of JIT proved to be critical. Without a thorough understanding of these concepts and the purposes of JIT, it would not have been possible to design a sufficiently focussed questionnaire, nor to interpret the nuances of the responses that came out of the surveys and interviews.

The literature drew attention to the tendency for firms to implement JIT to varying degrees depending on their status (as 1st or 2nd tier suppliers) and for the implementation of JIT to be a gradual process over time with individual firms increasing the extent of their JIT implementation in response to specific economic pressures. In addition, the literature noted the distinction between manufacturing and, or, supplying according to JIT. These proved to be important determinants in the case study. The international precedents were helpful in confirming patterns that appear to be emerging in Durban and in providing examples of practical ways in which JIT production has been enhanced.

In the final analysis the research showed that there is an increasing tendency towards spatial agglomeration. But in the case of KwaZulu-Natal, these agglomerations are dispersed at a regional scale on account of the relatively efficient road transport network as suggested in the central hypothesis. However, the trend is not towards the relocation of existing manufacturing plants but rather towards the establishment of new JIT facilities and the consolidation of production. In this way firms are able to fulfill their JIT commitments.

Initiatives aimed at increasing the implementation of JIT throughout the automotive supply chain will improve the competitiveness of both assemblers and component manufacturers. This, in turn, can contribute towards Durban's becoming a globally competitive city.

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ANNEXURE 1 - QUESTIONNAIRE

Draft Questionnaire

Automotive Component Suppliers

Important: **All information will be treated with the strictest confidentiality**
The firm's and respondent's anonymity will be respected and observed

Date: ____________________

1. General

1.1 Name of firm

____

1.2 Address

____

1.3 Telephone, fax & e-mail

____

1.4 Name of respondent and position in firm

____

2. Background

2.1 What is the status of your firm?

Status	
Branch plant	
Subsidiary (ie. Autonomous plant)	
Independent	
Headquarters	

2.2 If your firm is a branch plant or subsidiary, what is the name of its parent company?

____

2.3 Where is the head office of the parent company located?

____

2.4 What is the status of the parent company?

Status of parent company	
Large private firm	
JSE listed	
Part of multi-national	
other (specify)	

2.5 Does the firm have any sister companies?

☐ Yes

☐ No

If yes, where are they located?

____

What size are these companies in relation to your firm (in terms of labour and turnover)?

____

Do you have linkages in the production process with them? What kind?

____

____

2.6 How many people does your firm employ?

Employment	Number
Permanent	
Casual	

2.7 What are the main product/s produced by your firm?

____

____

____

2.8 Is your firm currently operating at full capacity?

☐ Yes

☐ No

If No, what capacity are you working at and what are the main reasons for the difference?

____

____

____

____

2.9 Who are your firm's major clients?

Market	Name	Location (eg. Prospecton, New Germany, etc)	%
Assembler/s			
Accessories and aftermarkets			
other (specify)			

2.10 How many times a day/week/month do you deliver to your major clients?

Market	Name	Location (eg. Prospecton, New Germany, etc)	Delivery times per		
			Day	Week	Month
Assembler/s					

2.11 Has your firm implemented just-in-time production systems?

☐ Yes If yes, when was this implemented? ______________________

☐ No

Why have you done so or not done so?

____

____

____

____

2.12 To what extent has your firm implemented JIT?

☐ Fully

☐ Partially

If partial, what do you consider to be the main constraints to the implementation of JIT

____

____

____

____

2.13 Where do you source your main inputs from?

Source of Inputs	%
Immediate vicinity (within 20km)	
Surrounding area (within 50km)	
Locally (within 160km)	
Within KZN	
Nationally	
Internationally	

2.14 Does your firm sub-contract out any stages of production

☐ Yes

☐ No

If yes, which stages?

____

____

2.15 Where are your main sub-contractors located?

____

2.16 To what extent is your firm involved in the design and development of vehicles (product innovation)

☐ very involved

☐ limited involvement

☐ not involved at all

2.17 Does your firm export its products?

☐ Yes

☐ No

If yes, to which countries and clients?

Country	% of product

If not, does your firm intend to do so in the near future? What are the main reasons?

☐ Yes

☐ No

Main reasons?

____

____

2.18 If your firm currently taking advantage of the import-export complementation schemes offered by government? (These allow exporters to offset the cost of imports against the proceeds of exports)

☐ Yes

☐ No

Main reasons?

____

____

2.19 In terms of competitiveness, how would you describe your firm? (Use scale of 1-5: 1 being very competitive & 5 being not competitive at all)

☐ locally competitive ____________________

☐ nationally competitive ____________________

☐ internationally competitive ____________________

2.20 What would you consider to be the main factors inhibiting or enhancing your firm's competitiveness?

____

____

____

3. Human resource development

3.1 What has been the employment change within your firm over the past 10 years (estimate)

Time period	Change in numbers
Past 1 year	
Past 5 years	
Past 10 years	

3.2 What do you consider to be the main reasons for the trend which may be deduced from the above?

____

____

____

____

3.3 Has your firm undertaken any changes in the organisation of labour (eg. Multi-skilling of the workforce)?

☐ Yes

☐ No

Main reasons

____

____

3.4 What percentage of your work force is defined as:

☐ Skilled? ____________________

☐ Semi-skilled? ____________________

☐ Unskilled? ____________________

3.5 Does your firm currently offer training to employees?

☐ Yes

☐ No

If so, what percentage of training is on-line? ______________________

and, what percentage of training is off-line? ______________________

3.6 As a proportion of your remuneration costs how much is spent on training?

____

____

3.7 How many man-hours are dedicated to training per week?

____

____

3.8 Does your firm have an overall human resource strategy in place?

____

____

3.9 Is your firm engaged in any joint training schemes?

☐ Yes

☐ No

If so, with whom and on what basis?

____

____

If not, would you be supportive of such a scheme for automotive component suppliers?

____

____

4. <u>Location</u>

4.1 How long has your firm operated from your current premises?

____

If less than 5 years, where was the firm previously located?

____

____

4.2 What do you consider to be the main factors influencing the firms decision to locate in its present premises?

Main factors influencing location (x)		Rank in order of importance (1-8)	Specify
Proximity to major clients			
Proximity to input suppliers			
Accessibility to major transport linkages			
Proximity to senior management homes			
Labour			
Land prices			
Suitable premises			
Other			

4.3 What is the distance between your firm and its major client/assembler (by road)

☐ 0-20 km ☐ 101-160km

☐ 21-50km ☐ 161-200km

☐ 51-100km ☐ Over 200km

4.4 What is the distance between your firm and major input suppliers?

☐ 0-20 km ☐ 101-160km

☐ 21-50km ☐ 161-200km

☐ 51-100km ☐ Over 200km

4.5 Does your present location enable your firm to fulfill its JIT committments?

☐ Yes

☐ No

If yes, what do you consider to be the major contributing factors? eg. Good transport linkages, skilled work force, proximity to major client, etc.

If no, what do you consider to be the main problems/disadvantages?

4.6 What would you consider to be the main problems and/or advantages to your current location?

4.7 Do you operate a warehouse facility in close proximity to any of your major clients (ie. Assemblers)

☐ Yes

☐ No

If no, would you consider doing so in the future? Reasons

If yes, how far is the warehouse from assembler?

How many people do you employ at your warehouse/s?

What are the main reasons for operating such a facility?

4.8 Are there other automotive component suppliers located in close proximity to your firm?

☐ Yes

☐ No

If yes, how many and are they in direct competition to your firm?

____

4.9 Do you consider this to be beneficial or problematic? Reasons why?

____

____

4.10 Do you foresee a change in your firm's location in the near future? If so, why and where to?

____

____

____

4.11 Within Brazil independent automotive component suppliers are locating inside or on the same site of the assembly plant. This concept is refered to as the "condominium concept". It has been argued that this gives rise to new logistical systems such as the "milk run" (root group) in which assemblers hire logistical operators to pick up components from the suppliers plant on a daily basis. Have you heard of this concept?

☐ Yes

☐ No

Do you think that such a concept could be applied in the South African context in the medium to long term?

____

____

____

4.12 What would you consider to be the main contraints to the implementation of condominiums?

____

____

5. Institutional

5.1 Is there any form of co-operation between your firm and other automotive component suppliers?

☐ Yes

☐ No

If yes, is this done formally or informally

☐ Formally

☐ Informally

If no, would you be interested in supporting networking initiatives?

☐ Yes

☐ No

Alternative question: Are you a member of the Automotive Component Suppliers Association?

5.2 Does this offer sufficient/appropriate institutional support?

____

____

5.3 What, if any, support has your firm received since establishing itself in its current location? (DTI, Provincial Authority, Local Authority, etc.)

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____

____

5.4 Do you receive support from automotive assemblers? What form does this take?

____

____

6. Planning

6.1 Bearing in mind the requirements of JIT, do you think there is shortage of well located industrial **land**?

☐ Yes

☐ No

6.2 Would you consider your firm to be located within a cluster of automotive industries?

☐ Yes

☐ No

6.3 If yes, have you taken advantage of cluster development initiatives offered by DTI?

____

6.4 If no, would you support the development of such a cluster? Why?

____

____

____

6.5 Do you think such cluster developments improve (or would improve) the competitiveness and effective implementation of JIT?

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6.6 Has the implementation of JIT altered your space requirements? In what way?

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6.7 Is your building layout appropriate for the effective implementation of JIT?

____

____

____

6.8 Have your building requirements changed since the advent of JIT? (ie. type of building -high ceilings, no columns etc and/or a move to more "smart" buildings ie. need for fibre optic cables, etc.)

____

____

____

6.9 Has JIT made accessibility to transport networks more important?

- ☐ Yes
- ☐ No

If yes, which networks

- ☐ Road
- ☐ Air
- ☐ Rail
- ☐ Shipping

6.10 Do you consider these networks to be adequate? Comment (benefits, problems, etc.)

Road:

Air:

Rail:

Shipping:

THANK-YOU FOR YOUR TIME AND CO-OPERATION