Hurreeram, Dinesh Kumar

Development of a manufacturing strategy for apparel manufacture in Mauritius using a systems modelling approach

Development of a Manufacturing Strategy for Apparel Manufacture in Mauritius Using a Systems Modelling Approach

by

Dinesh Kumar Hurreeram

Thesis submitted in accordance with the partial fulfilment of the requirements of the University of Huddersfield for the degree of Doctor of Philosophy

School of Computing and Engineering

June 2003

ABSTRACT

The liberalisation of world apparel trade by the year 2005 will eliminate quota restrictions on imports from a large number of low labour cost countries. This will impose a series of challenges to higher cost countries, involved in apparel exports, which so far have had preferential access to the markets like Mauritius. The competition against suppliers from low labour cost countries can only be won if companies can achieve competitive advantage in terms of factors other than cost. These include, for instance, design and manufacture of high value products, providing manufacturing flexibility for rapid change in garment style, providing better service to customers and fast responsiveness to meet changing market requirements. These conditions can be met only if the companies adopt the appropriate manufacturing strategy within the market context.

The importance of the manufacturing function for the achievement of competitive advantage has been extensively covered in the literature. The process of deciding upon appropriate manufacturing strategies for their implementation in specific sectors however remains to be fully investigated. The present research is an attempt to illustrate this process for the garment making sector in Mauritius which is currently at the cross roads of its development as it faces fierce competition for market share in the wake of world apparel trade liberalisation.

The project involved the use of the IDEF0 system-modelling tool for the development of an apparel manufacturing system reference model to illustrate details of all activities taking place in a typical company. The model was used for the production a manufacturing strategy audit tool to enable companies to make an assessment of their current manufacturing practice, benchmark the same against better practices from the industry and select alternative strategies for implementation with a view to achieving enhanced product competitiveness. The audit tool is supported by a set of data that was collected from a range of sources including ten different companies in Mauritius such that the tool illustrates all possibilities in terms of manufacturing practice from average to better practices.

A novel methodology for manufacturing strategy auditing through the use of the developed audit tool was tested in three case study companies. The results clearly demonstrate the effectiveness of the audit tool and the methodology, to enable companies to assess their current practice and embark upon alternate strategies to pave the way towards achieving enhanced competitiveness. Also, the audit tool was used in a sample of seventeen collaborating companies, which enabled sector wise analysis determination of the strategies that best suit the sector for maintaining its market share in a world of free apparel trade.

ACKNOWLEDGEMENTS

The research work undertaken and presented in this thesis could not have been possible without the financial support of the University of Mauritius and the logistical support from the University of Huddersfield.

Firstly I would like to extend my most sincere thanks to Professor David Little who kindly guided me all the way through in the research and especially during the preparation of the thesis. Special thanks to Catherine Noble and the staff from the Manufacturing Systems Research Group for their help, advice and friendship.

I would equally like to thank the Chief Executives and staff of the garment making companies that collaborated by sharing their knowledge and experience in the manufacturing system modelling, validation and auditing exercises. Special thanks to Messrs D Kohli, S Hazareesingh and J Baron from Firemount Textiles Ltd, Tee Sun Ltd and Job Textiles Ltd respectively, who provided all the support for organising and conducting the case study sessions in the companies. Also, I am grateful to the personnel of the Export Processing Zone Development Authority (EPZDA) and the Clothing Services Centre (CSC) for their valuable advice and views on the structure and contents of the manufacturing system model and the manufacturing strategy audit tool.

Also, I would like to express my gratitude to Mr S Baichu for his valuable help in the writing up and debugging of the computer programme and Messrs B Tow Nam, R Ramsamy and S Callychurn, my ex-students at the University of Mauritius, for helping me with the data collection in the companies.

Last but not least, I would like to thank my family for their patience, encouragement and understanding during the time it has taken me to complete this work.

LIST OF PUBLICATIONS

Refereed Publications:

1. Hurreeram D K, (1998) "CAD/CAM in Engineering Firms: The Mauritian Experience", *Proceedings of 14th International Conference on CAD/CAM Robotics and Factories of the Future*. University of Coimbatore, India. pp. 279-283.
2. Hurreeram D K, Little D, (2002), Manufacturing Strategy, A System Modelling Approach, *Proceedings of 2nd International Conference of Systems Thinking in Management*. University of Salford, UK. pp. A5 1-6.
3. Hurreeram D K, Little D, (2002), "Apparel Trade: The Challenge Facing Developing Economies and Mauritius", *University of Mauritius Research Journal: Science and Technology*. Vol. 9. No.2. pp 45-64.
4. Hurreeram D K, Little D, (2003), "International Apparel Trade and Developing Economies in Africa", *Proceedings of 4th International Conference of the International Academy of African Business and Development*. University of Westminster, UK. pp. 7-12.
5. Hurreeram D K, Little D, (2003), "Manufacturing Strategy: A Practical Approach", *Proceedings of First European Operations and Management Association (EUROMA) and Production and Operations Management Society (POMS) Conference*, University of Padova, Italy.

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1. Hurreeram D K, Little D, (2003), Competitive advantage through Manufacturing Strategy Auditing, *International Journal of Operations and Production Management* [submitted in August 2002]

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Chapter 1
Introduction

1.1 Background

The effect of world trade liberalisation of apparel products following the signing of the Multi Fibre Arrangement (MFA) in 1994 (GATT, 1994) by member countries of the World Trade Organisation (WTO) has been commented upon by various researchers around the globe (Yang 1994, Anson 1994, Page and Davenport 1994, Schott 1994, Majmudar 1996a). It is generally agreed that in terms of exporting countries, there will be both gainers and losers to the complete dismantling of the MFA. The countries forecasted to be the gainers are mainly low labour cost countries such as China, India, Pakistan, Sri Lanka, Indonesia and Philippines which so far have had restricted access to both the European Union (EU) and the United States of America (US) markets. These countries are already considered as the dominant suppliers on the world market. The countries forecasted to be on the loser side on the other hand, are mainly high labour cost countries like Italy, France, Germany, Portugal, the United Kingdom (UK) and the US. Also, countries like Mauritius, Jamaica, Costa Rica, Columbia, Mexico, Poland, Bulgaria, Hungary and Romania which so far have had preferential access to the markets in term of quota and duty are equally forecasted to lose a large share of their market unless the protection mechanisms are maintained beyond the year 2005.

By guaranteeing market share, the MFA had so far brought order and predictability over the evolution of the market and had been used as an instrument to protect a number of countries against competition from the dominants. Also, the MFA allowed the main importing countries namely the EU and the US to have a protected market for their locally manufactured apparel products. The implication of apparel trade liberalisation is quite clear; only the most competitive countries will have a share of the market, which will be more dynamic than ever in terms of supplier selection. The thrust of all economies, specially those with heavy dependence on apparel exports, is thus on the development of competitive advantages in order to survive the post MFA era whereby all countries will be competing for a share of the apparel market on level grounds without quota and duty restrictions. On the other hand, the importing countries are fully supporting the local apparel manufacturing industry to develop and implement appropriate strategies to face competition from the low cost supplier countries. The key questions to answer are:

- What makes a country involved in the manufacture of apparel products competitive?
- What are the pre-requisites to world-class manufacturing and supply of apparel products?
- Can manufacturing strategies of apparel making companies be assessed and benchmarked with a view to achieving enhanced product competitiveness?

This research has been designed to find appropriate answers to the above questions.

Whilst the above questions are relevant to both developed and developing countries, the scope of the present research is limited to an examination of the developing countries, which are considered as being on the losers' side and are bound to be the most economically affected by the liberalisation process. The Mauritian apparel industry, which has many characteristics in common with similar industries in developing countries, particularly those with economically high dependency upon apparel exports, will provide the main focus of the research. Like Mauritius, most of the countries considered as potential losers have so far been competing on the basis of their preferential access to the markets and on cost advantage. However these advantages will be superseded by the year 2005, once the dominant economies with lower labour costs are granted quota free access to the apparel market.

The literature on business strategy provides several plausible options for companies to develop and maintain the competitive advantage of their products. The two extremes within the options include:

1. Compete on cost or as a differentiated player but not both (Porter, 1980)
2. Compete on cost and provide differentiation features for which one cannot charge premium prices at the same time (Brown, 1996)

The differentiation features for manufactured garments include product quality, delivery speed and reliability, manufacturing flexibility and product innovation.

Though the importance of the various strategic options are extensively covered in the literature, no clear guidance was found with regards to the methodology to be adopted for strategy assessment and for embarking upon new strategies specifically for companies involved in garment making. This defines the scope of the present research, which attempts to develop a structured methodology to allow both individual companies and apparel industries in developing countries to assess their present strategy and make appropriate decisions for embarking upon alternative strategies with a view to enhancing the competitiveness of their manufactured products in the world market.

1.2 Problem Formulation

The liberalisation of world trade of apparel products inaugurates a new era of intense global competition. Manufacturers will now need to achieve world class status to compete effectively: failure to do so will imply going out of the market which if applied to a complete industry may be a severe blow to the economy of countries with high dependency on apparel exports like Mauritius. To achieve competitive advantage, companies must continuously review their manufacturing strategy in line with the changing requirements of the market place.

Researchers in the field of manufacturing strategy (MS) have put forward various connotations to the term as shown in table 1.1, which when viewed together imply manufacturing strategy encompasses each and every activity taking place within the organisation. The activities mainly include product design and development, planning and control, purchasing, marketing/merchandising, production/operations, human resource management and finance and accounting. So far most of the authors have viewed manufacturing strategy as being equivalent to the production and operations strategy of a business and have successfully stressed upon the importance of this function for meeting business goals. The author argues that MS cannot be treated in isolation as each and every activity within the organisation has a heavy influence on the way the production and operation function is conducted. Hence the need for a holistic approach for both the assessment and formulation of MS to ensure it tallies with the overall objectives of the manufacturing organisation.

Author	Manufacturing Strategy Connotation
Skinner (1969)	Manufacturing strategy refers to exploiting certain properties of the manufacturing function as a competitive weapon.
Hayes and Wheelwright (1985)	It is a sequence of decisions that over time, enables a business unit to achieve a desired manufacturing structure, infrastructure and set of specific capabilities.
Fine and Hax (1985)	It is a critical part of a firm's corporate and business strategies, comprising a set of well co-ordinated objectives and action programs aimed at securing a long-term sustainable advantage over competitors.
Hill (1987)	It represents a co-ordinated approach which strives to achieve consistency between functional capabilities and policies and the agreed current and future competitive advantage necessary for success in the market place.
Swamidass and Newell (1987)	The effective use of manufacturing strengths as a competitive weapon for the achievement of business and corporate goals.
Hayes and Pissano (1994)	In today's turbulent environment a company more than ever needs a strategy that specifies the kind of competitive advantage it is seeking in the marketplace and articulates how that advantage is to be achieved.
Swink and Way (1995)	Manufacturing strategy as decision and plans affecting resources and policies directly related to sourcing, production and delivery of tangible products
Berry et al. (1995)	The choice of a firm's investment in processes and infrastructure that enables it to make and supply its products to chosen markets.
Cox and Blackstone (1998)	A collective pattern of decisions that acts upon the formulation and deployment of manufacturing resources. To be most effective, the manufacturing strategy should act in support of the overall strategic directions of the business and provide for competitive advantages.
Brown (1996)	Manufacturing strategy is a driving force for continual improvements in competitive requirements/priorities and enable the firm to satisfy a wide variety of requirements.

Table 1.1 Manufacturing Strategy Connotations (Source: Dangayach and Deshmukh, 2001)

A review of literature on the subject of MS shows two distinct orientations as illustrated by Dangayach and Deshmukh (2001):

1. The content of the manufacturing strategy, which illustrates the importance of the manufacturing function for enhancing product competitiveness. This approach has allowed the development of a number of frameworks (Skinner 1969, Skinner 1974, Hayes and Wheelwright 1985, Hill 1985, Mills et al. 1995) for setting and achieving long term goals namely in terms of reducing cost, improving quality, achieving manufacturing flexibility and delivery reliability, implementing best practices and facilitating innovation among others. The vast majority of research work published on the subject of manufacturing strategy is in fact devoted to the content aspect. These publications provide strong evidence supporting the argument that business successes are largely dependent upon the effectiveness of manufacturing strategies being adopted.
2. The process of MS on the other hand addresses the procedure to be adopted for the development and implementation of manufacturing strategies. Among the few research publications in the area, the most widely cited works are from Hofer and Schendel (1978), Fine and Hax (1985), Swamidass (1987), Hill (1989), Platts and Gregory (1990), Anderson *et* al. (1991), and that of Mills *et* al. (1995). Though the publications do provide a generic approach for the development of manufacturing strategy, there is little illustration of the mechanism to be used by manufacturing organisations for deciding upon appropriate strategies and for analysing their current manufacturing systems. The process of manufacturing strategy thus still remains a myth for many companies, which are more interested in the use of a simple procedure for assessing current practices, deciding upon and assessing the effectiveness of alternative manufacturing strategies.

It should be noted that none of the research publications specifically deal with a methodology for making strategic choices for garment manufacturing. The focus of the present research is thus on the development of such a methodology, which can be used both for assessing the current MS and for deciding upon appropriate alternative strategies.

In order to adopt a holistic approach to MS for garment making companies, it was important to have a detailed representation of all activities and sub activities influencing the manufacturing function. Various system modelling methods and analysis tools were found to be available for this purpose. The most established ones included, Structured System Analysis and Design Method (SSADM) (Downs, Clare and Coe, 1991), Structured Analysis and Design Technique (SADT) (SofTech Inc. 1974), Integrated Computer Aided Manufacturing Definition (IDEF) (CAM-I Inc. 1980), and Input/Output Analysis (IOA) (Pandya, 1995). These methods and tools or a combination of them have been successfully used for the modelling of Computer Integrated Manufacturing (CIM) systems (Little et al 1998). Moreover, a CIM architecture for the manufacture of apparel products using IDEF has been proposed by Jayaraman (1990), and Malhotra and Jayaraman (1990). Though the above system modelling methods and tools do provide an efficient means for producing a apparel manufacturing system reference model, the literature provides no clear indication as to the use of such models for manufacturing strategy formulation and analysis.

In light of the above, the following research questions were identified to be addressed:

1. What will be the challenges facing developing countries like Mauritius following the complete liberalisation of world apparel trade?
2. What are the possible strategic options available to the garment making companies in these countries?
3. How can implementation of appropriate manufacturing strategies provide the increased competitive advantage needed by apparel manufacturing companies in the developing countries?
4. What are the most appropriate methodologies and tools for modelling the activities involved in apparel manufacture with a view to addressing the manufacturing strategy issue?
5. Can manufacturing system modelling and analysis be used for manufacturing strategy assessment and formulation? And for benchmarking purposes?
6. How can developing countries benefit from such system models and analysis tools to identify the pre-requisites to achieving world-class performance in the manufacture of apparel products?

The above research questions and the literature survey formed the basis for justifying the need to conduct an application based research programme to develop a novel methodology for addressing the subject of manufacturing strategy for the garment making industry from a holistic perspective. The methodology will allow garment-making companies in developing countries to assess their strategies and decide on the course to follow for achieving the sustained competitiveness of apparel manufacturing in a free world market.

1.3 Aims and Objectives of the Research

From the above discussion it is clear that there is a need for apparel making companies and industries in developing countries to both assess their current manufacturing practices and to decide upon alternative strategies for building up competitive advantage. Optimising competitive advantage within the developing countries becomes urgent with the imminent liberalisation of world apparel trade. The aim of the research is thus to produce a simple manufacturing strategy audit tool based on a manufacturing system reference model to aid garment manufacturing companies and industries to assess their strategies and to make appropriate decisions in pursuit of improved competitiveness.

To achieve the above aim, the following objectives were identified for the research:

1. To make an assessment of the challenges facing apparel industries in developing countries such as Mauritius following the liberalisation of world trade in the year 2005.
2. To review the status of current technology and manufacturing practices in the apparel industry in Mauritius.
3. To develop an apparel manufacturing system reference model which can serve as a basis for analysing manufacturing practices in companies.
4. To develop a tool for apparel manufacturing strategy assessment and for benchmarking.
5. To use the tool to make an assessment of the strategy used by garment making companies in Mauritius.
6. To develop and test a novel methodology for manufacturing strategy assessment and selection.

1.4 Research Methodology

Figure 1.1 is an illustration of the methodology adopted for the research, which is divided into three parts. The initial activity constituted a literature review of the various mechanisms through which apparel trade is presently conducted in the world and the implications of its liberalisation on the economy of developing countries. In line with the literature review, a survey of the Mauritian apparel industry was conducted using a mailed questionnaire, to make a preliminary assessment of the challenges the sector will face in an era of free trade. A number of site visits and interviews were organised, during the survey, with company executives who showed interest in the project both for filling the questionnaire and for discussing the research objectives and context. These visits eventually served the purpose of establishing contacts for data collection and for conducting a series of case studies during the second and third phase of the project. One paper was published upon completion of the survey.

The literature on manufacturing strategy was then reviewed to identify the frameworks, procedures and processes that could be useful for meeting the objectives of the research. Also, system modelling and analysis tools and techniques were reviewed to identify the ones that best met the requirements of the manufacturing system modelling exercise.

The second part of the project deals with the production of a system model to represent at a sufficient level of detail all the activities that are involved in the process of apparel manufacture. From a representative sample of seventeen garment-making companies, ten companies showed keen interest in the modelling exercise and were used for data collection. A consolidated model was constructed using detailed process related data collected through on-site studies at the garment-making companies. The model was validated through presentation and discussion sessions with personnel from the CSC in Mauritius, to ensure that all activities were thoroughly represented.

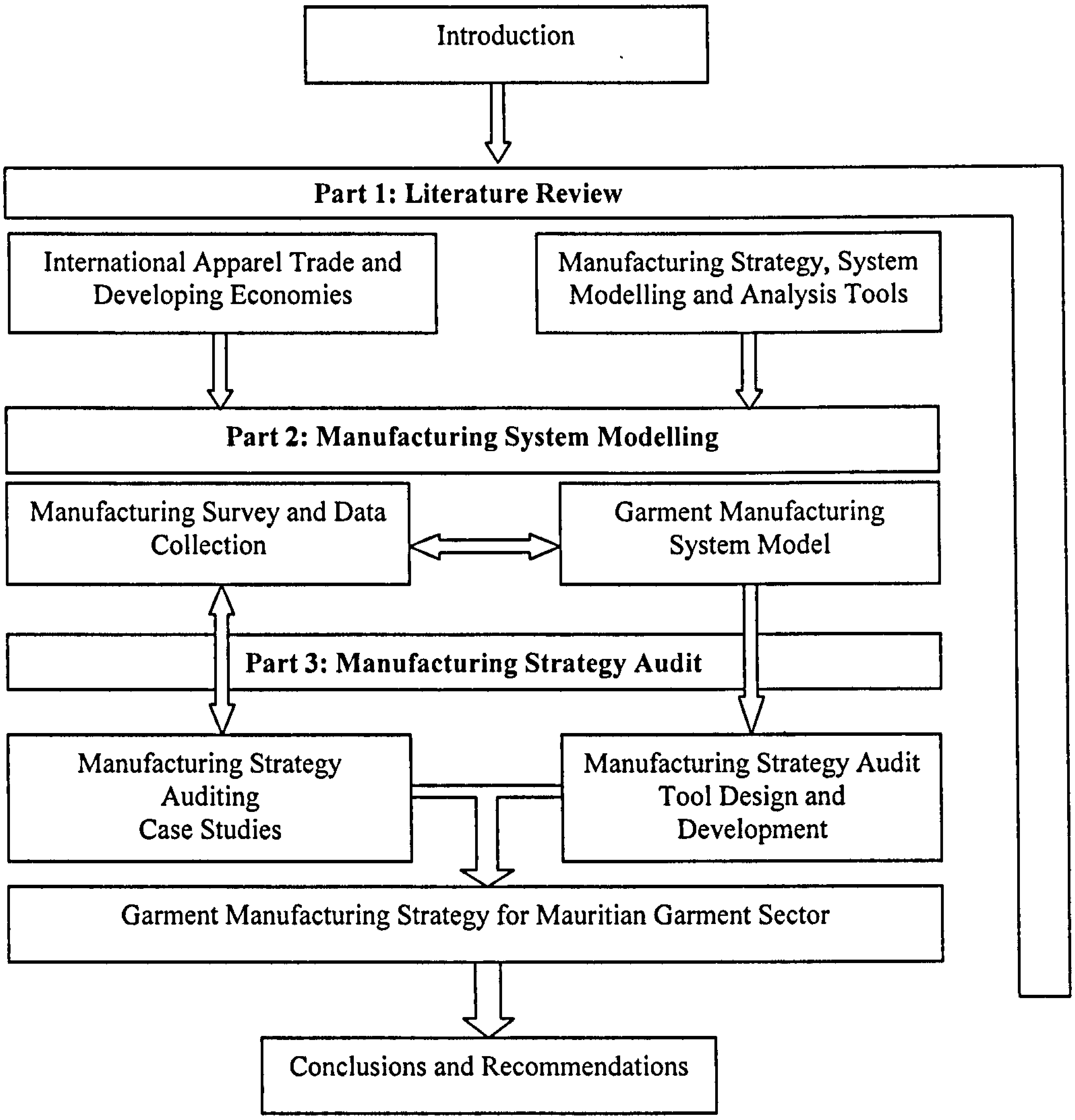

Figure 1.1 Research Methodology

It is the critical analysis of the apparel manufacturing system reference model that formed the basis for the construction of the manufacturing strategy analysis/auditing tool. The third part of the project thus consisted of producing a tool that would allow companies to make an assessment of their current manufacturing strategy, decide upon appropriate alternative strategies or to benchmark strategies against better practices from within the industry. To ensure that the audit tool provided a complete database of possibilities in terms of manufacturing practices, the views of various key informants from both within and outside the sample of companies were sought on the basis of their active involvement, position and level of know-how and competence in the apparel industry. One paper was published on the design and development of the manufacturing strategy audit tool.

The usefulness of the audit tool for the assessment and selection of appropriate manufacturing strategies was tested in three case study companies claiming to have in place different manufacturing strategies. Results of the case studies were presented to the companies and were thoroughly discussed to identify the course of action to adopt for achieving enhanced product competitiveness. The manufacturing strategy of the remaining companies was then surveyed through the use of the audit tool in order to assess the implications of using the tool for conducting a sector wise manufacturing strategy assessment. Based on the outcome of the case studies a paper was submitted to the International Journal of Operations of Production Management for publication.

1.5 Thesis Structure

The purpose of this thesis is to document and present the work accomplished in a structured way for easy and quick reference. The structure is as follows:

Chapter 1 gives an introduction to the need for the project, the objectives, the methodology used and the structure of the thesis.

Chapter 2 provides an overview of the international apparel market, the changes in trade policies and their implications to developing economies and in particular to the garment-making sector in Mauritius. The importance of using appropriate manufacturing strategies to face the challenges of international apparel trade liberalisation is also emphasised.

Chapter 3 is a review of the literature in manufacturing strategy and the tools and techniques used for strategy formulation and analysis. The possibilities in terms of implementing different manufacturing strategies with a view to achieving enhanced product competitiveness in the garment sector are equally reviewed. Also, the chapter includes results of a survey of the market categories for apparel products in the UK, undertaken as part of the original research.

Chapter 4 illustrates the development of the apparel manufacturing system reference model following data collection from a sample of companies, which were used for undertaking the research.

Chapter 5 illustrates the design and development of the audit tool from the manufacturing system model, for undertaking manufacturing strategy assessment and analysis.

Chapter 6 presents a novel methodology for manufacturing strategy assessment and analysis. The results following use of the methodology together with the audit tool in three case study companies are presented.

Chapter 7 illustrates the possibilities for using the audit tool for the assessment of the strategy employed by the garment-making sector in Mauritius. The results obtained following use of the tool in the sample of companies and the implications for the sector in the light of the changing economic conditions are discussed.

Chapter 8 covers the final conclusions of this research, summarising the effectiveness of the adopted methodology for manufacturing strategy assessment and selection for achieving enhanced product competitiveness. A summary of the research findings, the contributions to knowledge, an evaluation of the research and recommendations for future work are also presented.

Chapter 2
International Apparel Trade and Developing Economies

2.1 Introduction

International textiles and apparel trade has been one of the most contentious trade issues of the second half of the last century, particularly between the developed and developing countries (Cline, 1990). The developed countries have imposed restrictions in terms of quota and tariffs, on imports of apparel and textile products since the 1950s and it is only in 2005, after the complete phasing out of the Multi Fibre Arrangement (MFA), that the quantitative restrictions will be removed. The post MFA era is thus expected to allow for free competition between countries for market access, that is, developing nations competing among themselves for a share of the market in developed countries whilst local industries in developed countries compete against imports to consolidate their share of the market.

It is argued that the biggest share of the market will be occupied by countries having a competitive advantage in terms of cost, product quality, responsiveness to market requirements and manufacturing flexibility (Brown, 1996). This is a major challenge to developing countries which will have to adapt to the new market conditions for sustained competitiveness; failing to do so will imply going out of a market which may be a severe blow to several developing economies.

2.2 Overview of International Apparel Trade Policies

International apparel trade policies have been largely dominated by stands taken by the EU and the US to limit invasion of their local markets with apparel products from the developing countries. The stands have nevertheless been in derogation with the general principles of the General Agreements on Trade and Tariffs (GATT), which was set up in 1947 with a view to favour world trade liberalisation with the elimination of quota and tariff restrictions. Apparel trade has been treated as an exception to the general GATT principles on two grounds:

1. The need for a time frame over which the apparel industries in developed countries can adjust to international shifts in comparative advantage, and
2. The need to avoid market disruption which has been defined as instances of sharp import increases associated with low prices not attributable to dumping or foreign subsidies which could have serious economic, political and social repercussions on importing countries.

The above have been used by developed countries to justify the need for a separate structure, outside the aegis of the GATT, to regulate international trade in textiles and apparel. This led to the evolution of two main mechanisms through which textiles and apparel trade is conducted in the world, namely, through bilateral agreements under the Multi-Fibre Arrangement (MFA) and through Multilateral Agreements. While the MFA has been used by developed countries mainly to restrain imports, multilateral agreements on the other hand have been favoured to achieve economic integration.

2.2.1 The Multi Fibre Arrangement (MFA)

An overview of the various initiatives taken and policies adopted by developed countries to restrain imports of textiles and apparel from developing countries is given in Table 2.1. Though apparel trade restrictions date back to the 1930s, when the US imposed selective tariff increases on cotton textile products from Japan, it was only in the 1950s that the first bilateral agreement, known as the Voluntary Export Restraint (VER), was signed between the two countries (Agarwall, 1985). In the late 1950s the United Kingdom (UK) had similar agreements with countries like Hong Kong, India, Pakistan and with certain Eastern European Countries (EEC) in order to impose restrictions on import of textiles and apparel products from these countries (Anson, 1991). These agreements were mostly bilateral, that is, between the importing and the exporting country. The US made various efforts, then on, to have a multilateral agreement signed between the developed and developing countries, as the latter were increasingly becoming a threat to local textiles and apparel industries in the developed countries. The US effort was successful in the early 1960s when two such export-restricting arrangements were signed in 1962 and 1963. These were known as the Short Term Arrangement (STA) and the Long Term Arrangement (LTA) respectively and covered cotton textiles trade (GATT, 1962 and GATT, 1963). The LTA was renewed on two occasions in 1967 and 1970, as more developing countries joined the apparel export market.

Date	Global Textile Trade Policies
1955, December	Japan announced first VER on cotton textile products to the US.
1956, September	Japan announced five year VER on cotton products to the US.
1959, February	US tries to get Hong Kong to agree to a VER on cotton products. Unsuccessful.
1958-1960	Europeans use various legal and illegal measures to restrict cotton products from developing countries (Lancashire Pact from the UK).
1960, November	GATT members agree on a definition of market disruption.
1961, July	STA agreed upon; commence on October 1961.
1962, February	LTA agreed upon; commence on October 1962.
1962-1967	Various bilateral and unilateral measures taken by developed countries under LTA.
1963-1964	The US tries to secure international agreement to cover wool products.
1967, April	LTA renewed for three years; commence October 1967.
1969, April	The US tries to get the EC to agree to multilateral arrangement to include wool and manufactured fibre trade.
1970, October	LTA renewed again.
1969-1971	Through Bilateral Agreements, the US get Far Eastern countries to restrain wool and manufactured fibre products sent to the US markets.
1973, December	MFA I agreed upon; in addition to product made of cotton, restraints equally imposed on products made of manufactured fibres and wool; commence Jan. 1974.
1977, December	MFA II agreed upon with a "reasonable departure clause" included; implied possibilities for reduced growth rate, reduced quotas, reduced flexibility.
1981, December	MFA III agreed upon; "reasonable departure clause" withdrawn, "anti-surge" provision included which provided for restraint in the event of sharp and substantial increases in imports of most sensitive products with previously under-utilised quota.
1986, July	MFA IV agreed upon; coverage extended to silk blends, linen and ramie textiles
1991, 1992, 1993	MFA IV successively extended over one year as at December pending discussions on textiles and apparel trade liberalisation.
1994, December	Agreement on Textiles and Clothing (ATC) signed. MFA phase out agreed upon over a 10-year period starting January 1995 in parallel with setting up of the WTO

Table 2.1 Global Initiatives and Textiles Trade Policies (Agarwall, 1985)

Following the first oil shock in the early 1970s, the EU and the US decided to continue their policy of restricting apparel imports from the developing countries to safeguard the interest of the local manufacturing industry. This was achieved through a broader agreement known as the Multi-Fibre Arrangement (MFA), which covered trade in cotton, wool and man-made fibre products. The first MFA was negotiated in 1973 and came into operation in 1974 for an initial period of four years. However, textiles and apparel trade continued under the aegis of the MFA till 1994 as the MFA was renewed four times in 1977, 1981, 1986 and 1991 respectively, covering an even wider range of products each time it was renewed (GATT, 1978, GATT, 1982 and GATT, 1987).

The MFA in itself did not restrict imports but was a general framework laying down broad rules, which were then interpreted, in detailed bilateral negotiations between an exporting and an importing country. The main objectives of the MFA were as follows:

- To eliminate the difficulties faced by the textile and clothing industries in its developed country members and to provide a 'breathing space' during which these industries are to adjust to international shifts in comparative advantage
- To progressively liberalise world trade in textile and apparel products and to promote social and economic development in exporting developing countries.

In the late 1980s and early 1990s, negotiations for renewal of the MFA became more difficult as developing countries pressed for the elimination of the trade barriers as per the objectives of GATT. It was argued, through results of various studies (United Nations Commission for Trade and Development (UNCTAD) 1994, Schott 1994, Yang 1994) that the grounds on which restrictions were based did not justify the restrictions on imports. Also, the second objective set under the MFA was far from being met. With the setting up of the World Trade Organisation (WTO) in 1995, it was agreed by member countries to gradually phase out the MFA over a ten-year period starting from January of the same year. This was done in accordance with an Agreement on Textiles and Clothing (ATC) signed at the end of the Uruguay Round of trade talks in December 1994 (GATT, 1994). The EU and the US have since adopted policies to phase out the trade barriers on the least sensitive products in the first instance and on the most sensitive products (shirts, trousers, blouses, overcoats, dresses, skirts, pullovers among others) in the last phase of the ten-year period.

2.2.2 Multilateral Agreements

Though of major significance to developing countries, only 25% of world textiles and apparel trade are regulated through bilateral agreements under the MFA (Anson, 1991). The core of apparel trade is regulated through multilateral agreements mainly within and between trade blocs. These include export flows between industrialised countries (e.g. Intra-EU), between MFA signatories and non-MFA signatories (e.g. between China and Japan) and preferential arrangements between trade blocs (e.g. between US and the Caribbean countries). The various trade blocs and associated countries involved in the manufacture and trade of apparel products is given in Table 2.2. Among the most important multilateral agreements within trade blocs, are the European Free Trade Area (EFTA) and the Northern American Free Trade Area (NAFTA): the EU and the US being the leading apparel importers in the world, in both volume and value terms as illustrated in figure 2.1.

Trade Blocs	Countries
Asia	
• East Asia	Japan, Taiwan, Rep. of Korea, China, Hong Kong, Macau
• South East Asia (ASEAN)	Thailand, Vietnam, Malaysia, Indonesia, Singapore, Philippines
• South Asia	India, Pakistan, Bangladesh, Sri Lanka
Europe	
• EFTA and Western Europe	EU (England, France, Germany, Belgium, Italy, Spain, Ireland, Portugal, Netherlands, Luxembourg, Denmark, Greece, Sweden, Austria, Finland), Norway, Switzerland, Iceland, Liechtenstein. Turkey, Croatia, Slovenia
• Central and Eastern Europe (CEE)	Poland, Hungary, Romania, Bulgaria, Czech and Slovak Rep.
NAFTA	US, Canada, Mexico
South America	
• Caribbean Basin Area (CBA)	Dominican Republic, Costa Rica, Guatemala, Honduras, Jamaica, El Salvador
• Latin America	Brazil, Columbia
African Union	South Africa, Morocco, Tunisia, Egypt, Mauritius

Table 2.2 Main countries involved in imports and exports of apparel products (Japan, EU and the US are the main importers and the remaining being exporting countries)

EFTA provides quota and duty free access to its member countries for exports into the EU. Also, quotas on textile and clothing products from the CEE were eliminated in January 1998 in order to provide greater access to the EU market. The EU equally has other multilateral agreements, which favour free trade. Countries that benefit from these are Tunisia and Morocco as Preferential Countries, Mauritius as a Lomé Country, Bangladesh as a Least Developed Country and Turkey as an Organisation for Economic Cooperation and Development (OECD) country.

NAFTA on the other hand provides preferential access to the US market for apparel products manufactured in Canada and Mexico. Similar access has been extended to countries from the sub-Saharan African region and from the CBA under the Trade and Development Act (TDA) and the US-Caribbean Basin Trade Partnership Act (CBTPA) respectively; both acts were voted by the US government in the year 2000. Countries that are eligible for free access to the US market under the acts are expected to satisfy all the conditions laid in the Act, among others, the products need to be manufactured by using raw materials (yarn and fabrics) made in the US or from any other country eligible as per the act.

Like EFTA and NAFTA, there are other trade blocs that promote economic integration within various regions of the world. This involves removal of economic barriers between and among nations. The major forms of economic integration are Free Trade Areas (FTA), customs union, common market and economic union. The most influential trade blocs involved in apparel exports are

- The Asia Pacific Economic Co-operation Conference (APEC), which regroups the Asian countries. As at present, the level of economic integration is however limited.
- The Association of South East Asian Nations (ASEAN) Free Trade Area (AFTA) which allows for free trade between the South East Asian countries
- The Caribbean Economic Community (CARICOM) which regroups Caribbean countries within a common market with common external tariff among members

There are other trade blocs like the Southern Cone Common Market, the Central American Common Market, the Black Sea Economic Cooperation Region and the African Union, which have however, lower level of economic integration.

2.3 Global Apparel Trade

As at 2001, the EU, the US and Japan together accounted for about 84.5% of the total world apparel imports worth US$195 030 Mn (Figure 2.1). The high purchasing power within these regions makes them the most preferred destinations for apparel products from developing countries. The Japanese market is almost solely occupied by imports from China (77.1%). The remaining market being occupied by countries from the EU (7.7%), South East Asia (10.1%), the US (1.8%) and the rest of the world (2.7%).

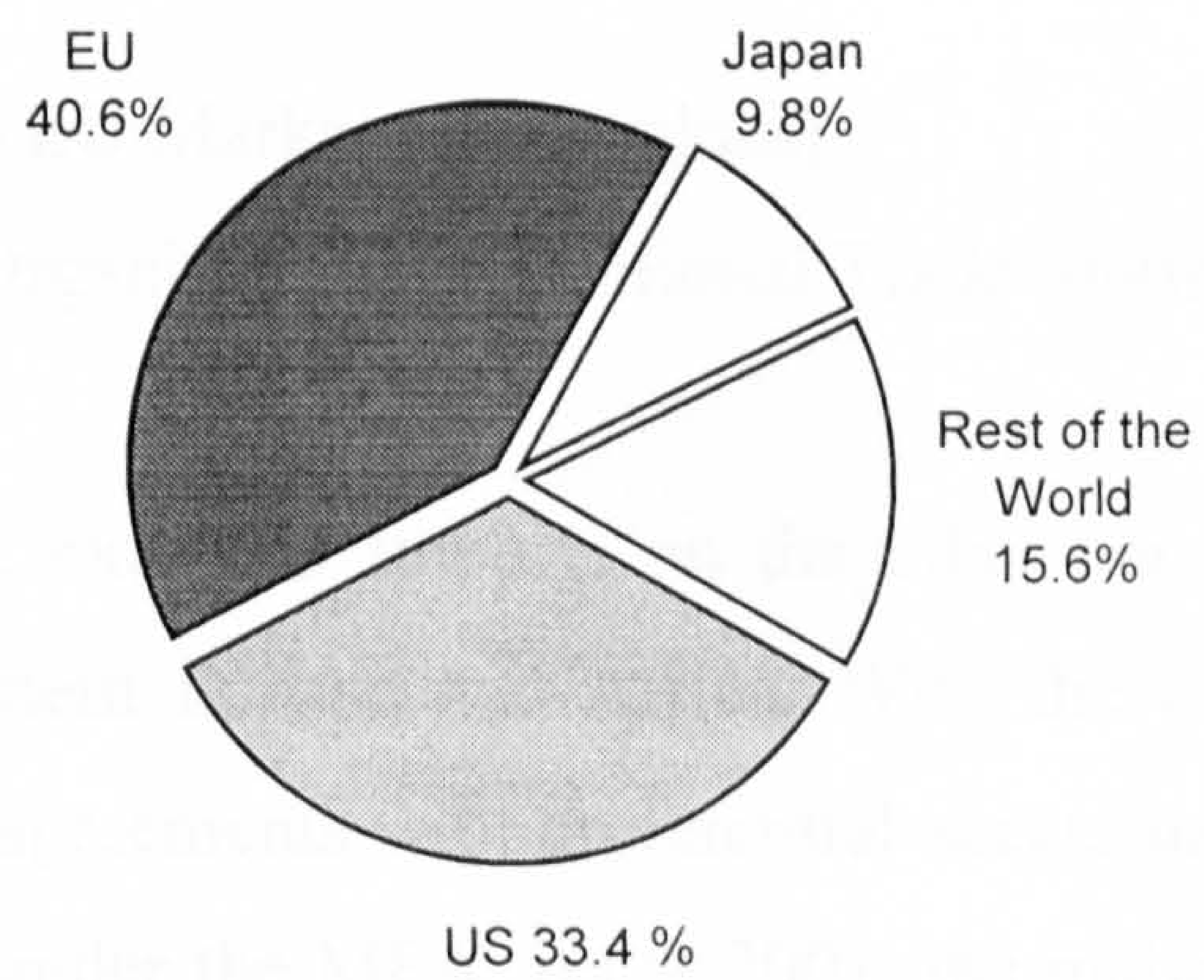

Figure 2.1 Share of World Apparel Imports (2001 Values),
Source: World Trade Organisation, International Trade Statistics 2002

2.3.1 The EU market

With 40.6% of world apparel imports worth $79 263 Mn, the EU represents the largest market for apparel products in the world. However, intra-EU apparel trade dominates the market with a share of 39.5% as shown in figure 2.2; the leading exporters from within the EU are Italy, Germany, France, UK and Belgium. It should be noted that intra-EU apparel trade is mainly based on the Outward Processing Trade

(OPT) concept. Through OPT, members of the EU export fabrics to Mediterranean rim countries (e.g. Turkey, Tunisia and Morocco) and East European Countries (e.g. Romania, Bulgaria, Hungary, Poland, Czech and Slovak Republic) for cut, make and trim (CMT) operations. The finished products are re-imported into the EU for export to other countries within the EU (Mersch, 1997).

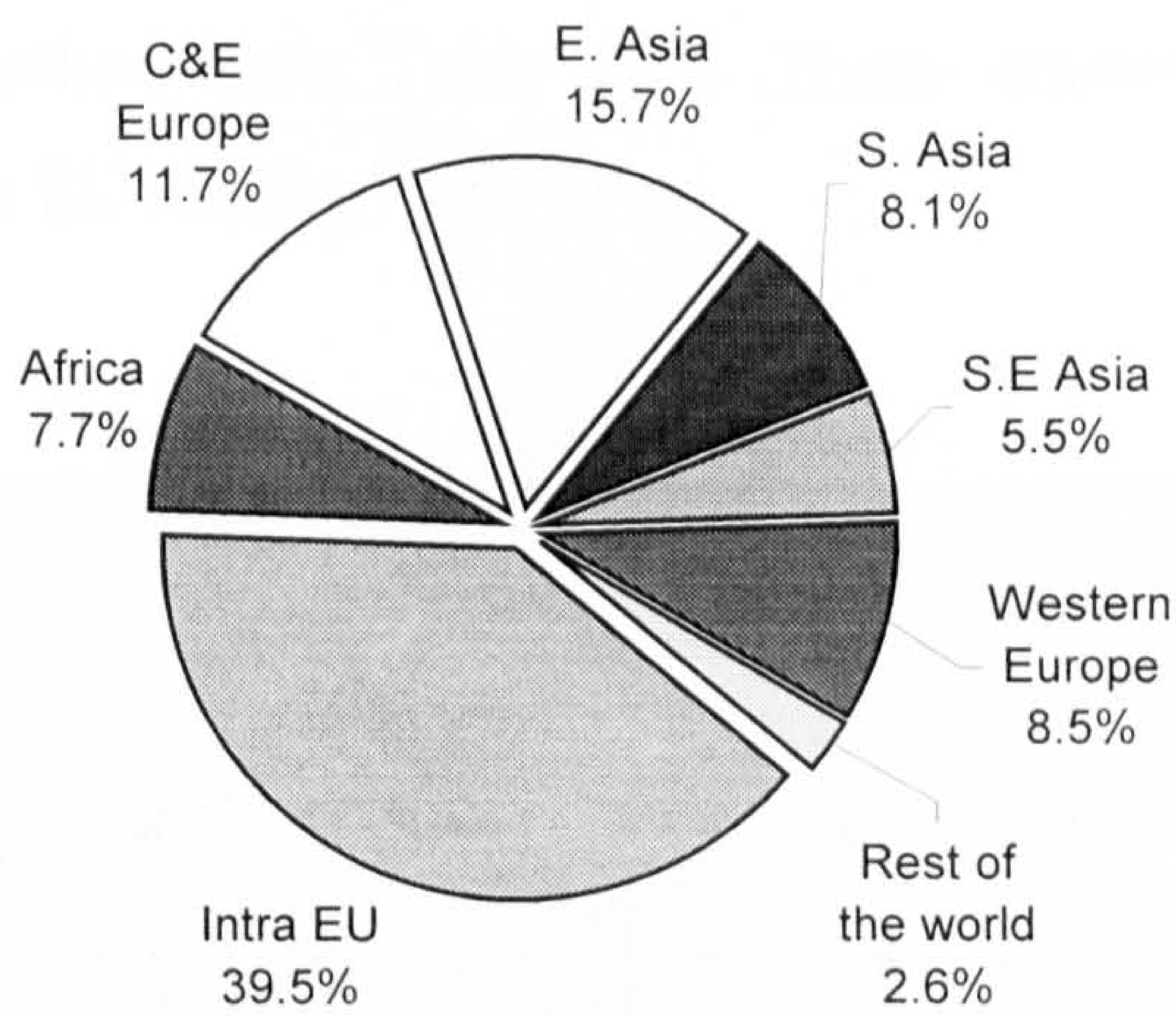

Figure 2.2 Share of the EU Market (2000 values).
Source: World Trade Organisation, International Trade Statistics 2001

The core of non-OPT, extra-EU imports on the other hand, come from developing countries in Asia, Eastern Europe and Africa. With the exception of the countries under the multilateral agreements with preferential access to the EU market, the other imports are regulated under the MFA. As at 2001, the major share of the market was held by three groups of countries

- Asian suppliers led by China, Bangladesh, India, Hong Kong, and Indonesia
- Mediterranean rim suppliers led by Turkey, Tunisia and Morocco
- East European suppliers led by Romania and Poland.

These ten countries accounted for 67% of extra-EU imports in value terms over the year 2001. The trend of imports of apparel products from the major suppliers over seven years prior to 2001 is shown in Figure 2.3.

The major changes in apparel sourcing have shown the decline of the Republic of Korea, Hong Kong and Yugoslavia as potential exporters because of increasing production costs, while China and the Asian countries have had an increasing trend in spite of restricted access to the market. The market share of other developing countries, under the low to medium cost suppliers, ranged from 0.1% to 3.5%. However, apparel exports remain a major source of foreign exchange earning, representing more than 10% of total merchandise exports, for a number of these countries, which include Romania, Bulgaria, Croatia, Mauritius, Tunisia, Madagascar and Morocco among others (see Table 2.4). These countries have so far had preferential access to the EU market.

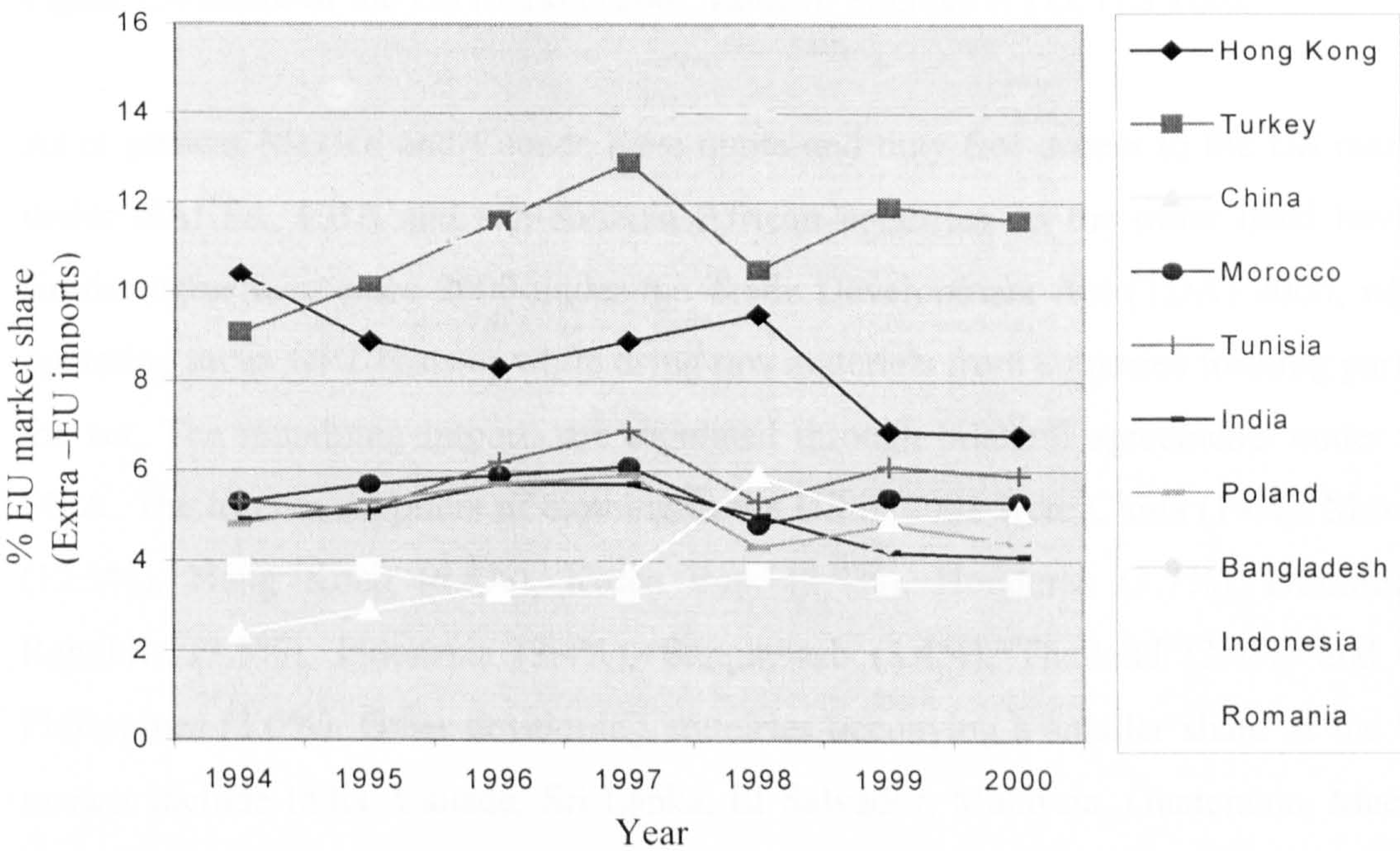

Figure 2.3 EU apparel market share evolution

2.3.2 The US market

The US market, the second largest after the EU in value terms, is largely dominated by imports from Asia (56.5%, mainly regulated by MFA agreements) and to a lesser extent from the NAFTA member countries and from the Caribbean countries as illustrated in figure 2.4.

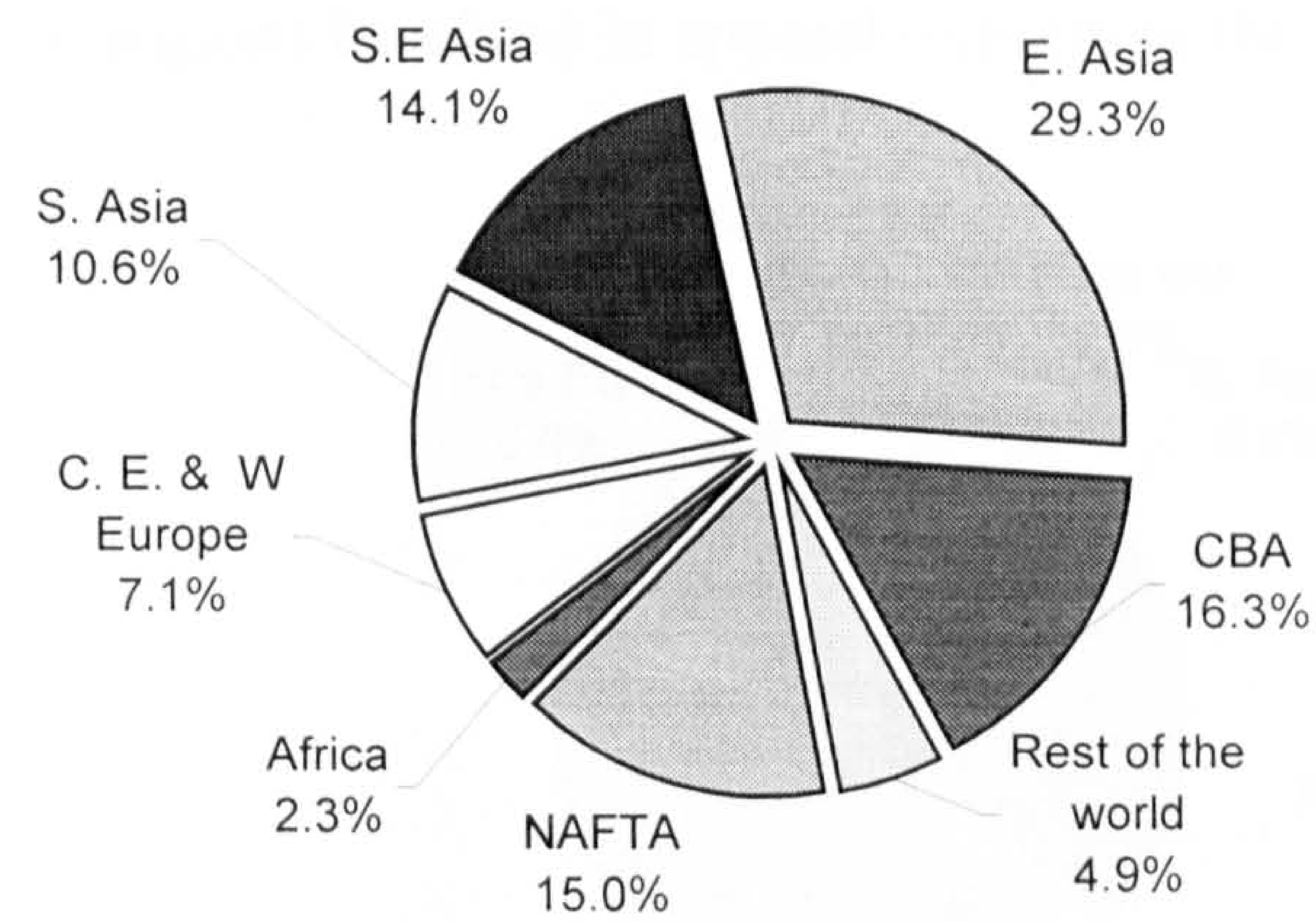

Figure 2.4 Share of the US Market (2001 values). Source: WTO, ITS 2002

As at present Mexico and Canada have quota and duty free access to the US market under NAFTA. CBA and sub-Saharan African countries on the other hand have a similar agreement since 2000 under the Trade Development Act (TDA) 2000, when operating on an OPT basis or while using raw materials from countries forming part of the act. The remaining imports are regulated through bilateral agreements under the MFA. The top ten suppliers of clothing to the US in 2001 were China (14%), Mexico (12.3%), Hong Kong (6.8%), Korea Rep. (3.7%), Honduras (3.7%), Dominican Republic (3.5%), Indonesia (3.4%), Bangladesh (3.4%), Thailand (3.4%) and the Philippines (3.0%). Other developing countries occupying a smaller share of the US market include India, Canada, Sri Lanka, El Salvador, Malaysia, Guatemala, Macao, Turkey and Pakistan with shares ranging from 1.5% to 3.0% (Source WT0, ITS 2002). It is worth noting that the majority of countries supplying apparel products to the US market are categorised as low to medium income countries and hence the competition for a share of the market is intense. Also, the share of countries like Hong Kong, Taiwan and Korea Rep. whereby the labour cost is relatively higher has been declining over the past 5 years while that of China and countries from South Asia, and Caribbean countries have been on an increasing trend (Khanna 2001).

Global apparel exports are thus largely dominated by developing countries from Asia, the Caribbean countries, Eastern Europe and to a lesser extent from Africa. However, though operating under the OPT, the EU remains a potential exporter occupying

24.1% of world apparel market (note that 8.1% is extra EU exports). Figure 2.5 illustrates the main regions involved in apparel exports in the world.

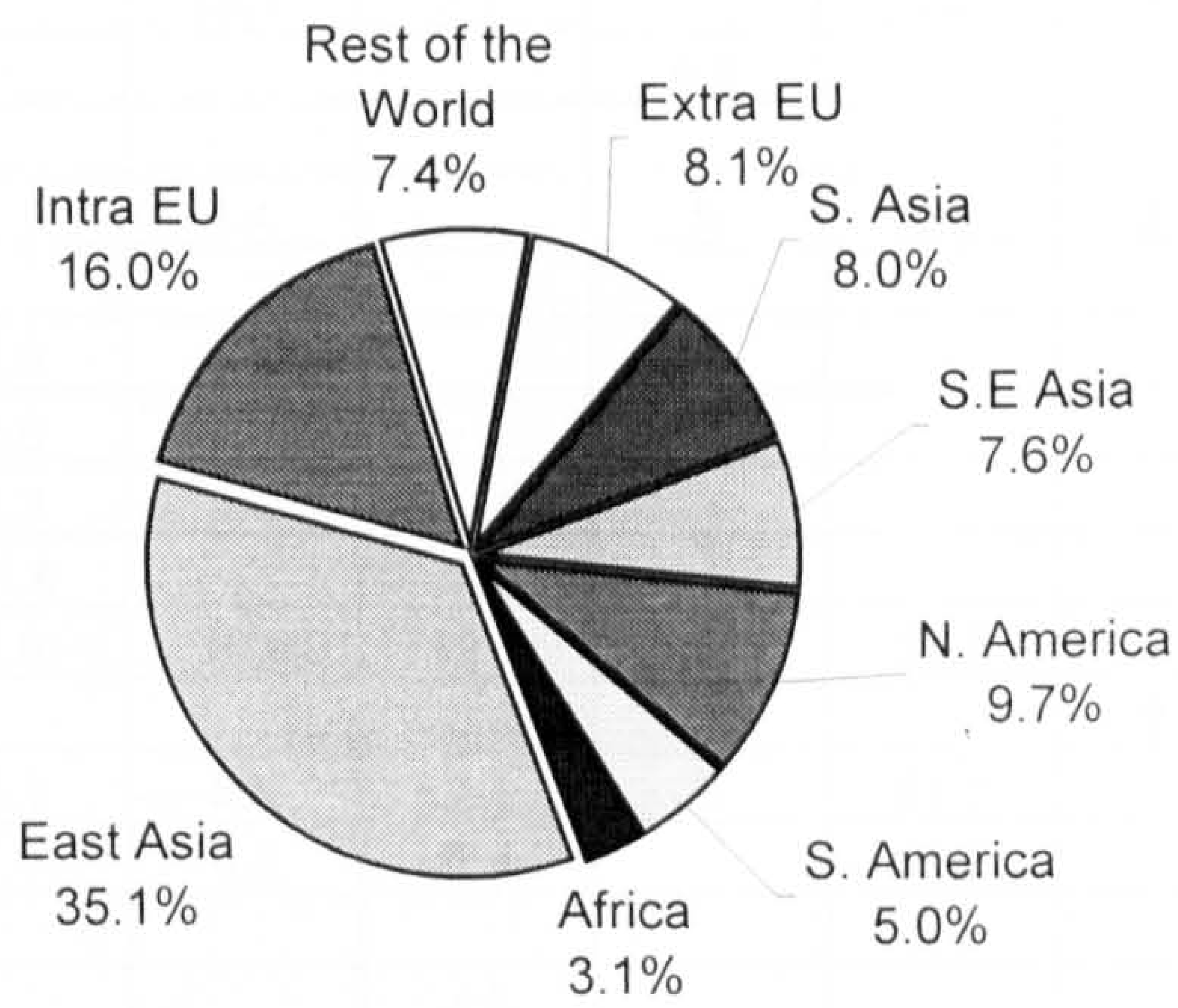

Figure 2.5 % Share of the world apparel market for exports (2001 values)
Source: World Trade Organisation, International Trade Statistics 2002

2.4 International Apparel Trade and Developing Economies

In addition to protecting the local apparel industry and avoiding market disruptions in developed countries, the MFA and the multilateral agreements have been useful so far to bring order and predictability to world apparel trade. By guaranteeing market share, it has protected the smaller emerging economies like those in the CEE, the CBA and in Africa against competition from the larger economies especially from Asia. This protection is called upon to phase out by the year 2005. By that time, with the gradual phasing out of quantitative restrictions and other trade barriers, Asian suppliers are forecasted to have an even larger share of the EU and US market.

It is argued that in the post MFA era, the top ten suppliers to each category of apparel products will together account for up to 70% of market share in which the Asian suppliers will have a leading role (Majmudar, 1996b). An analysis of the top ten suppliers of the main apparel products (T shirts, men's shirts, blouses and trousers) over the year 1999 to the EU and US markets, shown in table 2.3 in fact confirms the views expressed by Majmudar in his forecasts of the market scenario beyond 2005.

Country	Main Products, Market Share (% by value, 1999 figures)							
	T-shirts		Men's shirt		Blouses		Trousers	
	EU	US	EU	US	EU	US	EU	US
	Cat. 4	Cat. 338	Cat. 8	Cat. 340	Cat. 7	Cat. 341	Cat. 6	Cat. 347
Bangladesh	11.7		18.1	7.7		10	3.8	3.6
Bulgaria					4.5			
Cambodia								3.2
China	8.3		4.4		5	6.5	3.9	3.6
Costa Rica								3.3
Dominican Rep.		2.9						10
El Salvador		5.6						
Guatemala		3.3						3.2
Honduras		11.8		5.3				3.5
Hong Kong	5.4	2.9	10.5	12.1	11.6	20.3	9.1	5.8
Hungary							2.2	
India	5	5.1	8.5	7.5	9	21.7		
Indonesia	2.2		4.2	5.8		6.5		
Macao						2.1		
Malaysia				4.6				
Mauritius	5.9							
Mexico		17.8		4.3				32.9
Mexico						2.4		
Morocco	4		5.4		6.7		10.4	
Pakistan		7.9					2.4	
Peru		3.5						
Philippines				4.6		3.8		2.8
Poland			4.5		9.1		6.1	
Romania			5.7		7.2		7.8	
S. Korea								
Singapore								
Sri Lanka				4.2	3.1	7.7		
Taiwan				4.8				
Thailand	2.2	3				3.2		
Tunisia	2.5		4.4		3.9		14.7	
Turkey	22.3		5.5		11.8		10.7	
Total share	69.5	63.8	71.1	60.9	71.8	84.2	71	71.9

Table 2.3 Market share of the top ten suppliers to the EU and US

It should be noted that the majority of the Asian countries are regulated by the MFA, hence, they are presently subjected to major restrictions on their exports in terms of quotas and duty. Once liberated from these restrictions, it is expected that exports from these countries will increase considerably, making it more difficult for smaller economies to compete for a share of the market. In a forecasting model of the EU market scenario in the year 2005, Majmudar (1996b) argues that a combination of 5 Asian countries will occupy 41%, 59%, 69%, and 59% of the market share for T-shirts, shirts, blouses and trousers respectively. This clearly demonstrates the potential for the Asian countries to invade both the EU and the US markets following complete apparel trade liberalisation and more importantly following the accession of China as a member of the WTO.

The above is a major threat to the economy of a number of developing countries from the CEE, CBA and Africa, which are presently having preferential access to the markets under various multilateral agreements (Lomé Convention, Trade and Development Act, OPT mechanism). Most of these countries have heavy reliance on export of apparel products but have little or no apparel base (raw materials availability, research and development, fashion centre, branding etc.). Manufacturers in developed countries have mainly used the apparel industry in these countries as part of a delocalisation strategy in order to take full advantage of the lower labour cost. A comparison of the hourly wage and the importance of apparel exports to most of the countries involved in apparel trade are given in table 2.4.

The developing countries can be classified into three main groups:

1. The minor suppliers. These include countries with apparel exports representing less than 10% of total merchandise exports (e.g. Poland, Hungary, Czech and Slovak Republic, Slovenia, Guatemala, Costa Rica, Mexico, Indonesia, Thailand, Philippines, Malaysia and Egypt)
2. The clothing economies. These include countries having preferential market access that have shown rapid growth in apparel exports leading to them becoming one of the principal exports (e.g. Romania, Bulgaria, Croatia, Turkey, Jamaica, Bangladesh, Mauritius, Tunisia, Morocco and Madagascar)
3. The major suppliers. These include countries, which are important suppliers both in terms of value and volume and have economies of scale but presently have restricted market access (e.g. India, Pakistan, Sri Lanka, China)

There is however a number of countries classified under the high-income range, which are part of the major suppliers. These countries include Italy, Germany, Belgium, France, Canada, Macao (China), Hong Kong (China), Republic of Korea and Singapore. Most of these countries are involved in subcontracting operations with lower cost countries (CMT operations are subcontracted to lower cost countries and the finished products are imported for export purposes). The East European countries,

Region	Country	Hourly Wage Cost $ (1994) a	Apparel Exports as % of total merchandise exports (2000) b	Share of EU market % (2000 in value terms) 95.3% total c	Share of US market % (2000 in value terms) 90.6% total d	Income Group e	Apparel Export Trend Over the past 5 years f
Central And Eastern Europe	Romania	0.57	22.5	2.9	M	LI	Increasing
	Bulgaria	0.57	14.6	0.8	M	LI	Increasing
	Poland	1.00	6.0	2.2	M	MI	Stable
	Hungary	1.62	4.3	1.1	M	MI	Stable
	Slovak Rep.	*0.95*	4.4	0.5	M	MI	Stable
	Czech Rep.	0.90	2.2	0.6	M	MI	Stable
EU and Western Europe	Turkey	3.19	24.6	6.4	1.7	LI	Stable
	Croatia	1.85	10.7	0.5	M	MI	Stable
	Slovenia	4.63	5.4	0.5	M	HI	Stable
	EU (15)	*14.5*	3.9	41.3	4.2	HI	Decreasing
Caribbean Basin Area	Jamaica	1.80	16.5	M	0.4	LI	Stable
	Guatemala	0.87	6.8	M	2.3	LI	Increasing
	Dominican Rep.	0.79	N/A	M	3.8	LI	Increasing
	El Salvador	*1.05*	N/A	M	2.5	LI	Increasing
	Honduras	1.16	N/A	M	3.8	LI	Increasing
	Costa Rica	1.16	3.7	M	1.3	LI	Stable
NAFTA	Mexico	*1.95*	5.2	M	13.6	MI	Increasing
	US	13.6	5.6	0.7	N	HI	Decreasing
	Canada	14.4	1.5	M	3.0	HI	Stable
South Asia	Bangladesh	0.25	74.9	2.8	3.3	LI	Increasing
	India	0.50	14.2	2.9	3.1	LI	Increasing
	Pakistan	0.50	23.4	1.0	1.6	LI	Stable
	Sri Lanka	0.22	49.9	1.0	2.3	LI	Increasing
East Asia	Macao (China)	N/A	75.6	0.6	1.8	HI	Stable
	China	0.35	14.5	9.4	13.2	LI	Stable
	Hong Kong	5.70	12.0	5.5	7.1	HI	Stable
	Taipei (China)	5.85	4.4	0.7	3.4	HI	Decreasing
	Japan	12.97	5.3	M	M	HI	Decreasing
	Korea Rep.	4.30	2.9	1.1	3.8	MI	Stable
South East Asia	Indonesia	0.49	7.6	2.2	3.4	LI	Increasing
	Thailand	1.08	5.7	1.3	3.3	LI	Decreasing
	Philippines	1.09	6.0	0.4	3.0	LI	Decreasing
	Malaysia	1.65	2.7	0.8	2.0	MI	Stable
	Singapore	9.00	1.4	0.2	0.6	HI	Stable
	Vietnam	0.29	N/A	0.9	N/A	LI	Stable
Africa	Mauritius	0.95	63.6	0.8	0.4	MI	Stable
	Tunisia	1.73	40.4	3.1	M	LI	Stable
	Egypt	0.72	7.8	0.3	0.6	LI	Increasing
	Madagascar	*0.56*	10.4	0.3	M	LI	Stable
	Morocco	1.63	31.9	2.8	M	LI	Stable

Table 2.4 Apparel Exports and Developing Economies

Sources:

a,e *World Development Indicators 2000, World Bank (values in italics are approximate)*

b,c,d *World Trade Organisation, International Trade Statistics, 2000*

f *Trends in EU Textile and Clothing Imports, Textile Outlook International, Nov. 2000*

Notes: *HI* *High Income Group ($9266 or more per year)*

MI *Middle Income Group ($2996-9265)*

LI *Low Income Group (less than $2995 per year)*

N/A: *Not available* *N: Not applicable* *M: Minimum*

Croatia, Turkey, Tunisia and Morocco for instance possess the advantage of being a lower cost location for the EU member countries while Mainland China is the ideal location for CMT operations for Hong Kong manufacturers.

Global apparel trade liberalisation will mostly affect the minor suppliers and the clothing economies. A comparison of the hourly wage cost in the clothing industry of the countries of concern clearly show that all the minor suppliers together with some of the clothing economies (with the exception of Bangladesh and Vietnam) are at a disadvantage vis-à-vis the major suppliers (China, India, Sri Lanka, Pakistan). Combining production costs and productivity (comparing cost per standard minute for the manufacture of standard clothing item) does however decrease the margin between these countries and the major suppliers. In spite of improved competitiveness and the presence of other low cost labour countries, it is argued that China, India and Pakistan will emerge as the main gainers of world trade liberalisation because of economies of scale (Davenport, 1994). Though presently classified to be on the losing side, the minor suppliers and the clothing economies are expected to build up comparative advantages on factors other that labour costs in order to at least maintain their share of the market. The above defines the scope of the present research, which uses the island of Mauritius as a case study example.

Mauritius has been selected as it shares a number of features with both the minor suppliers and clothing economies as listed below:

1. As is the case for many developing economies, the apparel sector in Mauritius was set up as one of the strategies to solve the massive unemployment problem the country was facing in the 1970s and early 1980s. Presently however, the country is enjoying full employment and there is constant pressure to increase wage levels. In order to maintain the labour cost competitiveness, the country is involved in importing cheap labour from countries like China, Sri Lanka and India and some companies are delocalising their labour intensive operations to African countries like Madagascar and Mozambique.
2. Mauritius has preferential access to the EU market under the Lomé Convention and to the US market under the TDA. This has prompted a number of investors

from MFA restricted countries (for instance, Hong Kong, Taiwan, India) and countries in the high-income range (for instance, Germany, France, Singapore) to invest in Mauritius. However, foreign direct investment (FDI) in the sector has been stagnant over the past 4 years because of increasing production costs.

3. The government provides a wide range of incentives to attract FDI in the apparel sector.
4. Apparel exports represent 63.6% of the total export earnings of the country hence there is heavy reliance on this industry for maintaining the standard of living of the people.
5. Mauritius has no apparel base, that is, all the raw material, equipment and accessories are imported. Also, there is negligible investment in design and research and development in the sector. The industry is mainly used as a subcontractor to overseas mother companies for CMT operations.
6. Mauritius is far from the markets (EU and US) hence the relatively longer delivery lead-time and higher freight costs are major factors to the disadvantage of local suppliers.
7. The productivity level of the apparel manufacturing companies is lower than that achieved in some of the Asian countries, the CEE or in the Mediterranean Rim countries.
8. Mauritius is mainly involved in the manufacture of low to medium quality products (mass production). There is little indication of the companies moving up market.
9. Mauritius is classified under the countries that are expected to lose at least half of their market share following complete apparel trade liberalisation in the year 2005 (Page & Davenport 1994, Majmudar 1996).

The following sections provide a detailed analysis of the challenges facing the Mauritian apparel sector following a survey carried out as part of the research work, to make a preliminary assessment of the level of technology in use, the marketing and manufacturing practices.

2.5 Mauritius and its Apparel Sector

Located in the south west of the Indian Ocean, the Republic of Mauritius, island state of 1969 square kilometres with a population of 1.2 million, is one of the few countries in the world involved in the manufacture and export of apparel products without having any indigenous textile resources. The success of Mauritius as an apparel exporter has largely been influenced by its preferential (quota and duty-free) access to the EU market through the Lomé Convention since 1975 and as from 2000 to the US market through the Trade Development Act 2000 (also referred to as the Africa Growth and Opportunity Act).

Manufacturing activity in Mauritius accounts for about 25% of the Gross Domestic Product (GDP), which is subdivided into activities related to Sugar Production (representing 1.2% of GDP), the Export Processing Zone (EPZ representing 12.7% of GDP of which apparel manufacturing represents 8% of GDP) and non-EPZ activities. In 2000, exports from the EPZ represented 76.1% of the total domestic export earnings of the country, of which 80% came from the export of apparel products (Figure 2.6).

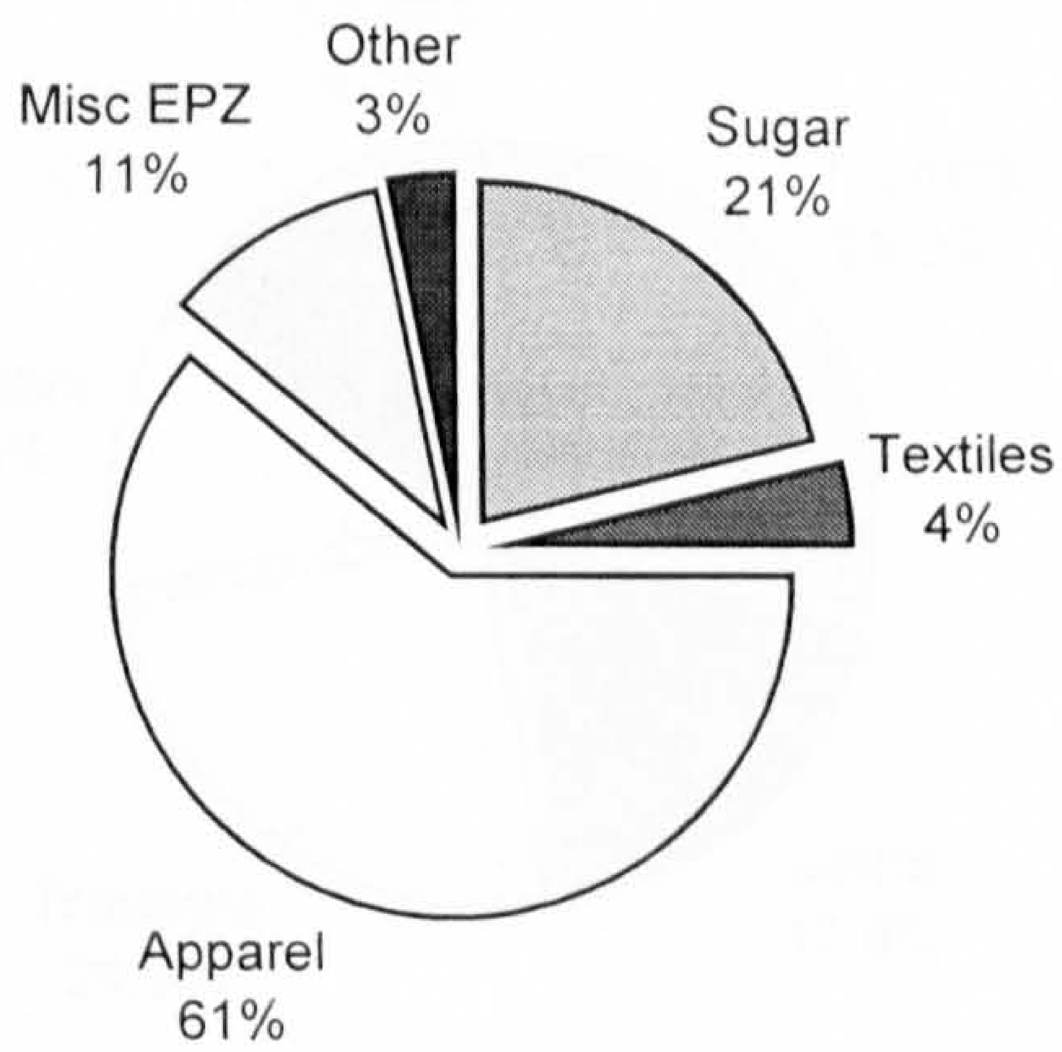

Figure 2.6 Domestic Export Earnings from various sectors (CSO, 2001)

Moreover, there were about 512 companies registered in the EPZ of which almost 50% were involved in apparel manufacture. The direct labour force in the apparel sector was 76 919 as at end of the year 2001 (Figure 2.7).

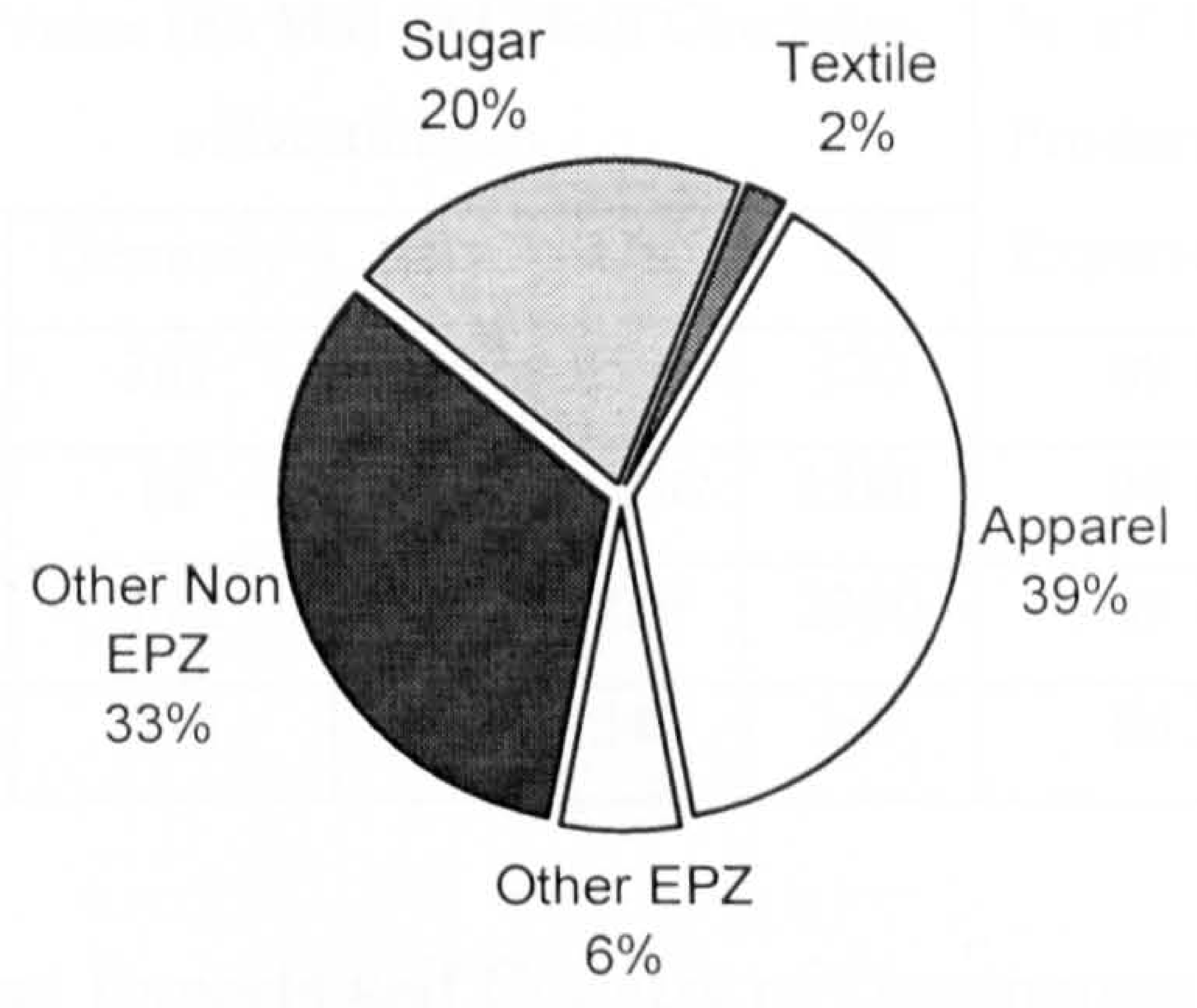

Figure 2.7 Distribution of employment in the manufacturing sector (CSO, 2001)

The main products manufactured by the apparel sector include T-shirts, men's shirts, trousers and pullovers which accounted for about 85% of total apparel exports worth US$987 Mn in value terms for the year 2000. The main countries of destination were France, UK, US, Germany and Italy. The distribution of the exports to these destinations is given in Table 2.5.

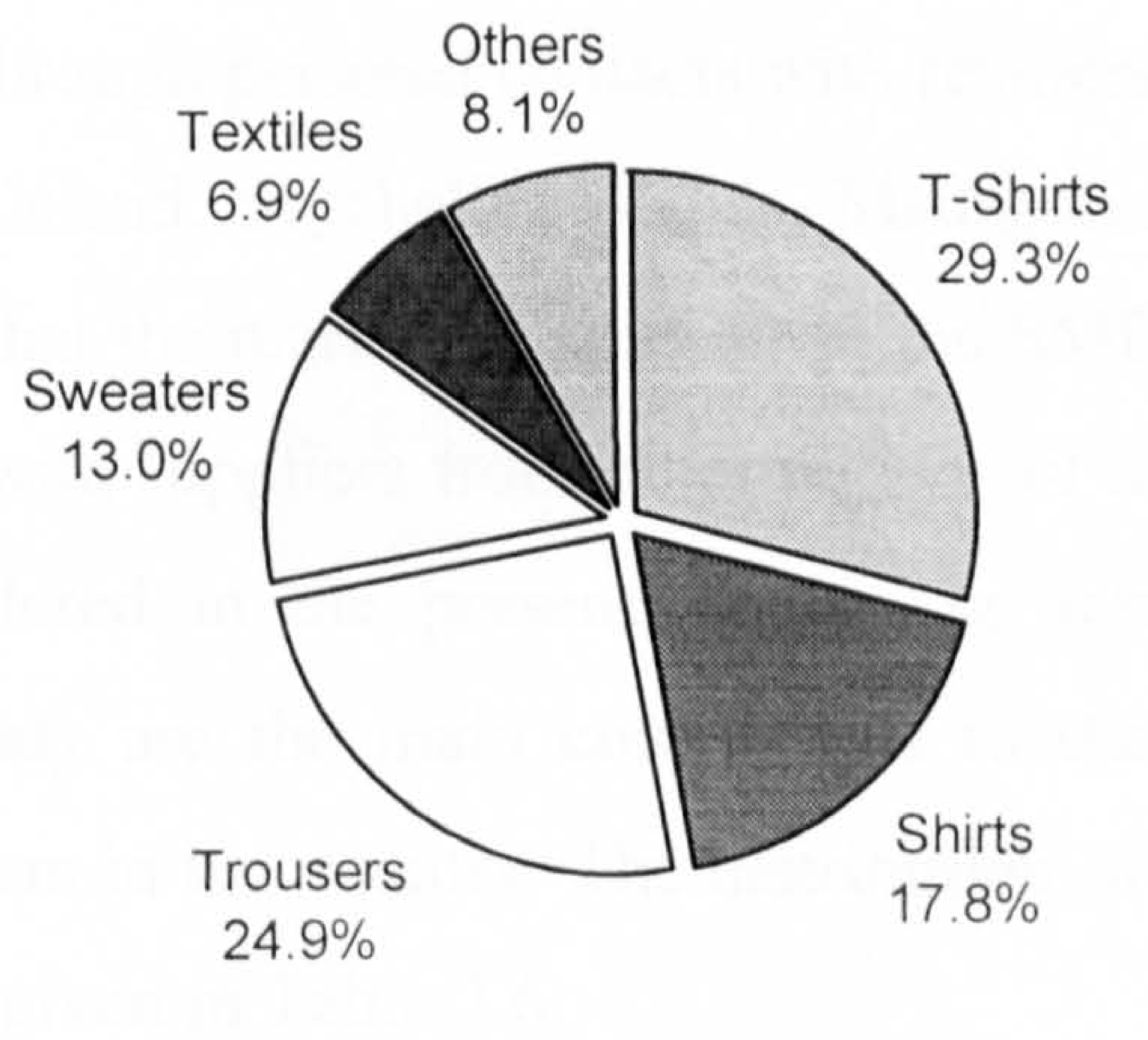

Figure 2.8 Textile and Apparel Export Earnings distribution (2000 Values)

Main Products Exported	Export Value (Rs Mn) and Main Countries of Destination					% of Total Product Exported	Total Exported (Rs Mn)
	France	Germany	Italy	UK	US		
T-shirts	2905	361	769	2591	370	89.9	7781
Trousers	718	88	111	1456	3580	90.1	6609
Men's Shirt	849	172	65	729	2390	89.1	4721
Sweaters	1464	338	264	549	365	86.2	3458

Table 2.5 Mauritian Apparel Exports and Country of Destination (2000 values)
Source EPZDA, 2001 (note 1 US$ = MRs. 28 as at 2000)

2.5.1 Structure of the Apparel Sector

The Mauritian apparel sector is made up of 256 EPZ registered companies, 55% of which are categorised as SMEs, defined as companies having either a total investment of less that £200 000 or employing less than 50 employees. These are mostly home-based factories, which either work as subcontractors to larger local companies or are involved in low volume manufacturing for exports. The net contribution of the SMEs to export earnings in 2000 was 4% (CSO, 2001). Most of the SMEs involved in exports do so mainly through personal contacts with retailers in countries of the Indian Ocean Rim (Reunion Island, Seychelles islands, Madagascar, and South Africa), the EU or the US. Given that the marketing strategy of the SMEs is such that they are not in direct competition with suppliers from other regions of the world, these companies have not been considered in the present study. The remaining companies, those considered in this study are the main contributors to the export earnings and are equally major employers in the country. The distribution of these companies in terms of employment rate is given in Table 2.6.

2.5.2 Apparel Sector Survey

Although there are many statistics available on the economics of the Mauritian apparel industry, relatively little is known about the manufacturing processes and the strategies employed on the shop floor. Availability of such information is vital prior to addressing the issue of manufacturing strategy. It was therefore decided to conduct a survey of the apparel manufacturing industry with a view to make an assessment of its current status.

The objectives of this research work were twofold

1. To assess the relationship between the manufacturer of apparel products and their customers and
2. To assess the manufacturing capability of the companies

In order to meet the above objectives all the apparel manufacturing companies excluding SMEs, were surveyed through mailed questionnaires and on site interviews of the Chief Executive or the personnel manager. A copy of the questionnaire used for the purpose is given in Appendix A.

2.5.3 Survey Results

A. Response Rate and Structure of Apparel Companies

Of the 115 apparel manufacturing companies contacted, 45 positively responded to the survey. This constituted all companies employing more than 1000 employees and more than 50% of companies employing between 200 and 1000 employees. The poor response rate (22.5%) for the companies employing less that 200 employees was mainly due to unavailability of the appropriate personnel for the organised interviews or in certain cases, the information was being treated as confidential. However, given that most of the large companies responded to the survey, the results do provide a good indication of the current state of the apparel sector with regards to its marketing and manufacturing practices. The response rate and other relevant details regarding the companies are given in Table 2.6.

Most of the companies (70%) were established in the 1980s when the then government offered a myriad of incentives to foreign investors to make effective use of the widely available pool of cheap labour. However, over the last decade, a large number the foreign owned companies have either closed down or have been taken over by local investors. The closing down of the foreign owned companies has been largely attributed to the increasing labour costs and to the expiry of incentives (for instance, 10 year tax holidays) which were used to attract the foreign investors in the early 1980s. As at present, almost 80% of the apparel companies are owned by Mauritians.

No. of Employees	No. of EPZ Apparel Making Companies	Response (No. of Companies	Response Rate (%)	Number of Companies					
				Year of Establishment			Ownership Structure (Mauritian M, Joint Venture JV, Foreign F)		
				1970s	1980s	1990s	M	JV	F
51-100	34	7	20.6	1	5	1	7	0	0
101-200	37	9	24.3	1	4	4	6	1	2
201-500	20	11	52.4	0	9	2	7	0	4
501-1000	14	8	57.1	1	6	1	4	1	3
>1000	10	10	100	0	8	2	6	2	2
Total	115	45	39.1	3	32	10	30	4	11

Table 2.6 Response Rate and Structure of the Apparel Sector

The annual turnover of the companies was found to be largely dependent on the category of the market (low, medium or high value added product range) the companies were servicing rather than on the quantity of products sold. In a number of cases, it was found that the smaller companies had turnovers higher than those of the larger ones (Figure 2.9). These companies were identified as those having invested in the state of the art technology and those working for the higher segment of the market. It has been observed that the majority of companies established in the 1990s fall under this category.

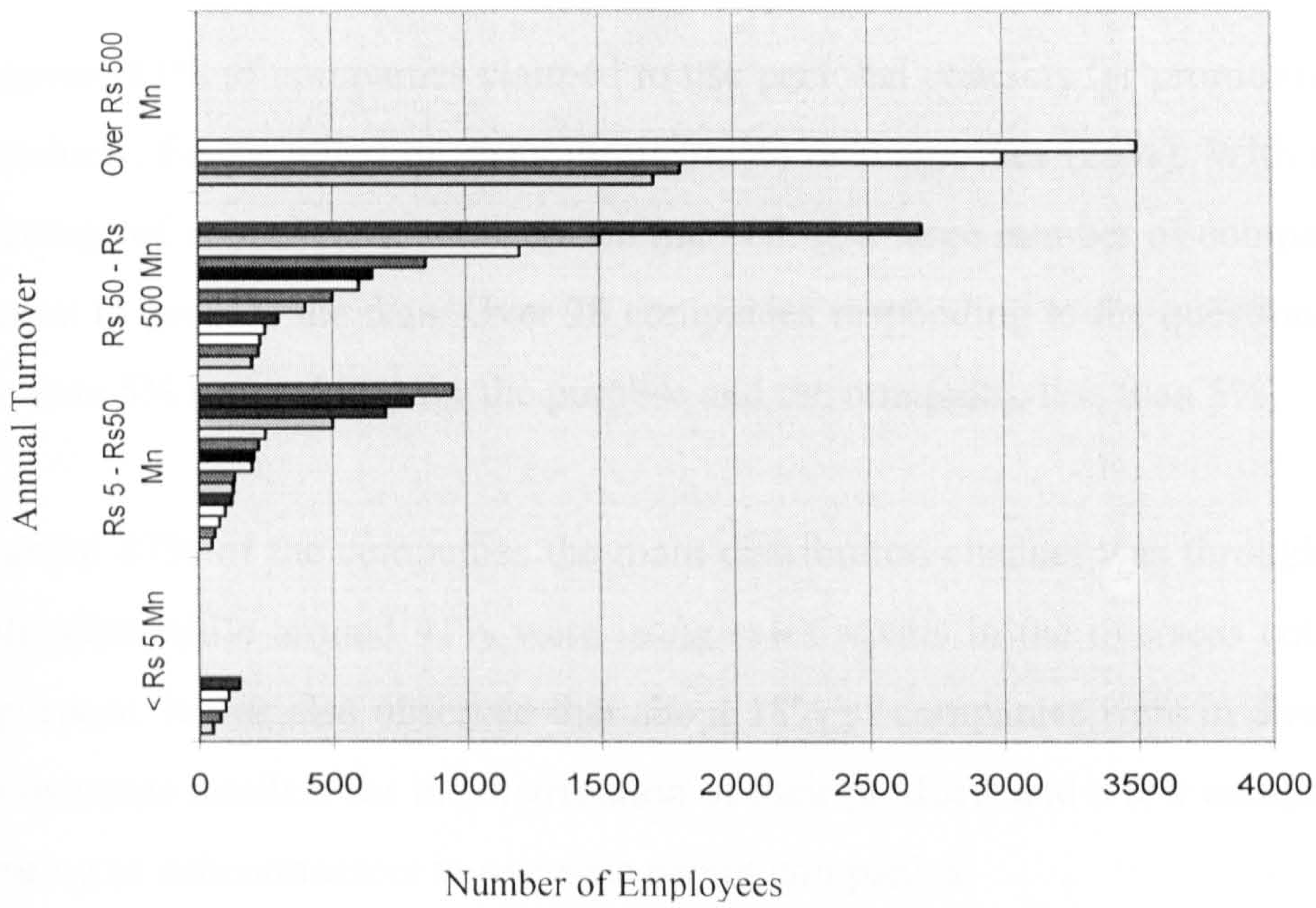

Figure 2.9 Annual turnover v/s number of employees

B. Market Access and Competitor Assessment

Though most of the companies surveyed (85%) were involved in exports to the EU, it was observed that a considerable number of them were looking for new opportunities in the North American region (USA and Canada). For instance, 30% of the companies were already involved in exports to the US market. Over the last 5 years, these exports have almost doubled in both value and volume terms and there are signs of further increase following the implementation of the Africa Growth and Opportunity Act, which provides for duty and quota free access for apparel products from Mauritius to the US.

It was equally observed that about 30% of companies were exporting to the African region. In these cases, marketing was organised mainly through the government organisations namely, the Export Processing Zone Development Authority (EPZDA) and the Mauritius Export Development Authority (MEDA). A large number of companies interviewed showed keen interest in the developments surrounding the setting up of the Common Market for Eastern and Southern Africa (COMESA). This is expected to give a boost to exports of apparel products to the African continent in the near future.

Moreover, 83% of companies claimed to use personal contacts for promoting the sale of products. Fewer relied on exhibitions (43%) or magazines (25%). With regards to percentage of annual turnover spent on marketing, a large number of companies were reluctant to provide the data. Over 28 companies responding to the question, 13 spent more than 5% (up to 15%) for the purpose and the remaining less than 5%.

For about 67% of the companies the main distribution channel was through overseas wholesalers while around 41% were using sales agents in the overseas countries for the purpose. It was also observed that about 18% of companies were in direct contact with overseas retailers for the distribution of their products and a few companies were operating as subcontractors to overseas parent companies.

The survey also clearly demonstrated that there was a good working relationship between the export companies and their customers, which was developed over the years and these companies (about 55%) do not even view the phasing out of the MFA as a threat to their market. However, about 45% of companies believe that Mauritius was at the crossroads with regards to competing for a market share be it in the EU or in the US. The immediate competitors for the apparel market were quoted to be mainly from the low cost manufacturing countries including India, China, Vietnam, Pakistan, Bangladesh, Madagascar, Mexico, the Caribbean countries, Taiwan and Thailand.

Very few of the companies surveyed rated Mauritius vis-à-vis its immediate competitors, as being much better off in terms of the production cost involved, the labour cost and the productivity (Table 2.7). On average around 50% of the companies claimed that the production cost was much higher in Mauritius while 73% claimed that the productivity in Mauritius was much lower vis-à-vis their immediate competitors. The main competitive advantage of Mauritius was observed to be in terms of the quality/cost relationship of the products offered. It should be noted that the respondents did not differentiate between high quality products and high value added products. The number of companies claiming to be involved in the manufacture of high quality and medium quality products was 43% and 57% respectively.

Competitive Factor	% No. of companies		
	Higher	Similar	Lower
Production cost	50	22.8	11.4
Labour cost	55	27.3	6.9
Quality	63	18.2	2.3
Productivity	27	25	31.8

Table 2.7 Rating of Mauritius vis-à-vis its immediate competitors

With regards to pressures from the market, the companies surveyed claimed that these were mainly in terms of frequent changes in design (77%), decreasing lead times (75%), improved quality (50%), reduced price (48%), and in quite a number of cases for increased quantity (30%). Issues related to design and lead-time emerged as being the most common type of pressures from the market.

C. Manufacturing Audit

One of the key areas dealt with during the survey was to assess the changes in lead-time for manufacturing. It was observed that around 30% of the companies still enjoyed long order to delivery lead-times of 8 weeks or more. These were mainly the large volume manufacturing companies which were getting orders one season in advance. The most common order to delivery lead-time was found to be between 4 to 7 weeks (58% of cases). In only a few cases (11%), the lead-time was found to be 3 weeks or less. None of the companies showed difficulty in meeting the lead times, which were however observed to have a decreasing trend over the years, and hence a major constraint for the future, as claimed by 77% of the respondents.

Shorter lead times have as at present, been met through overtime or expansion of present facilities (44%). Fewer companies (16%) relied on subcontracting to other local firms, because of difficulty in control and management of the orders. Around one third of the companies claimed that an improvement in productivity would be helpful for meeting shorter lead-times. The product introduction lead-time was in most cases (86%) observed to be less than one week. It was a matter of concern for the remaining companies, which were using up to 3 weeks for organising production of new orders.

The main weakness of the manufacturing companies was identified as being with regards to original design of new products including fabrics to be used. In 93% of cases the customers provided both the product and the fabric design. Also, very few companies had their own R&D lab for the purpose. R&D was not viewed as being important by the companies, as the orders were almost always accompanied by the design from the customers.

Even in terms of utilisation of computerised control systems for marketing and distribution, manufacturing or for management information systems, the apparel sector was found not to be equipped with state of the art information technology. On average about 35% of the companies were still using manual controls for the above operations (Table 2.8). Only a quarter of the companies did have integrated computerised control systems for manufacturing and management. Fewer companies were involved in the use of these systems for marketing and distribution.

Control Operation	% Number of Companies			
	Manual	Computerised Control System		Not Applicable
		Stand Alone	Integrated	
Marketing and Distribution	40.9	22.7	15.9	20.5
Manufacturing	34.1	34.1	25	6.8
Management Information System	27.3	38.6	25	9.1

Table 2.8 Use of Computerised Control Systems in the Apparel Sector

In addition to the marketing and manufacturing practice assessment, an audit was carried out in the companies to identify areas of concern with regards to the business in which they were engaged. The results are as shown in Table 2.9. Though most of the issues contained therein are pertinent for discussions, the following emerge as the vital ones:

1. Most of the companies still look for large manufacturing orders with long lead times. In certain companies a minimum order size is stressed upon as a pre-requisite for acceptance to manufacture. Little attempt is made to move from the mass production system to smaller batch production with wider variations in product specifications. This is the case for almost two thirds of the companies, which limit their manufacturing operations to a limited range of products.
2. There is very little design from scratch. Most companies (79%) were found to rely on the design proposed by the customers with only slight modifications. It was noted that there is little effort on the part of the companies to move from customer designs to in-house designs. Most companies complain of the lack of qualified resources for the purpose and, above all, design is not perceived as a problem for the companies.
3. Though 80% of companies showed concern for improved productivity, only a few (14%) had keen interest for investment in the state of the art technology for manufacturing or for investment in production related R&D. Like productivity, design of fabrics and/or products, and R&D are not viewed as acute problems necessitating immediate actions.
4. Most of the companies (86%) lay emphasis on quality as the panacea for winning orders and hence, the manufacturing process incorporates a large amount of inspection to meet the quality specifications.
5. The only acute problems identified by the companies were the following:
   - The shortage of labour (75%)
   - The increasing cost of labour (68%)
   - Absenteeism (65%) and
   - The increasing cost of raw materials (57%).

Condition	% Number of Companies*		
	Possibilities		
	Little	Some	Much
Allowable variation in product specifications	32	32	30
Design from scratch	43	36	7
Extent of production related R&D	43	27	14
Use of state of the art technology	25	45	14
Concern for productivity	2	11	80
Emphasis on quality	0	2	86
Amount of inspection	0	7	82
Number of supervisory levels	41	32	23
Degree of mechanisation for material handling	30	41	18
Extent of subcontracting	57	23	2
	% Number of Companies*		
	Possibilities		
Rating of Problems	Acute	Average	Not a problem
Shortage of labour	75	20	2
Cost of labour	68	23	5
Absenteeism	65	15	12
Cost of raw materials	57	9	23
Low productivity	32	39	25
Pace of IT change	30	23	34
Availability of technical staff	20	11	64
Quality control	18	14	64
Inventory control	14	12	66
R&D	14	18	61
Marketing of products	11	20	57
Design of fabrics	9	20	64
Rejects	9	14	75
Maintenance of equipment	9	27	52
Design of products	7	20	66
Availability of fabrics	2	23	70

Table 2.9 Manufacturing Audit for the Apparel Sector

* In certain cases companies preferred not to answer the questions, hence the sum may not be equal to 100%

2.5.4 Challenges facing the Apparel Sector

Mauritius has been involved in the manufacture and export of apparel products for the last 25 years and has gained the reputation of being a reliable supplier to both the EU and the US markets. Apparel manufacturing is expected to remain one of the main economic activities both in the medium and long term. However, it has been observed that due to pressures of increasing demand from the market, the companies have almost deliberately ignored the implications of competing against other low cost manufacturing countries on a level ground, that is, without protectionism policies including duty and quota free access to the markets. The past and present scenario is that of firm orders being widely available and the companies being completely involved in satisfying them with the available resources. Less time and effort are put in reviewing marketing and manufacturing strategies with a view to building up a competitive advantage based on factors other than low cost labour and privileged access to the market. Strategic issues like quick response, manufacturing flexibility, manufacturing of high value added products and strategic linking up with customers do not seem to be high on the agenda of the apparel manufacturing companies. The only issues of general concern seem to be in terms of the availability and increasing cost of labour and raw materials, meeting manufacturing lead-times and the quality specifications of the customers.

With the phasing out of the multi-fibre agreement in 2005 and increasing liberalisation of world trade, the future market scenario will be that of limited protectionism mechanisms for market access. It has been observed through the study, that only a few companies are preparing for such a scenario in the short to medium term. The possibility of a severe economic crisis resulting from massive loss of market share seems to be at the doorstep unless protectionism mechanisms continue to safeguard the interest of the country as has been the case so far. The only viable option for the majority of companies is to reengineer their manufacturing facilities in order to build up their own competitive advantage for the 'Made in Mauritius' label. The plus point of the industry is that companies do have the competence and experience to achieve the above: What they seem to lack, is a simple tool for allowing them to make an assessment of present manufacturing practice and take appropriate decisions based on the assessment for continuously enhancing the competitiveness of the manufactured product. This in fact, defines the scope of the present research, which is based on the use of system models for producing a manufacturing system audit tool for both manufacturing strategy assessment and selection.

Chapter 3
Manufacturing Strategy, System modelling and Analysis

3.1 Introduction

Manufacturing has for long been viewed by top management as a function within an enterprise rather than being of strategic importance for enhancing the competitiveness of manufactured products. Skinner (1969) first raised this issue in his famous Harvard Business Review article entitled "Manufacturing - Missing Link in Corporate Strategy". Since then, various researchers have investigated the correlation between corporate strategy and manufacturing strategy (Mintzberg 1973 & 1978, Skinner 1974 & 1985, Wheelwright 1978, Hill 1980 & 1985, Hayes and Wheelwright 1984, Prahalad and Hamel 1990, Hamel and Prahalad 1994, Hayes and Pisano 1994). It is now generally accepted that the manufacturing function is a key determinant in developing a comparative advantage and hence, a competitive position for manufactured products (Anderson and Schroeder 1991, Brown 1996). However, there is little understanding about the process of manufacturing strategy, that is, the procedure to be followed for analysing specific manufacturing systems with a view to assess and select appropriate strategies. Though a few publications do address this issue (Skinner 1978, Hofer and Schendel 1978, Fine and Hax 1985, Swamidass 1987, Hill 1989, Platts and Gregory 1990, Anderson *et* al. 1991, and Mills *et* al.1995), associated implementation aspects still remain to be investigated in manufacturing organisations.

The following sections provide a review of the literature on the content and process of manufacturing strategy to illustrate the above and justify the present application based research on the subject. Also, this chapter includes the results of a survey of a sample of customers in the UK in order to evaluate the characteristics of the market. Given that the research methodology involved the use of manufacturing system modelling for manufacturing strategy formulation and analysis, a review of systems modelling tools and techniques is also presented with a view to identify the most appropriate ones to meet the requirements of the project.

3.2 Corporate, Business and Functional Strategies

Most of the definitions of the term strategy converge towards that offered by Chandler (1962) as being the determination of the basic long term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals. Skinner (1969) defines strategy as being a set of plans and policies by which a company aims to gain advantages over its competitors. Evered (1983) defines strategy as the broad programme for defining and achieving the organisation's objectives and implementing its missions. Wheelan and Hunger (1989) define the same term as being the determination and evaluation of alternative paths to achieve an organisation's objectives and mission and, eventually, a choice of the alternative that is to be adopted. Mintzberg (1987) on the other hand defines strategy in terms of a plan, a ploy, a pattern of behaviour, a position and a perspective that a manufacturing organisation achieves with time. From the above definitions, it is clear that a strategy is a set of important decisions derived from a systematic decision making process conducted at the highest level of an organisation. Hofer and Schendel (1978) identify three major types of strategies:

- Corporate strategy which identifies the set of businesses which a company should be in, e.g. textile, apparel, knitting, weaving etc...
- Business strategy which identifies how the company should compete while being in a specific business, e.g. on cost advantage, quality, quick response to market requirements etc...
- Functional strategy, which identifies how the various functions, including for instance, manufacturing, marketing/merchandising, human resource management, product design and development, purchasing, planning and control, and finance, within a company can contribute towards enhancing the competitive advantage of the business.

The process for deciding upon corporate and business strategies is widely documented in the literature. Table 3.1 is a compilation of the mostly cited formulation techniques, key considerations and strategic options associated with each of these two types of strategies.

3.2.1 Corporate Strategy

Corporate strategies define the total objectives and goals of the firm, the firm's current and future business domains, and the firm's general approach to organising the productive and administrative systems (Shrivastava 1995). These strategies are mostly decided upon by the top management of the firm by bearing in mind the strength and weakness of the business portfolio and the changes taking place in the external environment. The most common decisions taken up at corporate level for instance include, business restructuring, forward and backward integration, diversification of the product domain, development of overseas businesses, delocalisation of business, licensing abroad, pure survival, divestiture, shutting down of businesses etc...

Strategy	Formulation Techniques	Key Considerations	Main Strategic Options
Corporate Strategy	Boston Consultancy Group (BCG) Matrix (Rue & Holland, 1989)	Market Growth Rate v/s Relative Competitive Position (Market Share)	Growth (Concentration, Vertical Integration, Diversification) Stability Defensive (Harvest, Divestiture, Liquidation, Bankruptcy)
	Ansoff Matrix (Ansoff, 1965)	Market Evolution v/s Product Development Strategy	
	General Electric (GE) Matrix (Hill & Jones, 1989)	Long term industry attractiveness v/s Business Strength	
Business Strategy	Porter Generic Strategies (Porter, 1980)	Meeting Customer Requirements SWOT Analysis	Cost leadership Differentiation (Product Quality and Reliability, Design and Volume Flexibility, Response Time) Focus

Table 3.1 Key Considerations for formulation of Corporate and Business Strategies

Choosing a corporate strategy involves selecting businesses that will fulfil the corporate goals. In making this choice a structured technique called business portfolio analysis is often used. The most common tools used for the purpose include the Boston Consultancy Group (BCG) matrix, the Ansoff matrix, and the GE matrix (Table 3.1). The BCG matrix allows managers to compare and choose businesses by assessing industry growth and market strength of each business. Figure 3.1 illustrates the BCG business portfolio matrix. The cell definitions are as follows:

- Cash Cows are characterised by high market and low industry growth rate
- Dogs are characterised by low market share and low industry growth rate
- Stars are characterised by high market share and high industry growth rate
- Question Marks are finally characterised by low market share but high industry growth rate

Use of the BCG matrix involves classifying the businesses into the cells based on company and market data, carrying out detailed analysis of the possible changes in both the company and the external environment and taking appropriate decisions for the benefit of the firm.

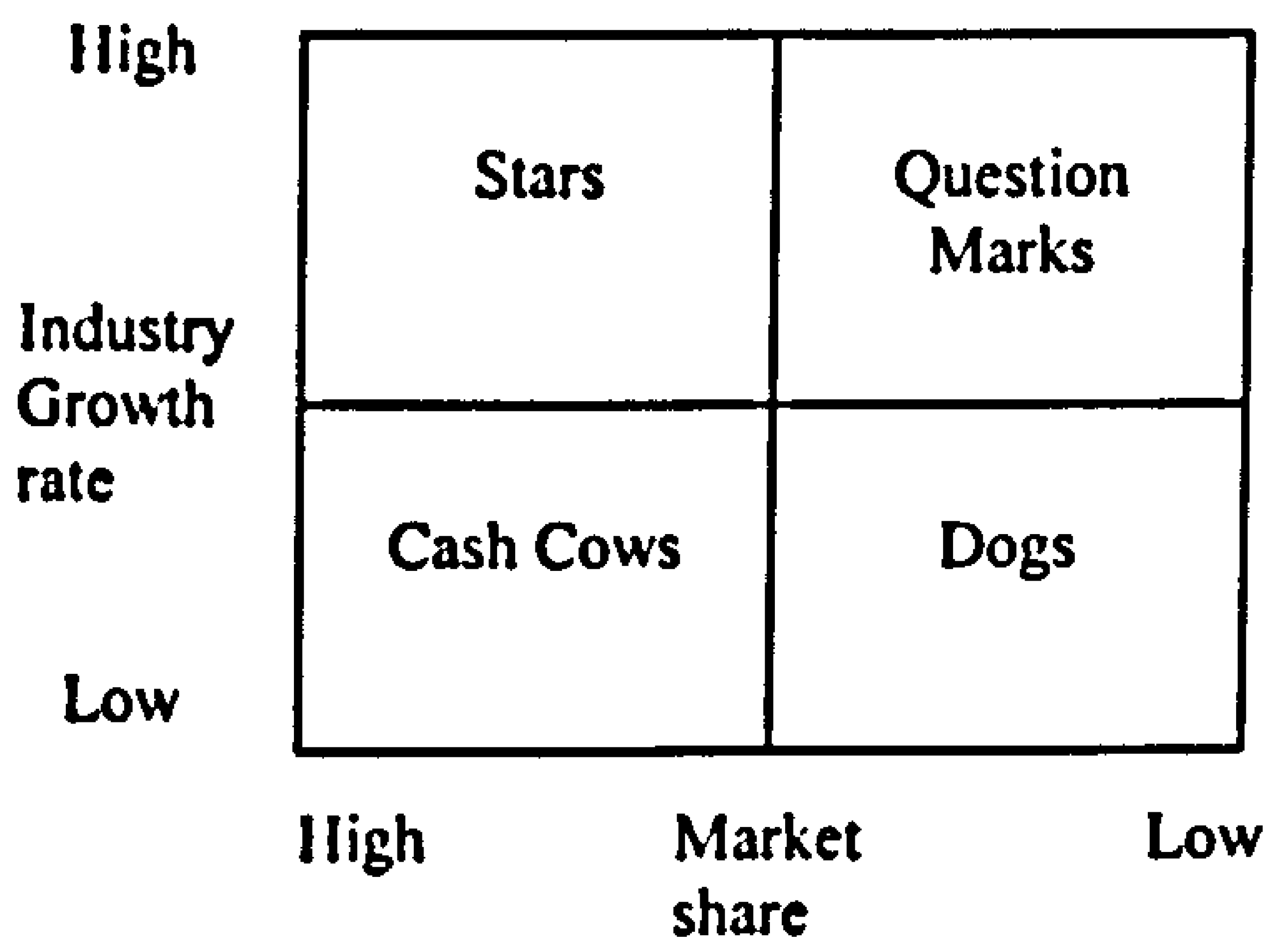

Figure 3.1 BCG business portfolio matrix

The Ansoff and the GE business portfolio matrix have the same structure as that of the BCG matrix with differing emphasis. The Ansoff matrix is a plot of product development against market evolution while the GE matrix is a plot of business strength against industry attractiveness as shown in figures 3.2 and 3.3 respectively.

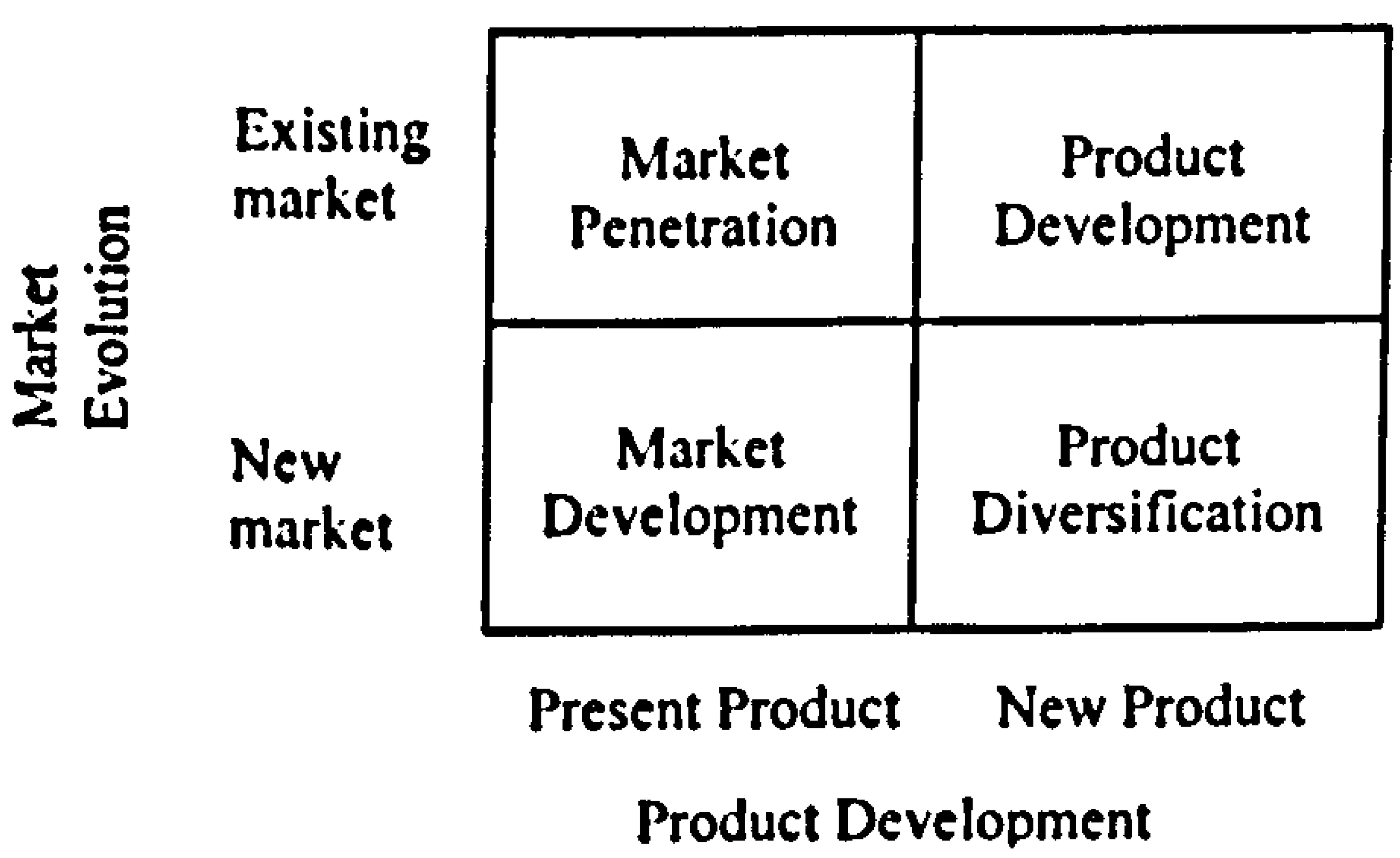

Figure 3.2 Ansoff Business portfolio matrix

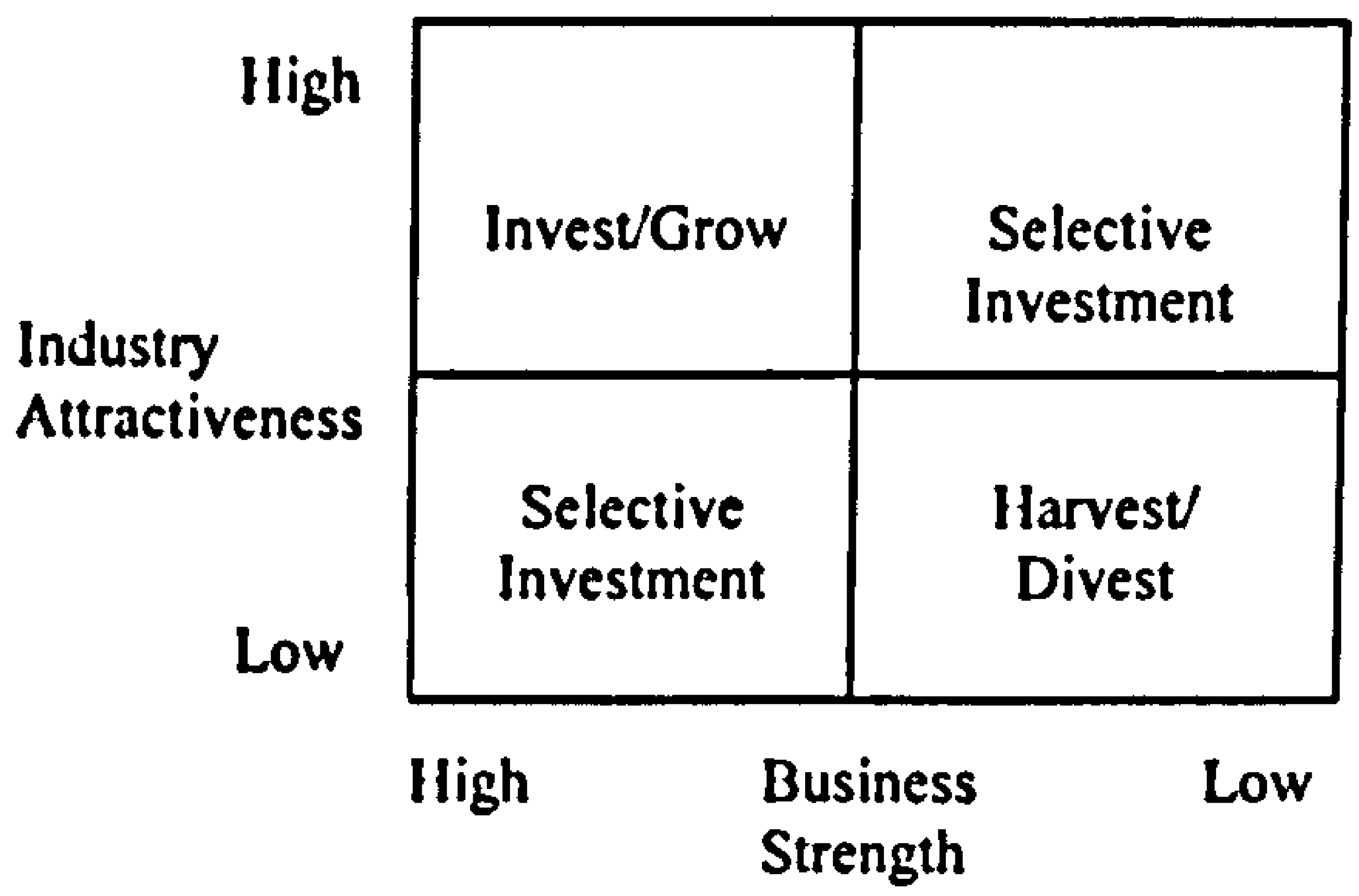

Figure 3.3 GE Business portfolio matrix

All the above tools help top management of manufacturing firms to decide on the course of action to follow with regards to the various businesses they are in. Corporate strategy thus is more oriented towards making high level decisions based on present data and forecasts, which usually have a high bearing on the future of the business.

3.2.2 Business Strategy

At the business unit level, the key strategic issue is establishing sustainable competitive advantage within the industry in which the business unit operates. This usually follows an assessment of the strengths and weaknesses of the company vis-à-vis the opportunities and threats facing the business organisation (SWOT Analysis). There are three main generic strategies that a business can embark upon to gain competitive advantage namely, least cost, differentiation and focus strategies (Porter, 1980). The strategy to embark upon is usually based on the results of the SWOT analysis and the strategic target set by the company to take advantage of its strengths. The possibilities in terms of business strategies are shown in figure 3.4.

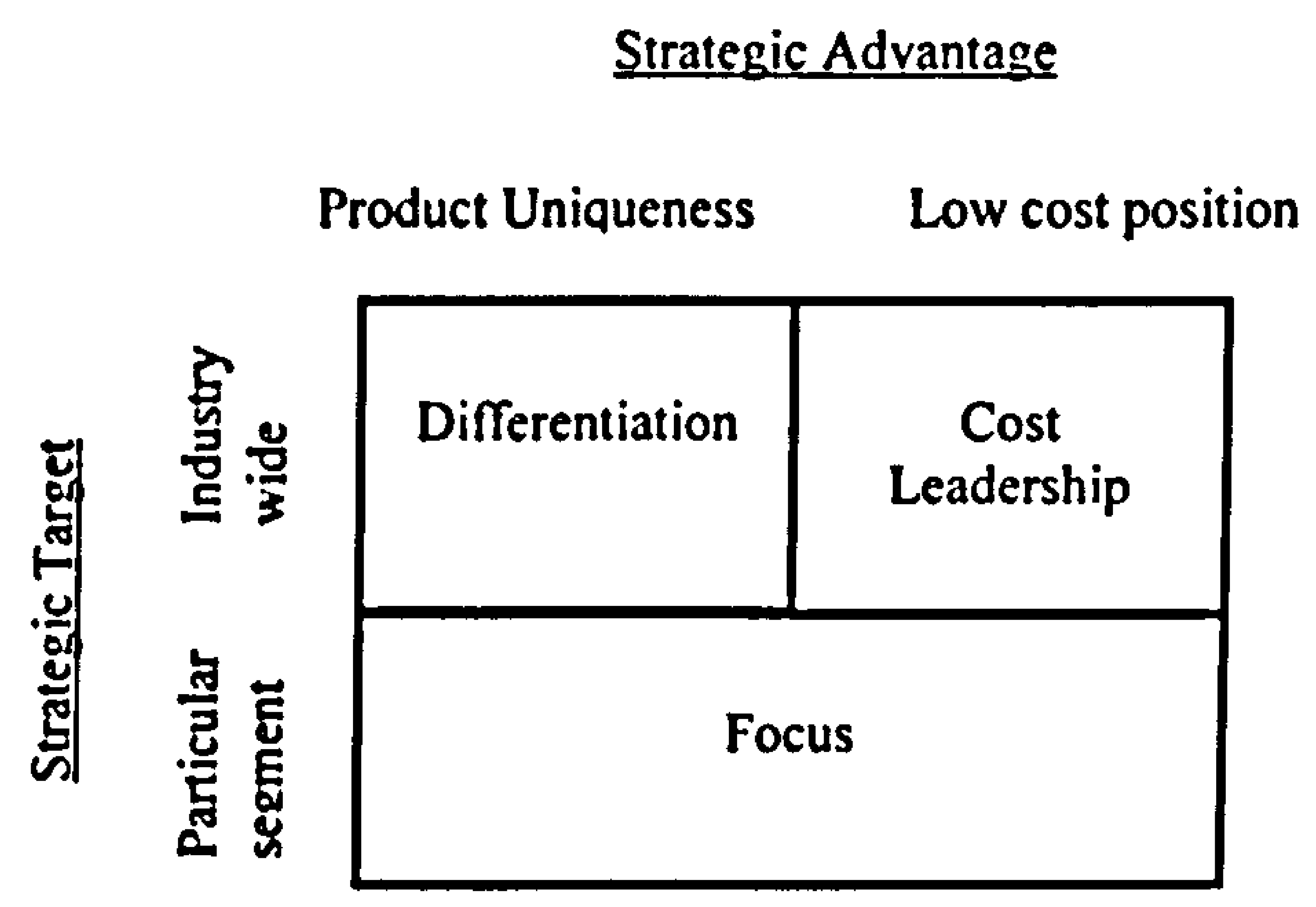

Figure 3.4 The three generic business strategies (Porter, 1980)

Cost leadership strategy refers to operating at the lowest cost in the industry. It involves the construction of efficient facilities, vigorous pursuit of cost reductions, tight cost and overhead control, cost minimisation in areas like Research and Development (R&D), sales, advertising and production operations among others. Achieving a low overall cost position often requires a high relative market share and designing products for ease in manufacture, maintaining a wide line of related products to spread costs, and serving all major customer groups in order to build volume.

Differentiation strategy involves creating products that have distinct and hard to imitate features and which appeal to a range of market segments. Uniqueness can be in the form of design, brand image and company reputation and manufacturing flexibility among others. Commonly differentiation implies a trade off with cost position if the activities involved in the strategy are costly like intensive research, product design and use of high quality materials.

Focus strategy on the other hand implies focussing on a clearly defined segment of the market and fulfilling customer expectations in that niche. Usually this means producing specialised products and marketing them through limited focussed delivery systems. As a result, the company may achieve differentiation by better meeting the needs of the particular market segment, or lower costs in serving that target market, or both.

The traditional approach for business strategy formulation is thus based on an analysis of the external environment to identify opportunities and threats and finding the best match between the opportunities and the internal strengths of the organisation. This dictates the strategy the company can best compete on. Typical issues considered while conducting a SWOT analysis are shown in Table 2.2.

Organisation and Management	**Marketing**	**Human Resources**
Management Quality Staff quality Degree of centralisation Planning and scheduling Information and communication system Control systems	Distribution channels Market share Advertising efficiency Customer satisfaction Product quality Service reputation Sales force turnover	Employee experience Education level Union status Turnover, absenteeism Work satisfaction Grievances
Finance	**Production**	**Research and Development**
Profit margin Debt-equity ratio Inventory ratio Return on investment Credit rating	Plant location Machinery obsolescence Purchasing system Quality control Productivity/efficiency	Basic applied research Laboratory capabilities Research programmes New product innovations Technology innovations

Table 3.2 Checklist for analysing business strength and weaknesses (Stevenson, 1976).

3.2.3 Functional Strategies and Manufacturing Strategy

Functional strategies are plans of action for each of the core functional areas within the manufacturing organisation to meet the requirements of the business strategy. Functional strategy can encompass a host of strategies in the various functional areas of the business for instance, purchasing or sourcing strategies, design strategies, marketing strategies, processing strategies, human resource development strategies, investment strategies etc... In spite of the hierarchical nature of the thinking in strategic management, it is argued that the strategies are not mutually exclusive

(Skinner, 1969). However, the top-down approach to strategy formulation has always prevailed such that, functional strategies are tailored in accordance with the business strategy which itself meets the requirements of the corporate strategy. The main drawback of this approach, whereby decisions are passed down the hierarchy, is that there are considerable discrepancies between what top management wishes to achieve and what is achievable using the resources within the enterprise (Schonberger 1986). World-class manufacturing requires more of a holistic approach towards strategy formulation, involving all functions in shaping the business and corporate strategy as illustrated in Figure 3.5. This model clearly illustrates the interaction between the various functions within the enterprise and its importance during the strategy formulation process cannot be overlooked. It is this holistic approach that will be adopted for the current research. The author is of the view that it is a combination of the functional strategies that tailor the business strategy of the company.

A review of the literature on corporate and business strategy formulation processes clearly shows the missing link between the higher-level strategies and functional strategies. While corporate strategies are based on business strengths and market evolution, business strategies are mostly based on meeting customer requirements through cost advantage, differentiation or focus strategies. Both of these concepts lay heavy emphasis on the marketing function and on the external environment for deciding upon the course of action to be adopted. The outside-in approach has thus so far been the predominant structure for deciding upon strategies. Most of the researches in manufacturing strategy argue that such processes frequently cause problems for companies, or at least do not aid in the development of the manufacturing function into a competitive weapon. The manufacturing function is often viewed in isolation, as adding cost rather than adding value to products. Also, the importance of the other strategic functions within the manufacturing organisation is treated in complete independence.

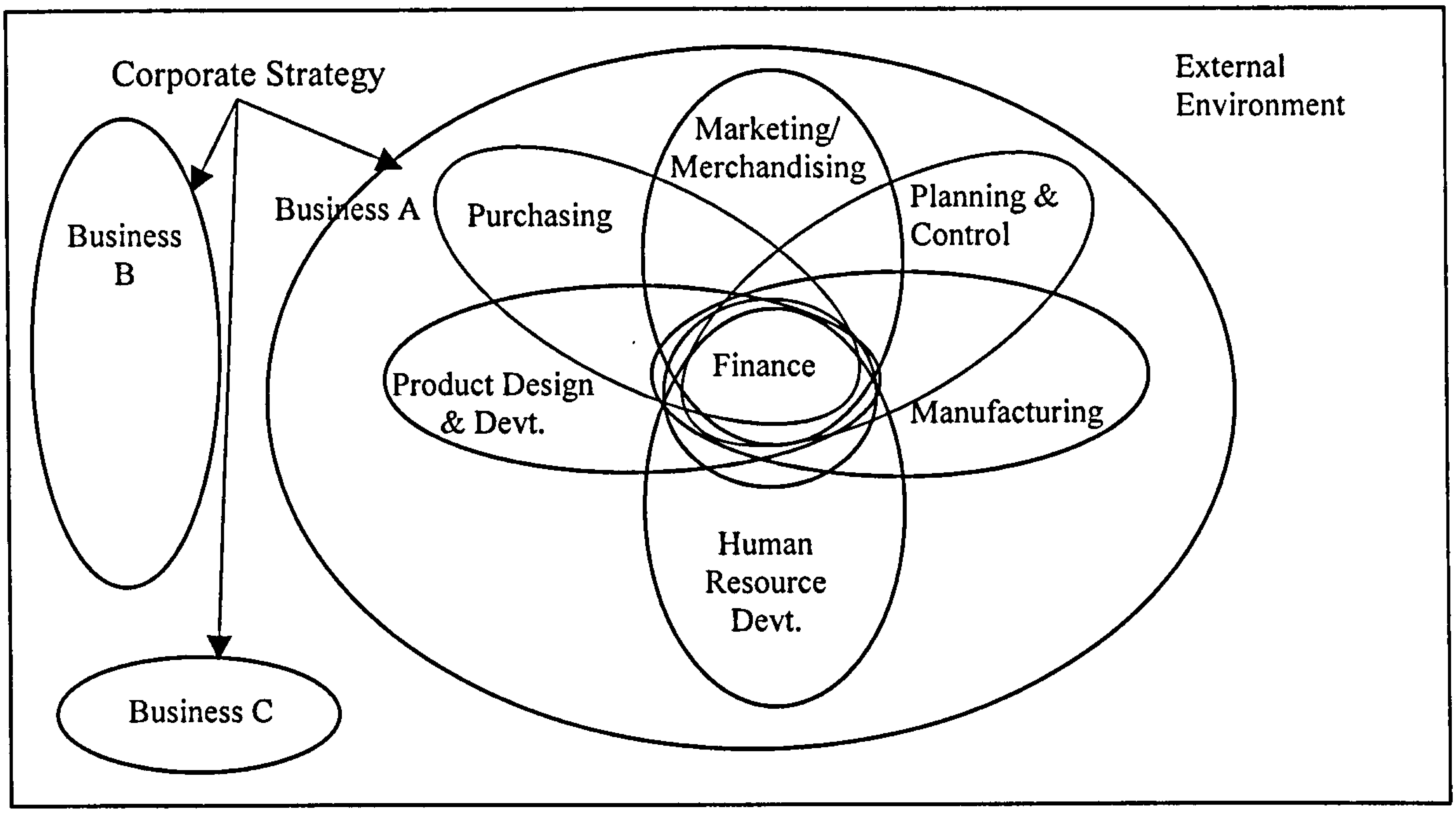

Figure 3.5 Holistic approach towards strategy formulation

The holistic approach towards achieving enhanced competitiveness through manufacturing was first raised by Skinner (1969). It is argued that the best way to compete in the global market is by using the manufacturing function as a competitive weapon (Mintzberg 1973 & 1978, Skinner 1974 & 1985, Wheelwright 1978, Hill 1980 & 1985, Hayes and Wheelwright 1984, Prahalad and Hamel 1990 & 1994). Moreover, Hayes and Pisano (1994) stress that the adoption of improvement programs like Total Quality Management, Just In Time, Design For Manufacturability, Lean Manufacturing, Reengineering and Benchmarking do not necessarily lead towards enhanced competitiveness. What is needed is that companies adopt strategies for building critical manufacturing capabilities to achieve competitive advantage.

Platts and Gregory (1990) argue that the inclusion of the manufacturing function within the business strategy formulation process requires more than the traditional approach using SWOT analysis. Research in the area has, as at present, led towards the setting up of a number of frameworks for fitting manufacturing strategic decisions within the process of business strategies (Skinner 1969, Hayes and Wheelright 1984, Hill 1985). Also, based on the above frameworks, a description of the overall process of strategy formulation has been proposed by various researchers (Hofer and Schendel 1978, Mintzberg and Waters 1985, Schwaninger 1987, Anderson et al. 1991). The application of these frameworks and processes in specific manufacturing environments however still remains to be investigated.

3.3 Manufacturing Strategy: Frameworks and Processes

Manufacturing strategy can be viewed as the effective use of manufacturing capabilities to provide a competitive weapon for the achievement of business and corporate goals (Swamidass and Newell, 1987). It defines how the manufacturing function assists in the achievement of business objectives through the provision of the appropriate structural items and the appropriate infrastructure to ensure that operations are efficient and effective. Leong and Ward (1995) argue that the above can be used to define the content of manufacturing strategy, which can be considered to contain the six views illustrated in Table 3.3.

View	Description
Planning	Manufacturing strategy as a part of an essentially hierarchical corporate planning framework that assures a fit between manufacturing goals and actions and those of the larger organisation.
Proactive	The ability of a manufacturer to anticipate new manufacturing processes and technologies and to implement long term programmes to acquire capabilities in advance of needs
Patterns of actions	The observed stream of decisions or actions of a manufacturer over a period of time in nine categories: capacity, facilities, process technology, vertical integration, production planning and control, quality systems, organisation, workforce, and new product development.
Portfolio of manufacturing capabilities	The portfolio of manufacturing capabilities reflects competitive strengths possessed by the manufacturing function and their relative importance. Generic manufacturing capabilities include cost, quality, delivery performance, flexibility and innovation.
Programme of improvement	The set of structured, time phased and evaluated actions, which are implemented to improve the manufacturing capability of the firm. Examples include TQM, GT, JIT etc involving broad worker participation.
Performance measurement	The systematic means by which manufacturing is evaluated. Good performance measurement schemes are aligned with strategic organisational goals so that behaviour, which furthers those goals, is systematically reinforced.

Table 3.3 The six Ps defining the content of Manufacturing strategy (Source: Leong and Ward, 1995)

It is generally agreed that the main objective for formulating a manufacturing strategy is to achieve enhanced competitiveness through:

- The manufacture of products of desired or better performance than competitors
- Achieving quick response to rapidly changing customer needs and delivery reliability
- Rapid new product development and introduction
- Reducing manufacturing costs

It is the linking of the manufacturing decisions with the above competitive options, which formed the basis of the work by Skinner 1969, 1974, 1985, Wheelwright 1985 and Hill 1985 who came up with suitable frameworks and processes emphasising the role of the manufacturing function to better achieve business objectives. The salient features of the frameworks developed so far, by the above and other researchers (Schroeder 1986), implicitly or explicitly include the issues raised in the first instance by Skinner (1969) namely

1. An analysis of the competitive situation, of how rival companies are competing in terms of products, markets, policies, and channels of distribution
2. A critical appraisal of the available skills and resources within the company
3. An assessment of the constraints and limitations imposed by the economy and the technology within the industry
4. An assessment of how the manufacturing function can provide competitive advantage in terms of cost, delivery, lead time, innovation, quality and reliability
5. Formulation of a manufacturing policy based on all the above and the
6. Development of a programme of implementation, control, performance measurement and review of procedures.

Though contained within the above set of features, each framework can be considered to have unique attributes. Wheelwright (1985) for instance proposes a framework whereby the strategic role of the manufacturing function is defined in four stages:

1. Internally neutral, whereby top managers consider the function incapable of influencing competitive success

2. Externally neutral, whereby the manufacturing function is considered at par with those available to competitors
3. Internally supportive, whereby the manufacturing function is expected to actively support and strengthen the company competitive position
4. Externally supportive, whereby the competitive strategy of the company rests to a significant degree on the company's manufacturing capability

The above framework outlines the different roles that the manufacturing function can play in a company's efforts to formulate and achieve its strategic objectives.

Hill (1985) on the other hand proposed a framework having the following stages

1. Assessment of the market requirements
2. Identification of the order qualifying and winning criteria
3. Assessment of the manufacturing function's contribution to each of these criteria
4. Use of the manufacturing function to build competitive advantage for both the order winning and the order qualifying criteria

While the frameworks define the overall structure for deciding on appropriate manufacturing strategies, processes on the other hand provide analytical and/or logical approaches that one might consider as decision aids for formulating the strategies. Bearing in mind the content of manufacturing strategy and the associated frameworks for generating them, various researchers have contributed towards developing a process for manufacturing strategy formulation. Hofer and Schendel (1978), proposed the following main steps in the strategy formulation process

1. The assessment of the current strategy
2. The identification of opportunities and threats
3. A comparison of the organisation's objectives, strategy and resource against the environment opportunities and threats to determine the extent of change required in the current strategy
4. The assessment of the principal skills and resources available to close the gaps identified
5. The identification of the options upon which a new strategy may be built

6. An evaluation of the strategic options to identify those that best meet the values and objectives of all stakeholders, taking into account the environmental opportunities and threats and the resources available
7. The selection of the options for implementation

The tool most often used for the purpose is SWOT analysis and manufacturing system surveys.

Platts and Gregory (1990) proposed an audit approach for strategy formulation. The emphasis of their work was based on identifying gaps between customer requirements and performance achieved by the company in terms of product features, quality, delivery speed, delivery reliability, design flexibility, volume flexibility and price. Though of major significance for the purpose of manufacturing strategy formulation, this approach does not seem to have received wide acceptance by companies as the process is tedious, usually requires an external consultant and is a medium to long-term exercise. Moreover, the process is a generic one and requires reviewing before implementation in specific manufacturing companies.

Mills et al. (1995) on the other hand have given a detailed framework for the design of manufacturing strategy for identifying gaps in past strategies and taking appropriate actions for the future. The process is based on conducting an audit as proposed by Platt and Gregory and the formulation and implementation of strategies in light of the audit results. Other researchers who have contributed towards the design of a process for manufacturing strategy formulation include Anderson et al. (1991), which emphasised on the use of interviews of manufacturing executives for developing strategies. The process from Hill (1987) is based on formulating strategies in line with order qualifying and order winning criteria. However, none of the above processes led towards the development of a simple tool to enable manufacturing executives to make a self-assessment of their present organisational strategies and take appropriate decisions for achieving enhanced product competitiveness. This defines the scope of the present research work, which will be supported by case study examples from the apparel manufacturing system.

3.4 Strategic Options for Apparel Manufacture

The discussions contained in the previous section provide definitions for manufacturing strategy while, at the same time, fitting it into the context of business and corporate strategies. With regards to garment manufacture, it has been observed that the frameworks and processes can lead towards any one or a combination of the following strategies:

- ➢ Low cost manufacturing strategy
- ➢ High value added strategy
- ➢ Quick Response (QR) strategy

Though the above strategies are not mutually exclusive, clear distinctions have been observed in relation with the market categories that are served by companies adopting each of the above strategies. The main market categories for apparel products include haute couture, designer shops, independent stores, department stores, retail chains and discount stores. The associated characteristics, order qualifiers and order winners for each market category are shown in table 3.4. These are based on data collected through a survey of sales personnel from a sample of twelve companies in the UK. The list of companies and the questionnaire used for the survey are included in Appendix B. Examination of the market place as part of this research indicates that there are four main variables that shape the different markets:

1. The price
2. The product quality
3. The product variety inclusive of product design and associated differentiation features and
4. The volume

A relative comparison of the above variables for the various market categories shown in figure 3.6 clearly demonstrates that price and volume are vital for servicing the lower end of the market while design and variety becomes more important when moving towards the upper end of the market. Garment quality and delivery reliability were found to be order qualifiers for all the market segments.

Market Category	Market Characteristics	Order qualifiers	Order winners
Haute Couture e.g. Christian Dior	Mainly branded garments Unique design High emphasis on personalised customer service Very expensive	Innovative fabric and garment design Excellent quality Aesthetic Fashion garments	Brand Design uniqueness Aggressive advertising and promotion campaigns Personalised service
Designer Shops e.g. Yves St. Laurent	Limited number of outlets Branded garments Personalised customer service Limited volume High variety & Expensive	Novel fabric Stylish garment design Excellent quality Aesthetic and long lasting	Brand Innovative design Distinguishable differentiation features including styling and fit
Independent Stores, specialised shops or Franchise shops e.g. Next	Branded or own brand Garments Limited to high volume Moderate variety Moderate price	Good fabric quality Exclusive garment design Delivery reliability	Differentiation features in garment design Rapid response to changes in customer demand Competitive price
Department Stores and concession shops e.g. Marks & Spencer	Medium to large size Large number of outlets Usually Plc ownership Own brand and key brands High volume Moderate price	Good fabric and Garment quality Delivery reliability	Fabric and garment design Competitive price
Retail Chains e.g. Littlewoods	Medium to large size Large number of outlets Own brand or branded High volume Low price	Good garment quality Delivery reliability	Competitive price
Discount stores, market Halls e.g. Matalan	Branded and non branded garments Low price	Personal contacts Garment quality	Competitive price

Table 3.4 Characteristics of markets for apparel products

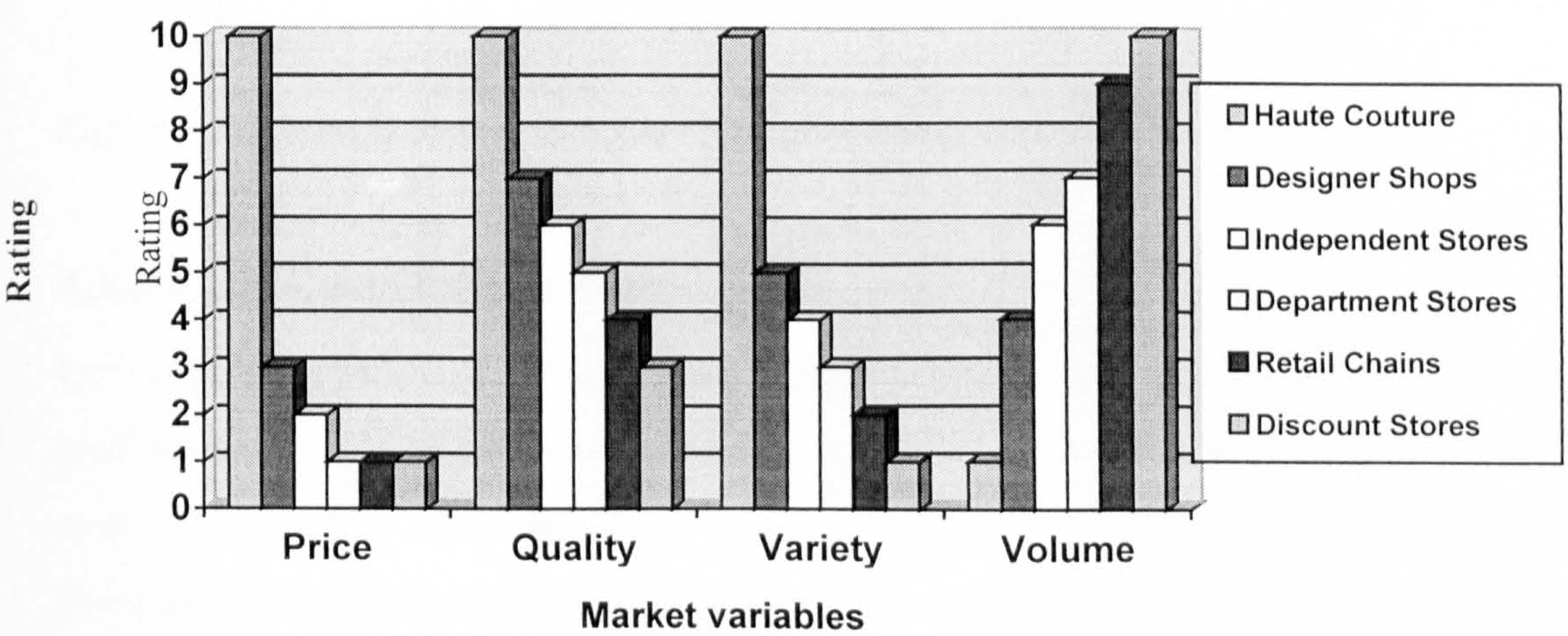

Figure 3.6 Comparison between market categories

The market study equally confirmed that the majority of suppliers to the independent stores, department stores, retail chains and discount stores came from developing countries that concentrate on low cost and high volume production. Suppliers to designer shops varied from developing to developed countries while the haute couture market was almost fully serviced by companies from developed economies.

Though the opportunities offered by the market are numerous, Majmudar (1996b) argues that competition at the lower end will be fiercer than ever in the wake of complete apparel trade liberalisation. The only possibility for developing economies to maintain and expand market share will be to excel in at least one of the strategic options. The possibilities for adopting alternative strategies are shown in Figure 3.7 and these are discussed in the following sections.

Concern for Design	High	**Design Centred** Quick Response Strategy *Designer Shops*	**Fashion Centred** High Value Added Strategy *Haute Couture*
	Moderate	**Production Centred** Low Cost Strategy *Discount Stores* *Market Stalls*	**Marketing Centred** Low Cost Strategy *Department Stores* *Retail Chains*
		Moderate	High
		Customer Concern	

Figure 3.7 Strategic moves available to garment making companies

3.4.1 Low Cost (LC) strategy

Low cost manufacturing strategy aims at maintaining the cost competitiveness of the product vis-à-vis immediate competitors. It is usually associated with mass production systems involving basic products, where cheap labour remains the driving force. Companies adopting low cost manufacturing strategy use dedicated automation systems with heavy emphasis on inspection to meet quality requirements. These companies usually migrate from one location (country) to another in search of low cost labour for their cut, make and trim (CMT) operations. The salient features associated with low cost strategy are:

1. Competitive price
2. Low variety (moderate concern for design) associated with medium to large batch size
3. Comparatively medium quality garments
4. Long lead times

The market categories serviced by companies adopting the low cost strategy include discount stores, retail chains and department stores.

3.4.2 High Value Added (HVA) strategy

In contrast with a low cost manufacturing strategy, whereby the emphasis is on maintaining the cost competitiveness of the garment, a high value added strategy aims to build up competitive advantages in terms of fabric and garment design and quality to serve the upper end of the market involving designer shops and Haute Couture. This strategy is used for generating and manufacturing new designs, through creativity, innovation and ingenuity that provide superior or unique product performance, features, durability, serviceability and/or aesthetics. Companies taking on HVA strategy usually have extensive in-house research and development on fabric and product design. Also, total quality management (TQM) or quality assurance (QA) programmes are used to ensure compliance to customer requirements. The cost competitiveness of the products is usually achieved through the implementation of continuous improvement policies like productivity monitoring procedures and total employee involvement (TEI) programmes. Integrated information and communication systems ensure prompt exchange of data between all players forming part of the supply chain. The salient features of high value added strategy are:

1. Innovative design
2. Excellent quality
3. Small to medium batch size

3.4.3 Quick Response (QR) strategy

Quick response strategy is about finding means and ways to reduce the time span which occurs in the period between the moment the customer defines his requirement and the moment the merchandise is received by the customer (Forza and Vinelli 2000, Hunter 1999). Time compression combined with relatively small batch sizes, can provide considerable competitive advantage for companies involved in garment manufacture by allowing for significant reduction in forecasting errors in terms of product mix and volume, and hence, in cost for stock maintenance and merchandise sold as mark-down goods. QR strategy thus aims at achieving customer expectations by providing the right products in the right place and at the right time in the right quantities and hence eliminating possibilities for wastes (including unsold stocks) and high opportunity costs. The emphasis here is on manufacturing flexibility for meeting changing market demands based on point of sale or other information provided by the customers. The salient features are:

1. Small batch size with possibility for repeat orders
2. Medium to high quality
3. Fast and responsive delivery

Though companies using QR strategy have been serving the upper end of the market, there are more and more pressures from retail chains and department stores for the implementation of QR strategy.

3.5 Manufacturing Strategy and System Modelling

Bearing in mind the scope of this research work and the strategic options available, it was required to analyse the content and structure of a typical garment manufacturing system in order to achieve any one or any combination of the manufacturing strategies within its operational boundaries. It was found that though previous literature does provide details on the processes, frameworks and contents of manufacturing strategy, the use of specific tools and techniques for both generating and assessing the results of implementing specific strategies was completely missing. For the manufacturing strategy generation model proposed by Skinner (1974) and selected for this research, illustrated in Figure 3.8, the existing literature for instance, provides no answer to a number of key issues like:

1. How company inventory is managed and data collected for the purpose of manufacturing strategy assessment and selection?
2. How do other functions influence the choice of manufacturing strategies?
3. What are the boundaries to the manufacturing function?
4. How a holistic approach to manufacturing strategy assessment and selection can be achieved?

In an attempt to provide answers to the above issues, a manufacturing system model was developed and validated for garment manufacturing companies. The model provided a mechanism to illustrate at a sufficient level of detail:

1. The link between the manufacturing function and other functions in the organisation
2. The control systems including the information systems in operation
3. The input to and output from each functional area
4. The materials, auxiliaries, tools and equipment being utilised
5. The human resources involved and
6. The interrelationship between all the above

The manufacturing system model was eventually used for the development of a manufacturing strategy audit tool for the assessment of the current practice and for the selection of alternate strategies for achieving enhanced product competitiveness.

A number of systems modelling tool and techniques were surveyed to support the development of the manufacturing system model. System modelling is most useful for illustrating in detail all the above parameters, together with the interactions involved in the manufacturing process. This was the basic requirement for a new methodology for manufacturing strategy formulation and analysis.

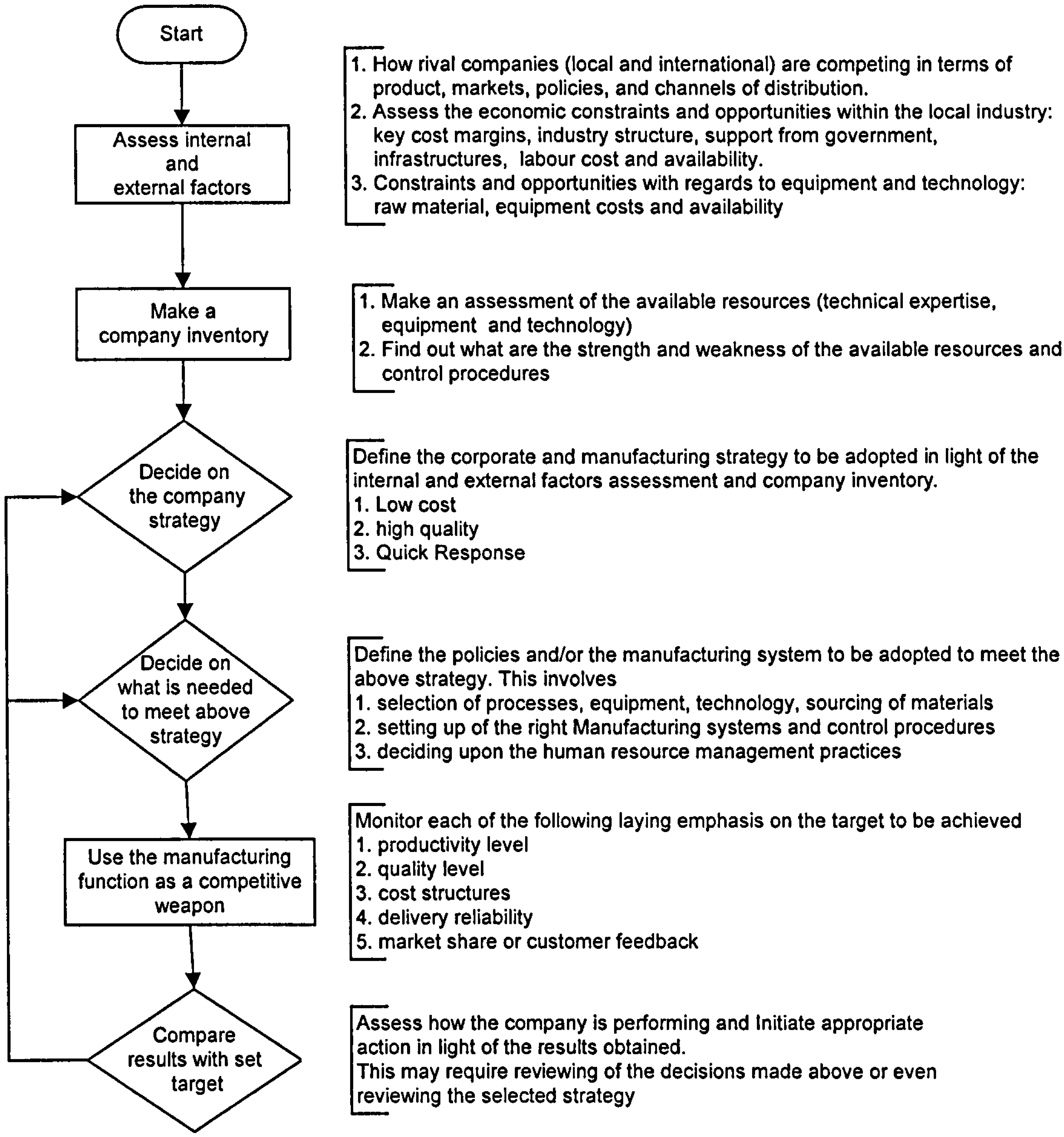

Figure 3.8 The process of manufacturing policy determination

(Source: Skinner, 1974)

3.6 System Modelling Methodologies and Tools

A system is defined as a collection of components, which are interrelated in an organised way and work together towards the accomplishment of a certain logical and purposeful end (Wu, 1996). The following are the salient features of a system:

1. It constitutes of an assembly of components including the input, output, processes, feedback controls and constraints

2. It has a logical relationship between the components
3. It has a well defined objective
4. It provides both a holistic and hierarchical view of the model; that is, a system can itself be part of a wider system and can be broken down into a number of sub-systems.

Modelling on the other hand is an abstraction, a representation of a part or the whole of a real system developed for understanding, analysing, improving or replacing the system. Models describe what a system does, what controls it, what things it works on, what means it uses to perform its functions, and what it produces.

3.6.1 Classification of system models

Manufacturing system models have been classified in different ways depending upon the expected outcome from the models. This can be representative of an open system with interaction with the environment or a closed system, which is self contained without any interaction with the environment. The various possibilities for classification of manufacturing systems models are shown in figure 3.9.

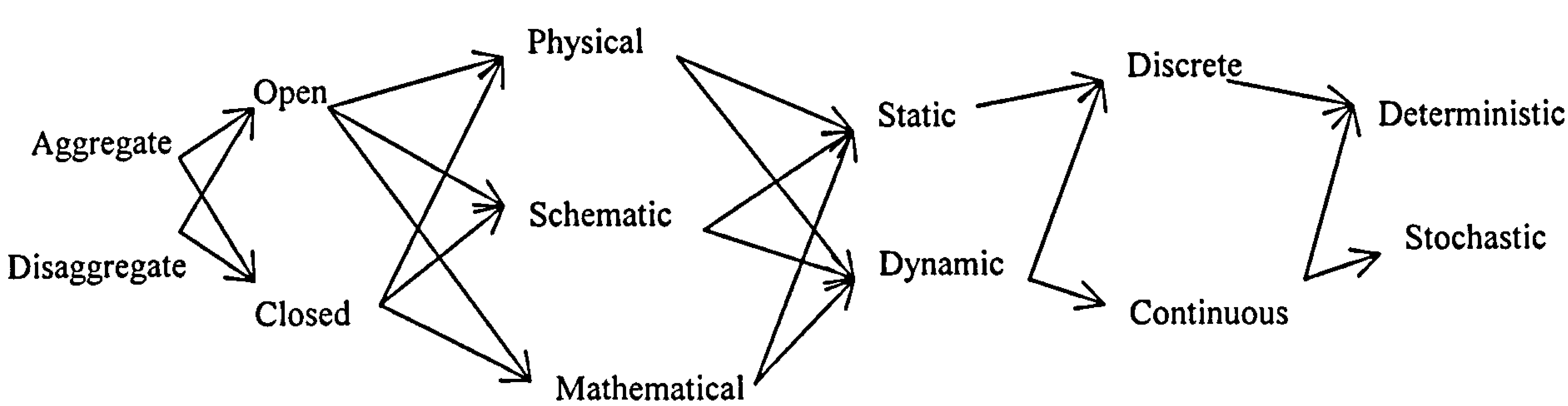

Figure 3.9 Types of System models

In addition to being open or closed, manufacturing system models can be considered as being physical, schematic or mathematical (McMillan and Gonzalez 1973). Physical models describe the system through the use of the real objects constituting the system while schematic models are pictorial representations of the constituents of the system and their interactions. The latter systems are also referred to as conceptual models, which are usually static in nature (Planche 1992). Static models attempt to provide a static representation of dynamic systems. They portray the relationship between all functions within the system and are useful to generate logical models for analysis purposes. Static systems cannot however, depict the time-variant behaviour of the manufacturing systems that are generated as a result of variations in inputs and/or controls.

Mathematical models on the other hand, consist of sets of equations that give solutions, which explain or predict changes in the state of a system. Askin and Andridge (1993) and Doumeingts et al. (1995) classify these as simulation models. These models are usually dynamic; that is, they attempt to describe the behaviour of the manufacturing system over time under different operating conditions. They can provide information about the state of the system or generate performance measures of the system over a given period of time.

Systems can be further categorised as continuous when system variables change continuously or discrete when system variables change in a stepwise manner, over time. In addition, depending on the input/output relationship, a system can be deterministic or stochastic. In the former case, the system exhibits unique and direct cause and effect relationship between the inputs and outputs (for a given input there is only one output possible). In the latter case, the relationship between the input and output can only be analysed in statistical terms (both input and output have random variation though cause and effect relationship still exist).

One further categorisation of system models is in terms of the level at which the system is being designed or analysed, whether this is at macro or micro level. This is illustrated by the level of aggregation of information within the model. While being treated at the macro level, aggregate models are produced. These are useful for studying the strategies (long term policies) of the manufacturing organisation (Forrester, 1975). The products, workforce, equipment and other resources are treated as aggregate entities within the model. Detailed production processes are not dealt with in aggregate models. Micro level models, referred to as disaggregate models, on the other hand are used to produce very detailed models for short term planning purposes or for solving specific problems within the enterprise. The entities of such models for instance include raw materials, parts and subassemblies, machines and operators as individual items. These types of models have been most widely used for simulation of manufacturing systems.

3.6.2 System methodologies

A methodology is an ordered set of tasks, which if undertaken, achieves a specific aim; for instance while deciding on major investments, a methodology guides the decision-maker on the aspects of the investments that are necessary and how these can be integrated into the manufacturing system. Also, the methodology provides the means for assessing the likelihood of success in order to allow an informed decision to be made as to whether the required investment can be justified. The review of previous works shows various methodologies that have been developed and used for the modelling of information systems, advanced manufacturing systems and Computer Integrated Manufacturing Systems. Though none of the methodologies have been used in the context of manufacturing strategy formulation and assessment, a number of them do share some features, which can prove to be useful for the present study. These methodologies include SADT (SofTtech Inc., 1970), the GRAI Methodology (Doumeingts et al, 1995) and Object Oriented Methodologies (Gaafar and Bedworth, 1994).

A. Structured Analysis and Design Technique (SADT)

SoftTech, Inc. developed SADT in the early 1970s, as a methodology for the activity and data modelling of manufacturing systems for analysis purposes with a view to achieve enhanced productivity (Marca and McGovan, 1988). It is based on the hierarchical representations of the activities that occur and the way data is processed in the organisation through the use of activity diagrams (actigrams) and data diagrams (datagrams) respectively. The models are constructed by starting with a parent diagram (also referred as context diagram) which is then decomposed into a number of child diagrams to give more detailed modelling as shown in figure 3.10. The number of lower level decomposition is however limited to six in order to keep the model simple and manageable.

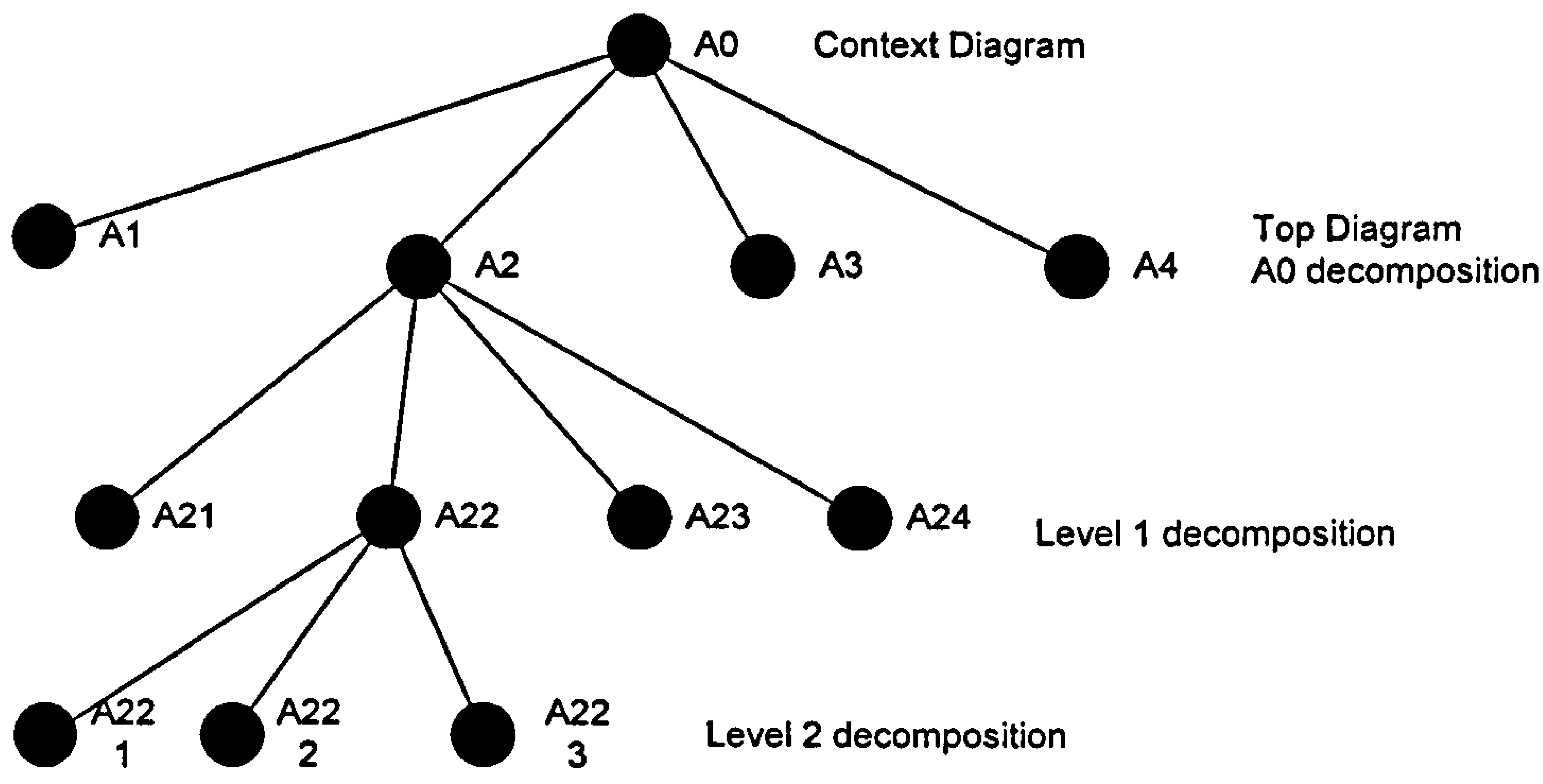

Figure 3.10 SADT diagram hierarchy with labelled nodes

In both the actigrams and the datagrams boxes as shown in figure 3.11 represent the nodes of the hierarchical tree. Each box or node has a text label that describes the activity performed or the data stored by the node and has a unique number that can be used to trace back its relationship with the parent diagram

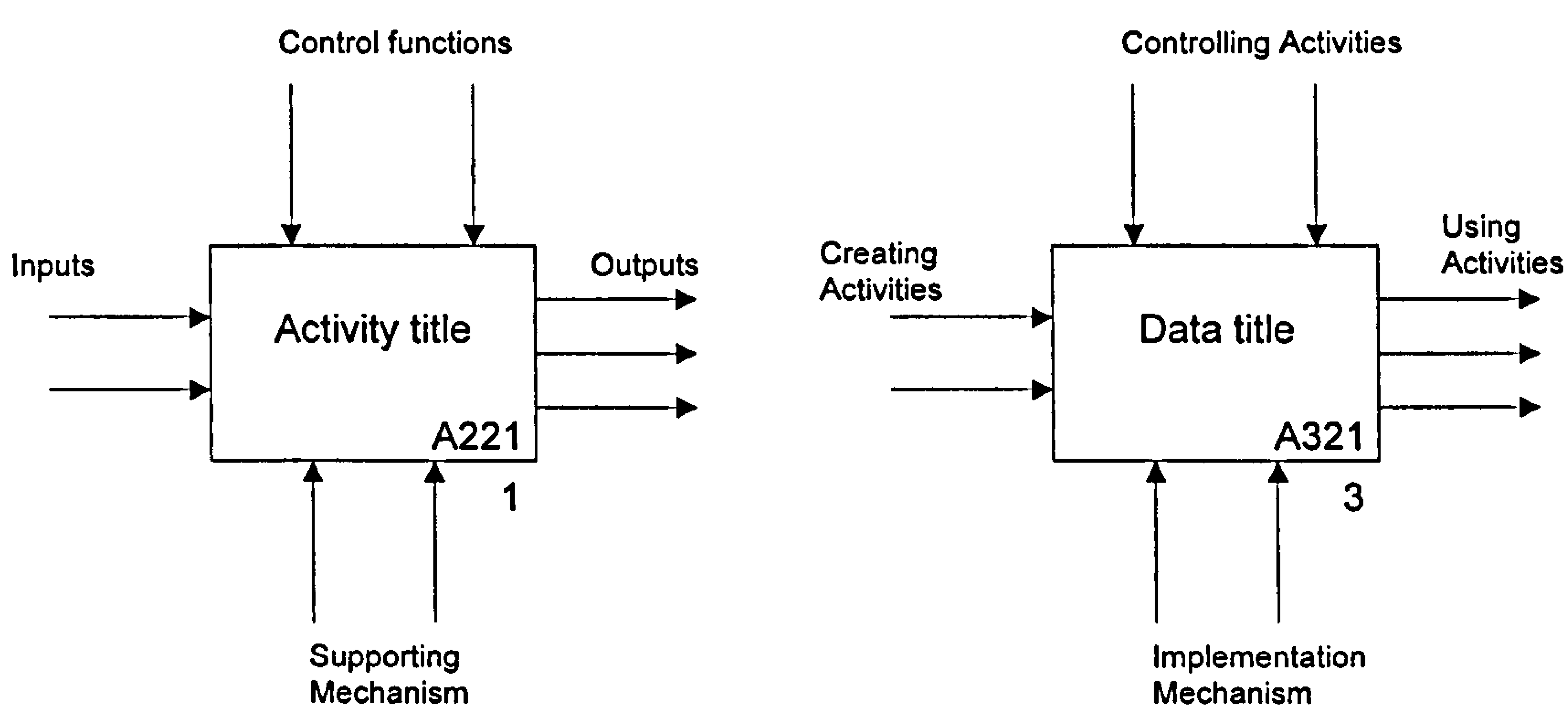

Figure 3.11 Actigrams and Datagrams

Arrows to and from the node define the input, output, controls or mechanisms used at that particular node. The arrows are labelled accordingly with I, O, C and M as prefixes.

The input, output, control and mechanism can however be shared by a number of nodes. Also, the output from a particular node can serve as input or control for another node. Thus arrows within the SADT diagrams serve to link the various nodes across the hierarchy of the system model as shown in figure 3.12.

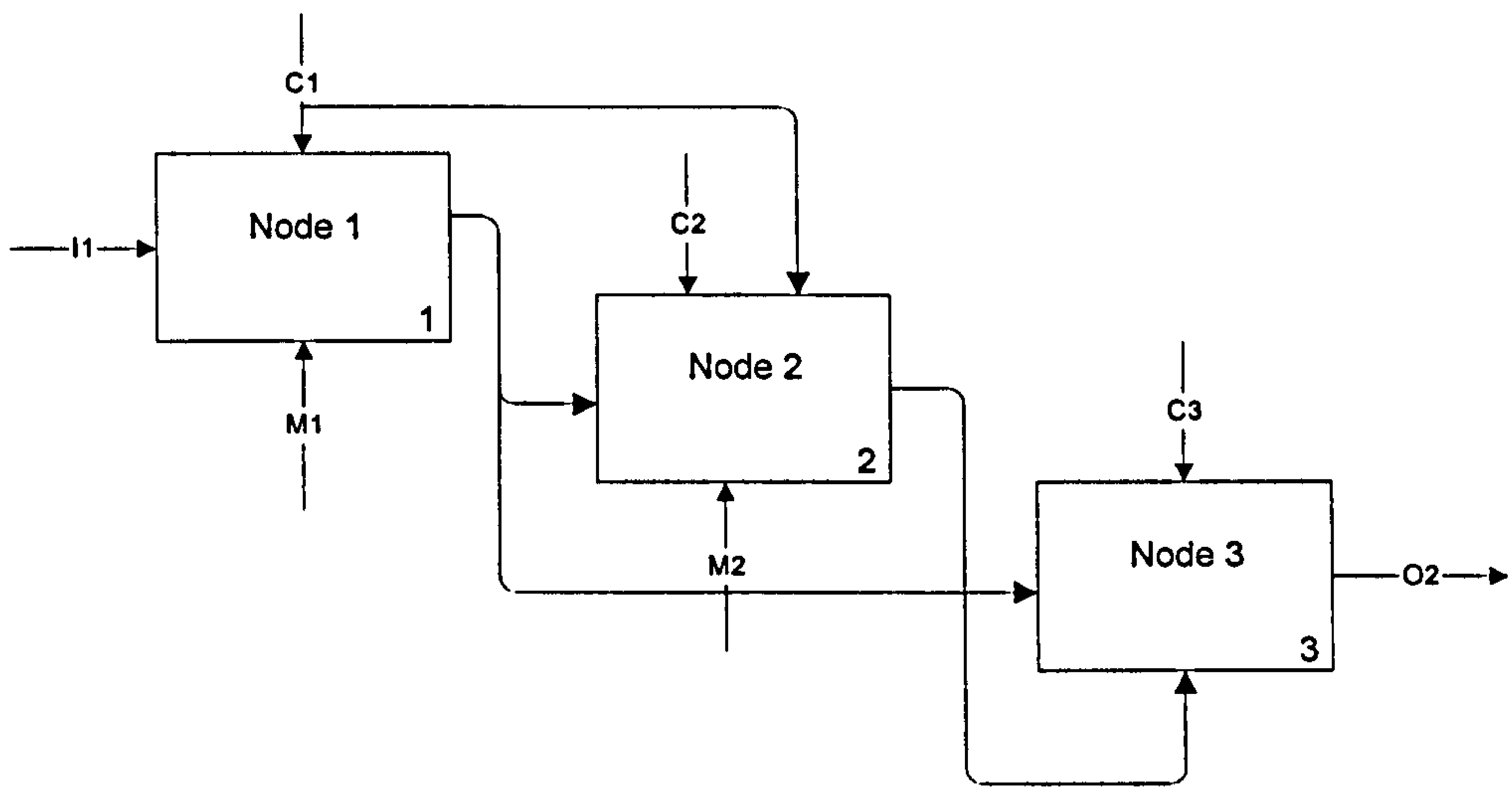

Figure 3.12 SADT diagram

The SADT methodology thus involves

1. The creation of a model to represent the activities that are undertaken or the data flow within the organisation. Prior to creating the model, it is usually vital to define the purpose of the exercise in order to set the boundaries of the system and decide on the tools to be used (actigrams and/or datagrams).
2. Once the model is produced, interviews are carried out to analyse the system for possible shortcomings and modifications are made accordingly to generate a new model of the manufacturing function or the information system.
3. The next step is to create a detailed specification of the new system. This is done by succinctly describing each activity and its relationship with others within the system.

B. The GRAI Methodology

The Graphe à Résultats et Activité interliés (GRAI) methodology was developed by the GRAI laboratory at the University of Bordeaux-I in France in the early 1980s

(Doumeingts et al 1987). Its objective was mainly to model the decision making process and associated information flows in manufacturing organisations. The methodology involves the following stages:

1. The development of a conceptual reference model illustrating the physical and information systems within the manufacturing organisation. The physical system transforms materials into products and is co-ordinated by a hierarchy of control or decisional systems. The information system carries all data transfers between and within the systems. These can be modelled using any appropriate system-modelling tool.
2. The second stage involves the analysis of the decision making process within the conceptual model through the utilisation of GRAI grids and GRAI nets. A GRAI grid is a table illustrating the location of decision-making centres (DC) in the manufacturing system to show where a decision is made and the time scales (frequency) in which decisions are made at each of the DCs. The columns of the grid correspond to the type of activities to be performed while the rows correspond to a value of the corresponding horizon or review period (see figure 3.13). For each DC, the column entry shows the function to which the decision is related to and the row shows the corresponding decision horizon and review period. The grid also illustrates the information and decision flows between the DCs: a simple arrow represents an information link while a double arrow represents a decision flow. The top-down approach is used for the construction of GRAI grids.

Horizon/ Period	Function				
	External information	To Design	To Planning	To Purchase	To Manufacture
H = 1/2 years P = 2/3 mts	Customer info.	Product Development	Master Plan		
H = 4/5 mts. P = 1 day	Customer Orders		Production Plan	Purchasing	
H = 1/2 wks P = 2/3 hrs.			Shop schedule		
Real Time					Production

Information flow →   Decision flow ⇒

H, Horizon: time lapse through which a decision made is valid
P, Review Period: the time interval at the end of which decisions are revised

Figure 3.13 The GRAI grid

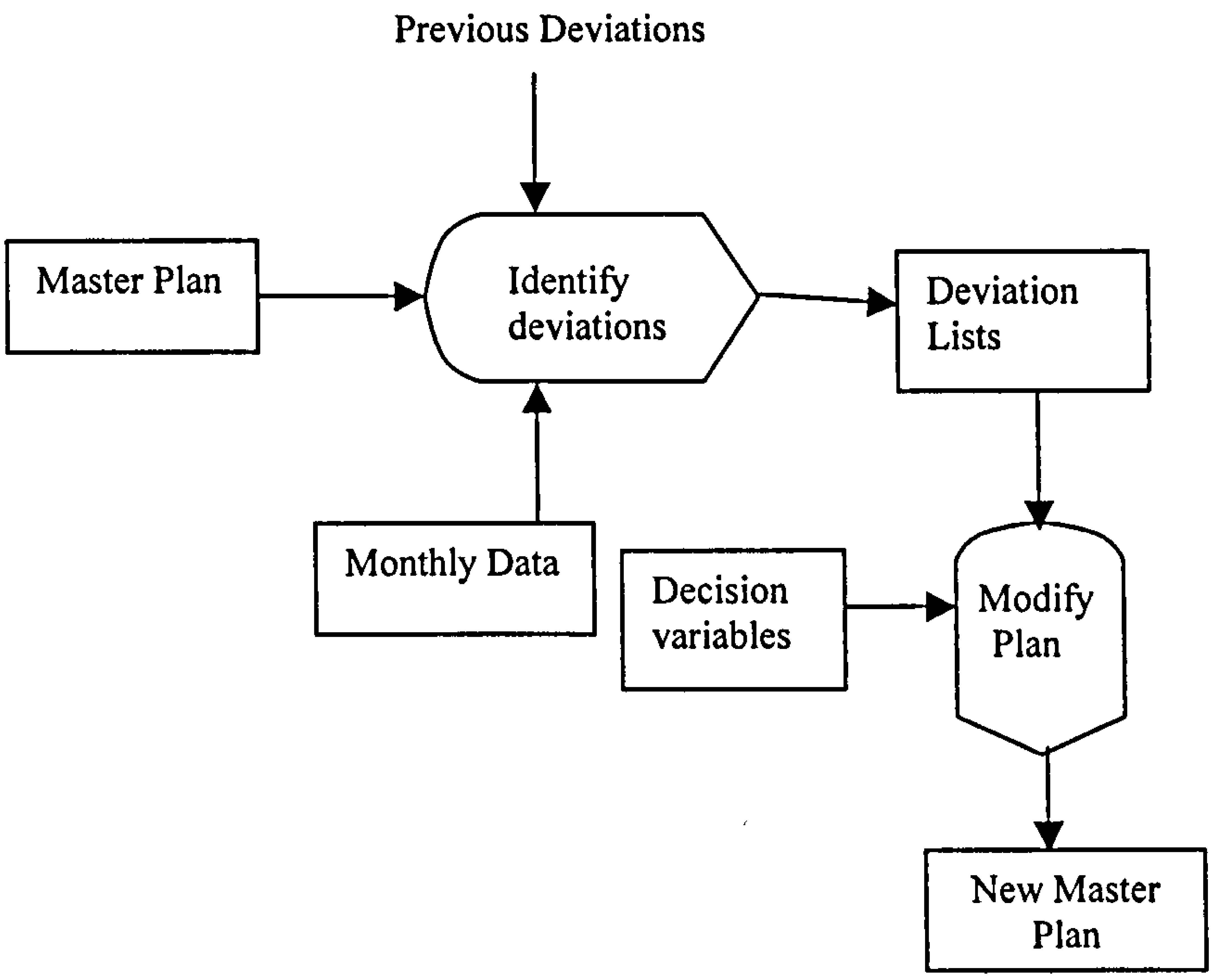

Figure 3.14 GRAI net

A GRAI net on the other hand uses a bottom up approach to describe the activities that are involved in each decision centre as shown in figure 3.14. Each activity has an initial and a final status, indicates the support information required and the output. The result from an activity can be the connecting input or resource to another activity.

GRAI grids and GRAI nets are used to identify faults such as missing information, lack of updated information, poor synchronisation, wrong procedures, inadequate criteria, non defined decision frames, missing DCs or incoherent co-ordination between DCs.

3. The last stage involves the design of a new manufacturing system model after refining the inconsistencies observed during the analysis stage. GRAI grids are used to model the structure of the new system and the construction of the decisional frame. Each DC is supported by a GRAI net, which presents a more detailed view of the activities involved within the DC.

C. Object Oriented Methodologies (OOM)

The object oriented approach for modelling of manufacturing systems views the system as a combination of objects, which are an abstraction of the entities in the real world encapsulating all the information about them (identity, state, class, the action provided and the interface with other objects). The methodology involves:

1. Specifying the system structure in terms of classes and inheritance hierarchies. A class is an object that acts as a template, specifying the properties and behaviour for a set of similar objects in terms of attributes, the external interfaces and the actions/services they provide. The relationship between classes is defined within a hierarchy of super-classes and sub-classes. A sub-class usually inherits commonalties from one or more of the super-classes. Inheritance thus allows the sharing of behaviour and data between objects through the definition of sub-classes by using the template of the corresponding super-classes. The tools used for identifying the classes and objects are functional block diagrams and system relationship diagrams.
2. Once the classes have been identified, the attributes of each of the objects and, the operations provided by and required of each object, within the system are identified.
3. The relationship or interfacing between the objects is established and lastly
4. The manufacturing system model is developed.

Several OOM have been developed for the design and analysis of manufacturing systems amongst which, the Object Oriented Analysis (OOA) approach (Coad and Yourdon, 1991), the Hierarchical Object Oriented Design (HOOD) approach developed by the European Space Agency, the BOOCH approach (Booch 1991), the Hierarchical Object Oriented Manufacturing Systems Analysis and Definition (HOOMA) approach (Wu, 1994) are the most commonly cited ones. The major difference between OOM and the other methodologies described above is that OOM incorporates both design and analysis during the development phase of the model. Also, OOM allows the merging of the functional and data perspectives of the entities constituting the model.

3.6.3 System Modelling Tools

In contrast with a methodology, a modelling tool is defined as a communication device used to aid in the generation and classification of ideas, and/or to analyse the quality of a design (Pandya, 1995). A methodology usually involves the use of one or more of system modelling tools for instance, GRAI grids are one of the modelling tools used in the GRAI methodology. In addition to the modelling tools already discussed in the system methodologies above (datagrams, actigrams, GRAI grid, GRAI net), there are other tools which have wide applications in the design and analysis of manufacturing systems. The most relevant ones for the present research include the Integrated Computer Aided Manufacturing Definition (IDEF) set of tools, the Input/Output Analysis method and Simulation.

A. The IDEF Set of Tools

The IDEF family of methods was developed as part of the US air force Integrated Computer Aided Manufacturing (ICAM) programme in the 1970s. The methods aimed at modelling the information and organisational structure of manufacturing systems for achieving increased integration through manufacturing automation. To date, the IDEF methods consist of a series of methods ranging from IDEF0 to IDEF14, of which IDEF0, IDEF1, IDEF1X (IDEF1 extended), IDEF2, IDEF3 and IDEF4 are the most cited; IDEF 5 through IDEF14 being only at the developing stages. A brief description of the IDEF tools is given in table 3.5.

Methods	**Perspective**
IDEF0	Function Modelling
IDEF1	Information Modelling
IDEF2	Simulation Model Design
IDEF3	Process Description Capture
IDEF4	Object-Oriented Design
IDEF5	*Ontology Description Capture*
IDEF6	*Design Rationale Capture*
IDEF8	*User Interface Modelling*
IDEF9	*Scenario-Driven IS Design*
IDEF10	*Implementation Architecture Modelling*
IDEF11	*Information Artefact Modelling*
IDEF12	*Organisation Modelling*
IDEF13	*Three Schema Mapping Design*
IDEF14	*Network Design*

Table 3.5 IDEF Methods (methods in Italics are currently being developed)

The IDEF0 Method

IDEF0 is the most commonly used modelling tool among all the IDEF methods. It is a subset of the activity modelling technique in SADT and provides a graphical representation, on a hierarchical structure, of the functional activities within a system. A node chart similar to that used in SADT is used to provide a quick index for locating details within the hierarchic structure of the diagram. The basic element of an IDEF0 model is a function block, which illustrates an activity within the system together with details pertaining to the inputs (I), the controls (C), the outputs (O) and the mechanism (M) (referred to as ICOMs) for the activity to take place as shown in figure 3.15.

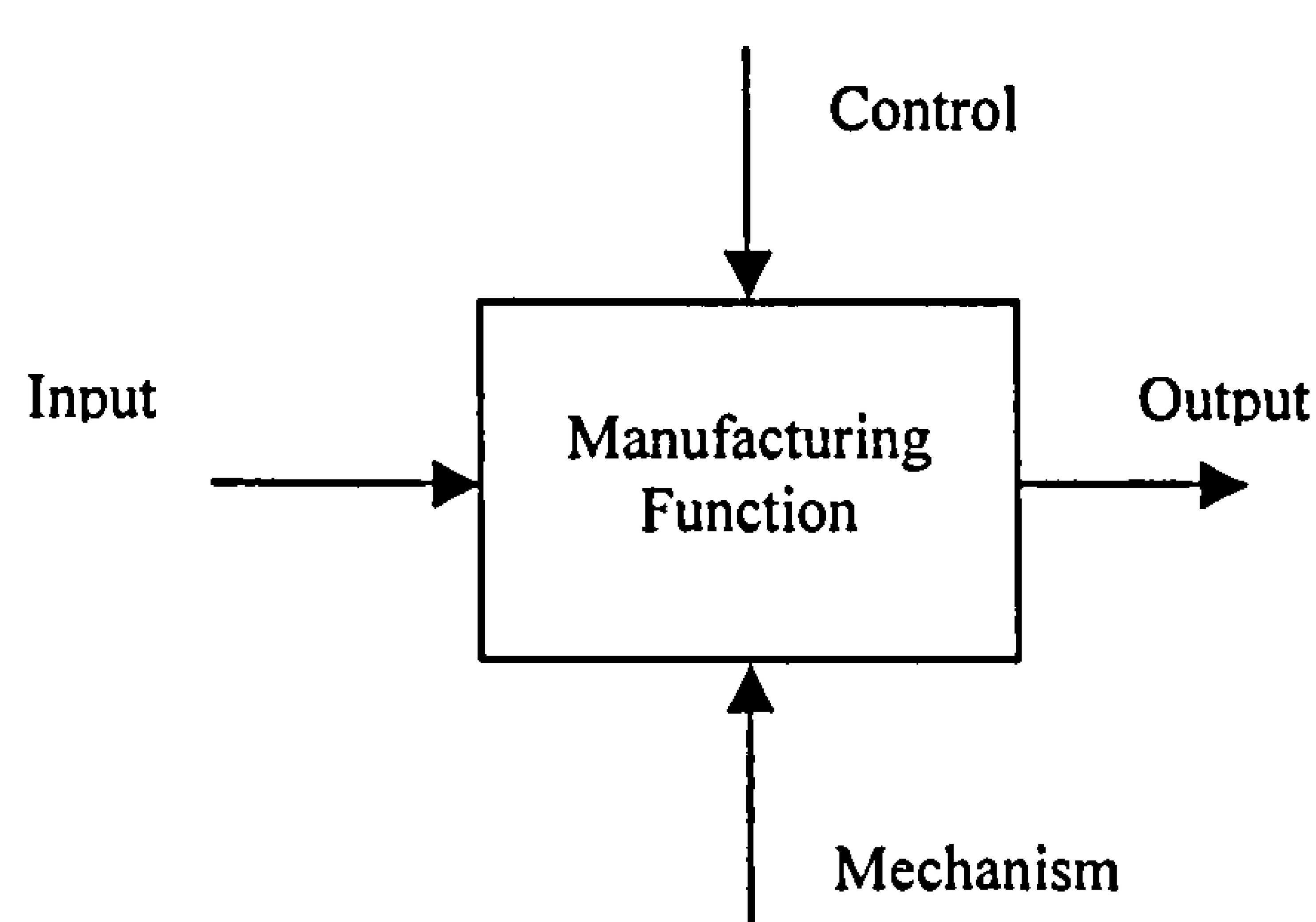

Figure 3.15 IDEF0 function block

Input to a function, entering the block from left to right, is usually consumed by the function to produce the outputs (raw materials consumed to produce the final product). The mechanism indicates the resources that are required to carry out the transformation process (e.g. equipment, tools and operators used in the process of converting input to output). The controls are used to influence the transformation process but are not consumed or processed themselves (e.g. production plan).

Through the use of the function blocks, the IDEF0 model can be exploded to any level of detail in order to model the activities within a company. The model usually starts with a single function block (context/top diagram labelled as A0 block) which is decomposed into a number of child-diagrams which can themselves be decomposed further until the required level of detail is achieved (figure 3.16).

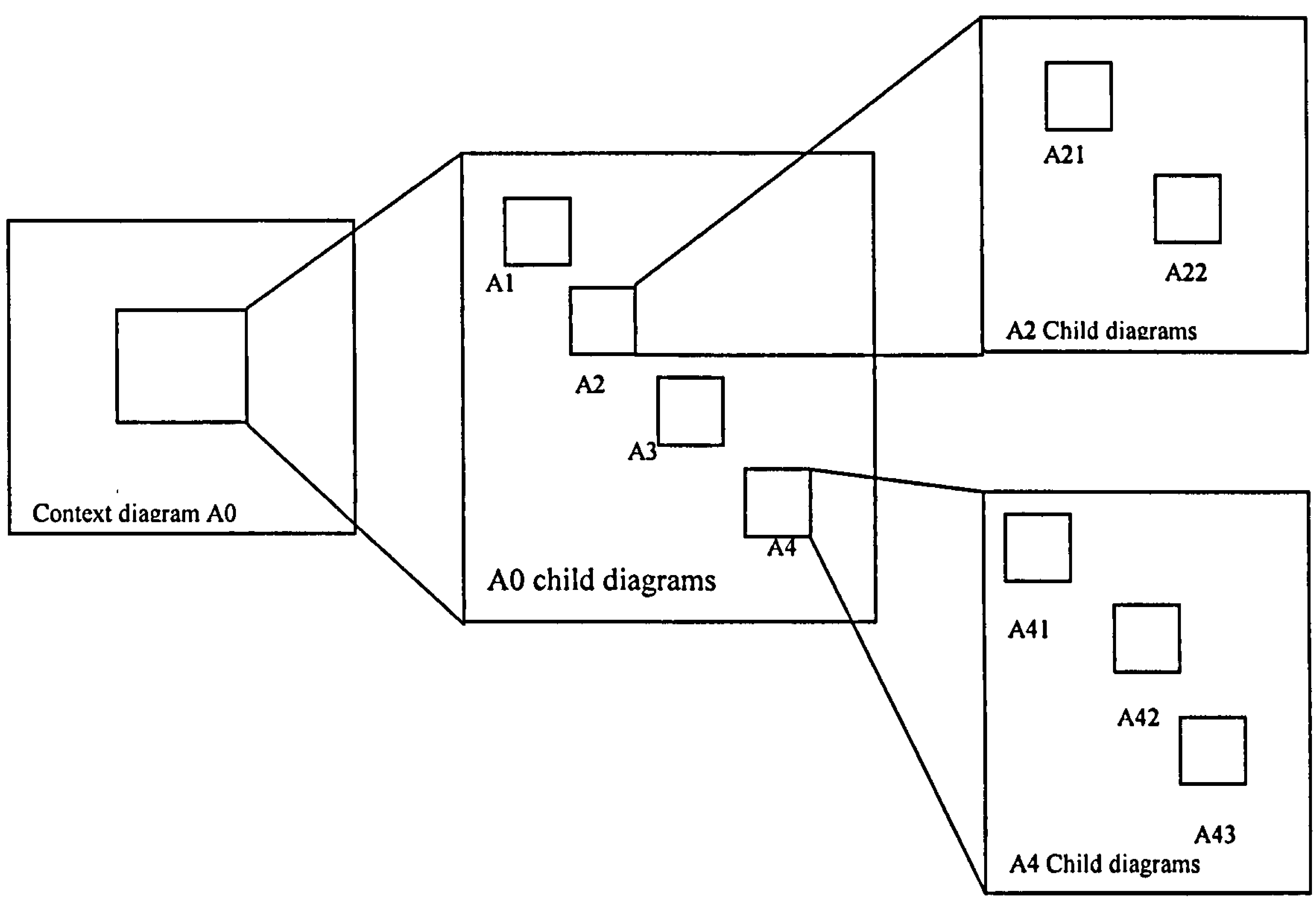

Figure 3.16 IDEF0 functional decomposition

In addition to containing information in terms of the ICOMs, each function block has a unique label, which can be used to trace back the relationship of the child diagrams with the corresponding parent diagram. In order to keep the model simple and comprehensive, each function is decomposed to a maximum of six lower level sub-functions: functions that cannot be subdivided into at least three lower level sub-functions are not considered for further decomposition.

The use of the IDEF0 modelling tool allows an organised representation of the activities taking place within an organisation. The functions are modelled at the most appropriate level of detail until the model is as descriptive as necessary for the decision-making task at hand. It is usual to have a model representing the current practice (AS-IS model) that is analysed for shortcomings and to develop from this a TO-BE model, with appropriate enhancements to meet the shortcomings.

IDEF1 Method

The IDEF1 method is used for information modelling. It is an analysis method to capture, communicate, analyse, and understand the information needs of the enterprise. IDEF1 is generally used to:

1. Identify what information is currently managed within the organisation,
2. Determine the problems caused by lack of management of appropriate information and find appropriate solutions, and
3. Specify what information will be managed in the TO-BE enterprise model

Strategic and tactical planners use the IDEF1 models to analyse the requirements of the enterprise for the design and development of computerised management information systems.

IDEF2 Method

The IDEF2 method was developed to represent the time varying behaviour of resources in a manufacturing organisation (dynamic modelling). However, its development was hindered by the availability of various commercial products and notations representing dynamic simulation languages.

IDEF3 Method

The IDEF3 Process Description Capture Method provides a mechanism for illustrating and documenting processes. IDEF3 captures the precedence and causality relations between situations and events by providing a structured method for expressing knowledge about how a system, process, or organisation works. IDEF3 descriptions are useful for:

- Recording the raw data resulting from fact-finding interviews in systems analysis activities.
- Determining the impact of the organisation's information resource on the major operation scenarios.
- Documenting the decision procedures affecting the states of the major functions within the enterprise for instance, manufacturing, engineering and maintenance.
- Managing data configurations and changing control policies.
- Making system design and design trade-off analysis.
- Providing the basic data for generating simulation models.

IDEF3 thus captures the behavioural aspects of an existing or proposed system, which is structured within the context of a scenario, making the method an intuitive knowledge acquisition device for describing a system.

IDEF4 Method

The IDEF4 method is an object oriented (OO) design method for developing software systems. It divides the object-oriented design activity into discrete, manageable chunks that are supported by a graphical syntax that highlights the design decisions that must be made and their impact on other perspectives of the design. It uses graphical syntax and diagrams (inheritance diagrams, protocol diagrams, taxonomy diagrams and client diagrams) as aids to focus on and communicate important design issues. The salient feature of the IDEF4 method is that one can swap between diagrams to have an overview of the design process rather than having all details fitted in one diagram or model.

B. Input Output Analysis (IOA)

IOA aims at solving specific problems within an enterprise by analysing the inputs required in order to generate predefined outputs (Pandya, 1995). The method thus starts by assessing the present system and defining the system requirements for producing the outputs. Following this, system inputs are configured based upon system requirements and the outputs identified. The main components of the IOA model are the inputs and outputs. Hence, the IOA model connects the organisation sub-systems based upon inputs and outputs. The inputs of one sub system can be connected into the outputs of another subsystem. This method is very simple and gives an obvious representation of an organisation's model. On the other hand, this method has some limitations such as misinterpretation, subsystem details not being included, and the complexity of creating feedback or parallel activities within the model.

C. Simulation

Manufacturing systems simulation is an experimental approach for studying and analysing the functional properties of the system by producing an appropriate computer model rather than by experimenting with the real system (Wu, 1994). This is achieved either through programming or through the utilisation of simulation software. Simulation provides a low cost and flexible way to experiment with changes needed within the organisation in order to achieve improved performance. In addition, it has the ability to model the real time behaviour of the system under investigation and provides graphical means (computer animation) for analysing the response of the system to changes. To date simulation has most widely been used at the micro level within organisations; modelling of specific processes in order to find appropriate solutions to specific problems (e.g. simulation of the shop floor for solving work in progress or line-balancing problems). Large scale simulation or macro simulation has only been rarely used and has been criticised for requiring a large amount of human and computing resources to develop, making them too complex, too expensive and time consuming to be of any real use (Wu 1994).

The stages involved in the development of simulation models involve

1. Problem analysis, whereby the need for the simulation exercise is clearly specified and the boundaries of the problem are defined. This stage equally allows users to define the type of simulation model that will be required (static/dynamic, continuous/discrete, stochastic/deterministic, aggregate/disaggregate).
2. Data collection. This involves the collection of all information (qualitative and quantitative) that is pertinent to the development of the simulation model. The data collected should be in line with the terminology associated with the

programming language selected or with the simulation software (e.g. entities, attributes, resources, queues, events, activities, and processes).

3. Generation of simulation model specification. Once the data has been collected, decisions are made with regards to expected outcomes from the simulation model, which constitute the specification for the simulation exercise.
4. Model development, verification and validation. This step ensures that the model developed is an accurate representation of the real system.
5. Simulation experimentation allows the user to make changes to the model and analyse the effect of the changes on the model. Graphics animation is usually used to display the results of simulation.
6. Evaluation and interpretation of simulation results. All possibilities are investigated with regards to finding appropriate solutions to the problem identified.
7. A report is produced containing an in-depth analysis of the possible solutions to the problem identified in step 1 above.

3.7 Methodology for Formulation and Analysis of Manufacturing Strategy

The system methodologies and modelling tools reviewed so far are from a non-exhaustive list of techniques available for the design and analysis of information and manufacturing systems. However, only some of the selected ones were found to contain features that can be used as part of a novel methodology for the formulation and analysis of manufacturing strategies. It should be noted that none of the techniques discussed have been used so far, for the formulation and/or analysis of manufacturing strategies specifically for the process of garment making.

The requirements of the present research work in terms of modelling was in the first instance, to produce a generic computer based functional model of the apparel manufacturing system to an appropriate level of detail in order to illustrate:

1. all functions having an influence on the manufacturing strategy or vice versa,
2. the interaction between the functions,
3. the information flow, and

4. the utilisation of resources for the accomplishment of each function.

The prime objective of this exercise was for data identification, collection and representation through the use of a simple and comprehensive graphical model. The model would serve as a basis for the development of a manufacturing system audit tool, as an aid for the evaluation of the information support, the resources needed and the characteristics of each function in order to achieve any one or a combination of the competitive manufacturing strategies.

From an evaluation of the surveyed system methodologies and tools, for the purpose of producing the above model, it was found that the SADT methodology and the IDEF0 tool best meet the requirements of the research. The assessment criteria used for the evaluation and the results are shown in table 3.6.

Model Requirements	System Methodology			System Tool		
	SADT	GRAI	OOM	IDEF0	IOA	Simulation
Easy to learn, use and understand and allows to produce simple and comprehensive models	√√	√	√	√√√	√√	√
Provides a decomposed view of the manufacturing system (high to low level of decomposition of each function within the enterprise)	√√√	√	√√	√√√	√	√√
Computer based i.e., provides the appropriate graphics interface	√	√	√	√√√	√	√√√
Provides the interface to store information with regards to the functions and the resources needed for at various levels	√	√	√	√	√	√√
Illustrates the relationship between functions	√√√	√	√	√√	√	√√
Illustrates flow of information between functions	√√	√√√	√√√	√√	√√	√√
Allows interfacing for simulation purposes	√	√	√	√	√	√√√
Evaluation: √ average √√ good √√√ excellent						

Table 3.6 Evaluation of system methodologies and tools vis-à-vis the modelling requirements

Based on the literature survey for manufacturing strategy formulation and analysis and system modelling methodologies and tools, a novel methodology was developed in order to achieve the aims of the project. The methodology involved the following stages:

1. The development of a schematic apparel manufacturing system model to represent all the activities involved in the garment manufacturing system based partly on the SADT methodology and using the IDEF0 modelling tool. The manufacturing system model was constructed from data gathered through on site attachment to a selective sample of ten different garment-making companies in Mauritius. The model was eventually validated in the companies to ensure that all activities were comprehensively represented.
2. The development of a database linked to the IDEF0 model for storing detailed information related to decision centres, information and communication systems and resources used for each activity and other constituents of the model.
3. Collection of data through interviews of key resource persons in the manufacturing companies and supporting organisations, related to the range of possibilities for conducting each of the activities in the manufacturing system model. The possibilities involved critical thinking in terms of
   - Who is involved in an activity and what are the possibilities in terms of other people being involved and what could be the best human resource combination for the activity?
   - What is involved in an activity? Are there other possible ways of conducting the activity? What is the best alternative?
   - When is the activity conducted? Is it the optimum time? What are the possibilities in terms of time compression?
   - Why does the activity take place? Can it be eliminated? Are there other options for the activity?
   - How is the activity undertaken? Is it the best choice in terms of process? What are the alternatives in terms of tools and equipment to achieve better practice?
   - What are the possibilities in terms of information, communication and control systems?

4. The development of a manufacturing strategy audit tool was undertaken based on the manufacturing system reference model and the collected data, in line with the manufacturing strategy framework developed by Skinner (1969) and partly in line with the manufacturing strategy auditing concepts developed by Platts and Gregory (1991) and Mills et al (1995). The audit tool was to provide a simple mechanism for manufacturing companies involved in garment making to both assess their current practice and benchmark it against better practices from the industry.
5. The use of the manufacturing strategy audit tool in a sample of garment making companies for validation and testing purposes. These were to be used as case studies to illustrate the effectiveness of the audit tool as a means for assessing the manufacturing strategy of individual companies.
6. Verification of the implications of using the audit tool for the assessment and formulation of manufacturing strategies of the garment-making sector in Mauritius.

Chapter 4
Garment Manufacturing System Modelling

4.1 Introduction

The requirement of the present study in terms of modelling was to produce a schematic, structured representation of all the functions having an influence on the manufacturing strategy of garment making companies. The modelling exercise, using IDEF0 as the system-modelling tool, was undertaken following the data collection process in order to have a clear view and understanding of all the activities that formed an inclusive part of the garment manufacturing process. The constructed model was validated in a representative sample of companies and was confirmed as being representative of the most common activities that take place in the garment making industry. In addition to providing a functional view showing activities and interactions between them, the model was linked to a set of documents, worksheets and databases containing pertinent information regarding each activity. This constituted the data collection phase of the research, the critical analysis of which led to the development of the manufacturing strategy audit tool which is discussed and presented in chapter 5.

4.2 Sampling and Data Collection

The focus of the research was on garment making companies employing more than one hundred employees involved in the manufacture of knitted or woven garments. These companies formed a homogeneous population in terms of the activities involved and the key functional strategies adopted for the design, manufacture and marketing of ready made garments. Companies employing less than one hundred employees, categorised as Small and Medium Scale Enterprises (SMEs), were not considered because these companies were found to be mostly centred around one person, the owner of the SME, and there is no clear evidence of the systematic implementation of functional strategies in these companies (Boodhoo, 2002). Companies involved in knitting activities, manufacture of fabrics (weaving) and those involved in the manufacture of garment accessories were not considered in the research as the manufacturing activities in these companies largely differed from those who employed involving CMT operations.

A total of sixty-eight companies constituted the population for the research. A listing of the companies with details of year of establishment, number of employees and the main products manufactured is given in Appendix C. The information is summarised in table 4.1.

No. of Employees	Manufacture of Knitted Garments No. of companies			Manufacture of Woven Garments No. of companies			Total
	Year of Establishment			Year of Establishment			
	1970s	1980s	1990s	1970s	1980s	1990s	
101-500	Nil	15	3	3	21	6	48
501-1000	Nil	5	1	1	1	Nil	8
>1001	Nil	5	Nil	Nil	6	1	12
Total	Nil	25	4	4	28	7	68

Table 4.1 Population of garment making companies in Mauritius

From the primary data obtained from the Export Processing Zone Development Authority (EPZDA) and the Mauritius Export Development Authority (MEDA), it was found that most of the companies were involved in the manufacture of a range of products rather than specialising in a few products. Also, the companies were seen to work either with knitted or woven fabrics except in the case of a few smaller companies who provided the flexibility to work both with knitted and woven fabrics. This was also confirmed during the preliminary survey of the garment making companies (see section 2.5.3).

Given that the modelling exercise required collection of as much detail as possible, at a macro level (aggregate modelling), for the various activities taking place in the companies, a representative sample of companies was worked out using the stratified sampling method based on the number of employees, the number of years the company was in existence and the type of product the company was manufacturing. By using this method, it was ensured that both medium to large size companies, companies with less and more experience and finally companies involved in the manufacture of both knitted and woven garments were selected. With a stratum containing 30% of the population members, the sample size for the research was twenty-one companies. The strata for the sample of companies are shown in table 4.2. Random numbers were then used to select the companies from the population.

No. of Employees	Manufacture of Knitted Garments No. of companies			Manufacture of Woven Garments No. of companies			Total
	Year of Establishment			Year of Establishment			
	1970s	1980s	1990s	1970s	1980s	1990s	
101-500	Nil	3	1	1	7	2	14
501-1000	Nil	1	1	Nil	1	Nil	3
>1001	Nil	2	Nil	Nil	2	Nil	4
Total	Nil	6	2	1	10	2	21

Table 4.2 Sample of companies for the modelling exercise

All the twenty-one selected companies were contacted and visited to discuss the aims and objectives of the research with the managing director and in certain cases with the personnel manager. Following the first visits, only ten companies showed keen interest in the research. Of the remaining eleven companies, seven agreed to participate in the post modelling auditing exercise. These companies were more interested in the development and use of the manufacturing strategy audit tool rather than on the production of the manufacturing system models. The four remaining companies did not show interest in the research either because the company information was treated as confidential or because of time constraints. Given that the seventeen companies met all the set criteria for the sample and were representative of the population, no additional companies were contacted for the purpose of data collection. Details pertaining to the companies participating in the research are shown in table 4.3.

No.	Company Name	Main Product Manufactured	No. Of employees	Year of establishment
1	*Star Knitwear*	*Knitted Garments*	*1300*	*1987*
2	*Tee Sun*	*Knitted Garments*	*1200*	*1987*
3	Kentex Garments	Knitted Garments	760	1987
4	World Knits	Knitted Garments	700	1991
5	Hong Kong Garments	Knitted Garments	500	1986
6	*Richfield Textiles*	*Knitted Garments*	*390*	*1994*
7	*Avant*	*Knitted Garments*	*350*	*1987*
8	*Nigma Gloves*	*Knitted Garments*	*250*	*1984*
9	Leisure Garments	Woven Garments	1950	1983
10	Sinotex (Mtius) Ltd	Woven Garments	1340	1984
11	*Firemount*	*Woven Garments*	*800*	*1989*
12	*Overseas Garment*	*Woven Garments*	*400*	*1988*
13	*Job Textiles*	*Woven Garments*	*250*	*1986*
14	Noblesse	Woven Garments	225	1986
15	Manupan	Woven Garments	200	1973
16	*L'Innattendue*	*Woven Garments*	*200*	*1990*
17	*R S Fashion*	*Woven Garments*	*175*	*1984*

Table 4.3 Companies involved in the research (companies shown in italics were directly involved in the modelling exercise)

Data collection for producing the apparel manufacturing system model was undertaken in three phases:

1. All the ten companies were visited in order to carry out a preliminary survey to identify the main functional activities taking place in the companies. The site visits were mainly organised through the personnel manager of the companies. During the visits, informal discussions were held with the personnel responsible for the various departments with a view to have a clear understanding of the roles and responsibilities of the department concerned.
2. Following the first site visit to all the ten companies and based on the outcome of the discussions held, a structured open ended questionnaire given in Appendix D, was

developed with a view to collect detailed information from the various departments or from people responsible for specific functions within the enterprise with regards to each of the following:

- Activities and sub-activities involved
- Input to, output from, control and mechanisms (ICOMs) that are associated with each activity/sub-activity
- Relationship and interaction between activities/sub-activities
- Information and communication systems in place
- Decision nodes and time frame for activities and sub-activities

Following use of the questionnaire in the two companies, a number of modifications were brought to the questionnaire to include other items like the

- Quality assurance system
- Maintenance management system and the
- Human resource development system

In addition to collecting information concerning the current practice within the enterprise, in relation with all the above, the views of the interviewees were equally sought with regards to better practices within the industry. Interviewees were thus requested to rate their current practice, where appropriate, as an average or better practice.

3. The companies were visited in a number of occasions, over a period of eighteen months, for collecting the relevant information through organised interview sessions with the personnel directly responsible for each of the functional activities. The questionnaire was used as a guideline document for conducting the interviews and collecting the relevant data.

4.3 Manufacturing System Model Architecture

The objective of the modelling exercise was to create one manufacturing system reference model that could be used to illustrate graphically the maximum amount of detail collected during the interviews and visits to the companies. Three software tools were used for the development of the model:

1. Visio Professional for the development of the IDEF0 model
2. Microsoft Access for creating a database containing information associated with the various activities and sub-activities of the IDEF0 model
3. Microsoft Excel for storing standard forms and documents commonly used in the companies

Figure 4.1 shows the manufacturing system model architecture, which was used as a guide for the construction of the model. While the IDEF0 diagram shows the ICOMs for each of the activities and sub-activities and the interactions between them, the database and excel files support the IDEF0 model by providing more detailed information associated with the activities. The system was designed such that all information can be accessed interactively through the IDEF0 model. However, users can equally access the database and documents independently.

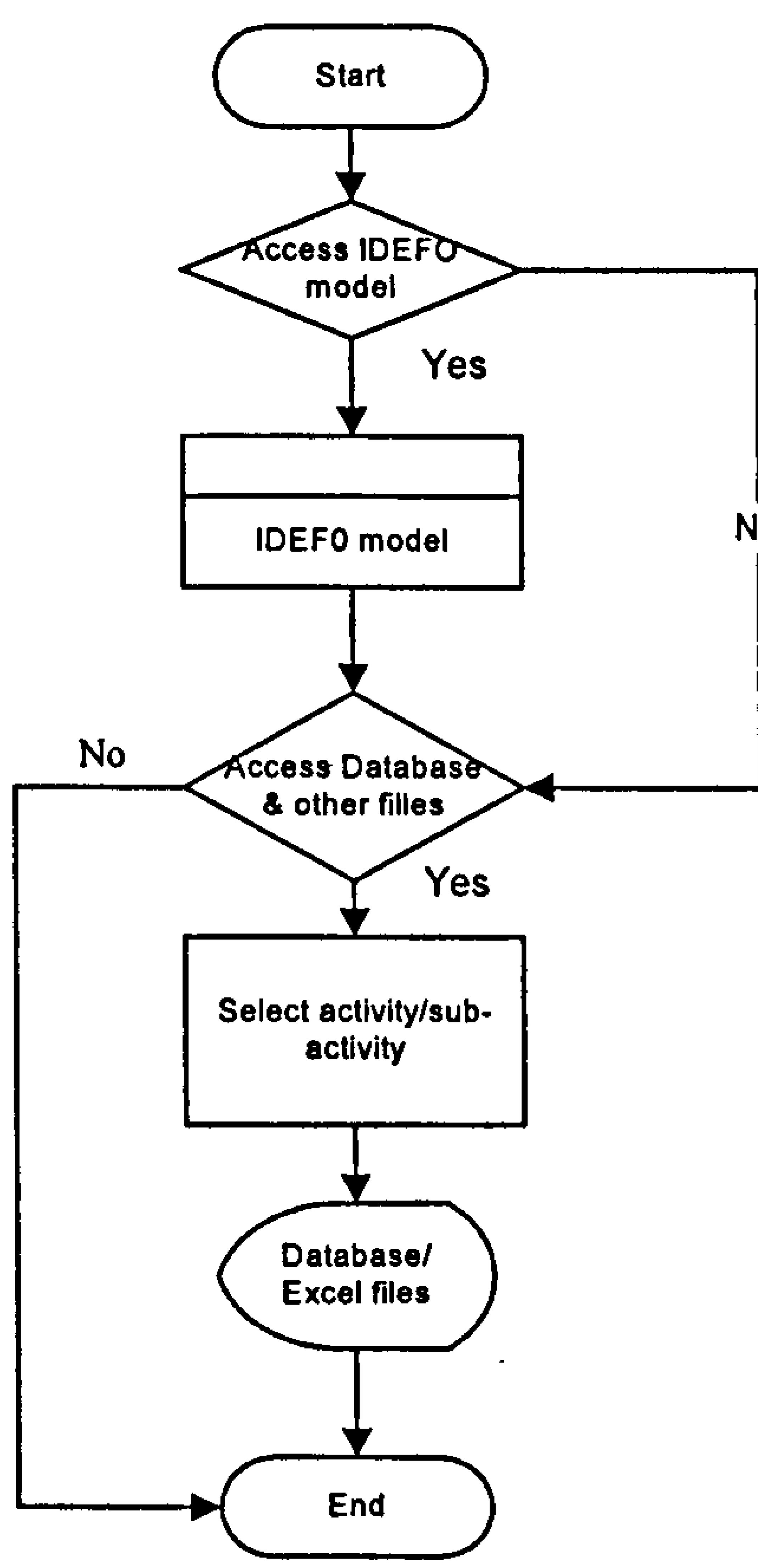

Figure 4.1 Manufacturing system model architecture

4.4 Scope of the Garment Manufacturing System Model

The initial step in the creation of a system model is to set the boundary of the system. In the present case, given that the apparel manufacturing companies were the focus of the research, the boundary of the system was limited to the apparel firm as shown in figure 4.2. The apparel manufacturing system was thus first treated as a black box in isolation with the other systems, external to the firm, directly or indirectly influencing its operations. The interactions with the external systems such as pressures from competitors, buyers, suppliers, changes in the market scenario, legislation and trade regulations, exchange rates, or in the political environment among others were not considered at the present stage as the focus of the study was to investigate the internal means and mechanisms used by the companies for satisfying the requirements of the market.

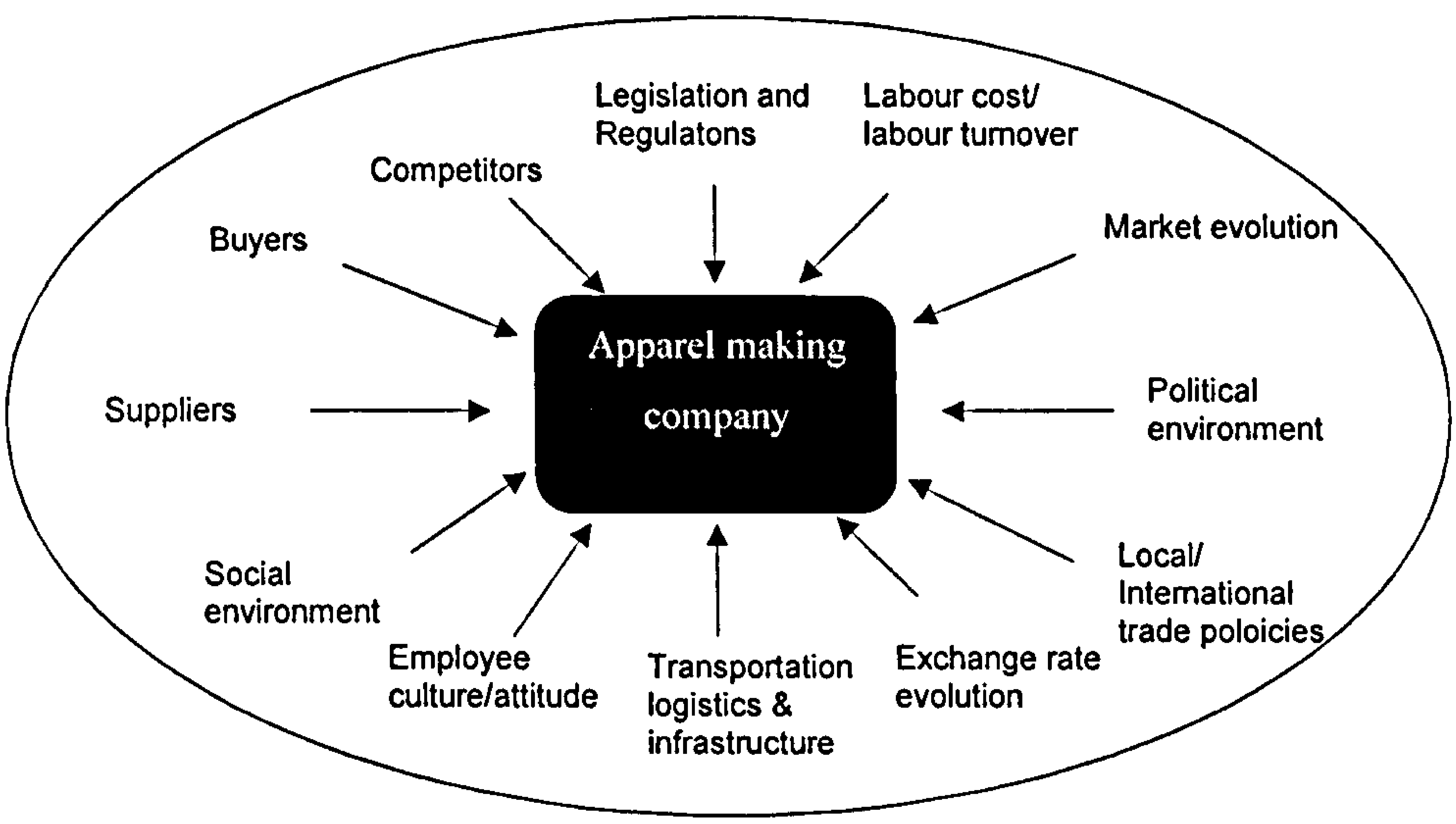

Figure 4.2 The apparel making company and its immediate environment

The scope of the modelling exercise was thus limited to the activities that take place within the garment manufacturing organisations. These activities can be classified under three categories (Presley, 1997):

- Managerial activities relating to the strategic planning, operational planning, performance monitoring and condition reporting associated with monitoring changes in the internal and external environments and defining lines of actions to adopt. Managerial activities can be considered to involve people higher up in the hierarchy of the organisation involved in the decision making process associated with plans and policy generation. These for instance include plans and policies related to recruitment, investment, marketing, sourcing, pricing, quality procedures among others.

- Manufacturing activities, which include those activities which directly add value to the product or which directly influence the value adding process. Manufacturing activities include planning and control, product design and development, CMT, finishing and packing operations.
- Support activities relate to activities that allow the smooth running of the business. These include activities associated with finance and accounting, human resource management, plant installation and maintenance, and the organisation of logistics.

The modelling exercise was conducted in an attempt to illustrate those activities having a major influence on the manufacturing strategy of garment making companies. Though the emphasis of the modelling was on manufacturing activities, relevant data was equally collected for managerial and support activities. These were in fact found to form an integral part of each and every function within the enterprises; almost all activities in an enterprise require appropriate human resources, financial support and reliable tools and equipment. Moreover, planning, control and monitoring of activities are closely associated to each activity in the organisation.

The functional activities common to all the companies visited included Sales/Marketing, Production Planning & Control, Product Design and Development (Sampling), Cut, Make and Trim (CMT), Purchasing, Inventory Control, Human Resource Development, Finance & Accounting, Plant Maintenance and Logistics. In the smaller companies however, certain functions were found to be lumped together such that one department was responsible for multiple functions, for instance, manufacturing personnel being responsible for sampling, planning and control and CMT operations. For the modelling exercise the functions and associated activities were considered independently (without lumping) in order to have a clearer view of the activities associated with each function. The objectives of the key functional activities are shown in table 4.4. It should be noted that none of the companies visited had a research and development unit and hence this activity does not form part of the manufacturing system model. Product Design and Development on the other hand was limited to the design of garment samples and corresponding patterns (sampling activities).

Functional Area	**Main Objectives**
Sales/Merchandising/ Marketing	To identify customer requirements. To liase with customers, market and sell apparel products.
Production Planning & Control	To plan, schedule and control design, CMT and purchasing operations. To also ensure conformance to customer requirements in terms of quality (through organised inspection), quantity and on time delivery.
Product Design & Development (Sampling)	To prepare assortment plans and sample garments in line with customer requirements. To develop graded patterns for garments and help in setting standard methods and times for manufacturing.
Cut, Make and Trim (CMT)	To cut, make, trim and produce finished garments according to customer specifications. To ensure effective use of plant and equipment.
Purchasing and Inventory Control	To liase with suppliers and purchase items required by the company. To ensure efficient inventory control and on time delivery of materials to the shop floor.
Finance & Accounting	To make financial provisions for each functional area.
Human Resource Devt.	To ensure effective use of human resources in each functional area.
Plant Maintenance	To maintain plant and equipment for smooth running of the business.
Logistics	To organise transportation.

Table 4.4 Objectives of key functions in the garment making companies

An overview of the interaction among the functional activities is shown in figure 4.3. The arrows show flow of information and/or material. Note that the finance and accounting, human resource management and the plant maintenance functions are treated as support to all the other functions. The CMT function is the main value added activity within the organisation. During the preliminary visits to the companies for identifying the functional areas, it was found that in most cases the manufacturing function included a range of activities encompassing for instance planning and control, sampling, purchasing, inventory control human resource management and CMT operations and hence in terms of strategy it could not be treated in isolation. In fact, the manufacturing strategy adopted by the companies was found to be largely dependent on strategies adopted for all the other functional areas including sales and marketing as advocated by Skinner (1969). Hence, in terms of modelling, it was preferred to have this holistic view of the manufacturing function in order to appreciate the interactions between all the functions and their influence on the manufacturing strategy of the company.

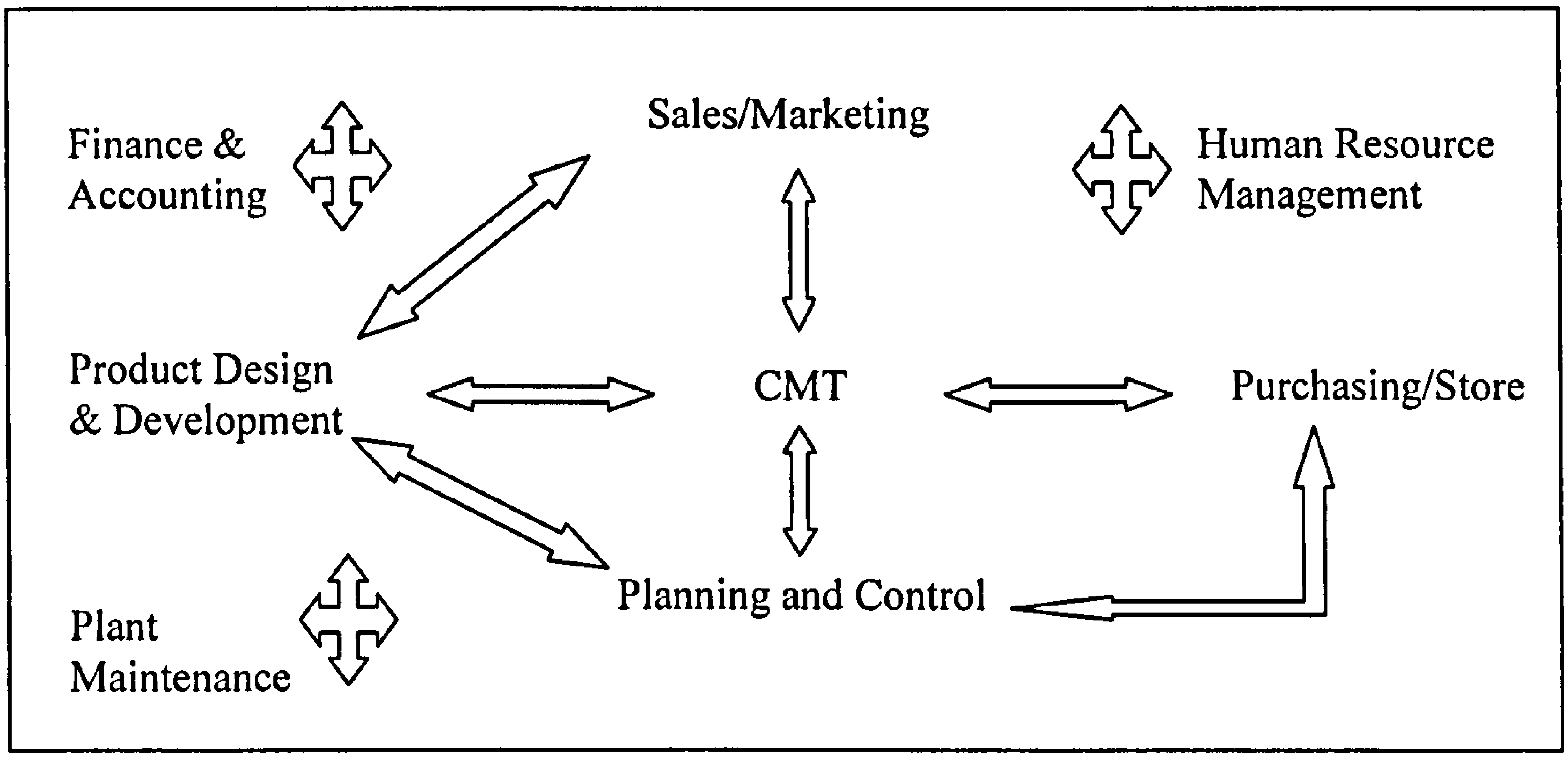

Figure 4.3 Interaction between various functions within garment manufacturing system

4.5 Garment Manufacturing System Modelling

Following the identification of the key functional areas to be modelled, it was required to identify the ICOMs for each function in order to develop the IDEF0 model. The questionnaire given in appendix D was used for the purpose. Together with the ICOMs, detailed information associated with the human resources, decision making points, time horizons, tools and equipment, materials, quality procedures, work instructions, and document records were all collected during the organised visits to the manufacturing companies. These formed an inclusive part of the manufacturing system model, which was designed and developed to contain all the data collected during the visits to the companies. Figure 4.4 is an illustration of some the information collected for one of the functional areas, namely, sales and marketing.

Diagrams similar to figure 4.4 were constructed for each of the functional areas, which formed the basis for the construction of the IDEF0 block diagrams and the supporting information system. The IDEF0 diagram was constructed up to the third level of detail where appropriate to have a clear illustration of all the activities and sub-activities involved in the process of garment manufacture.

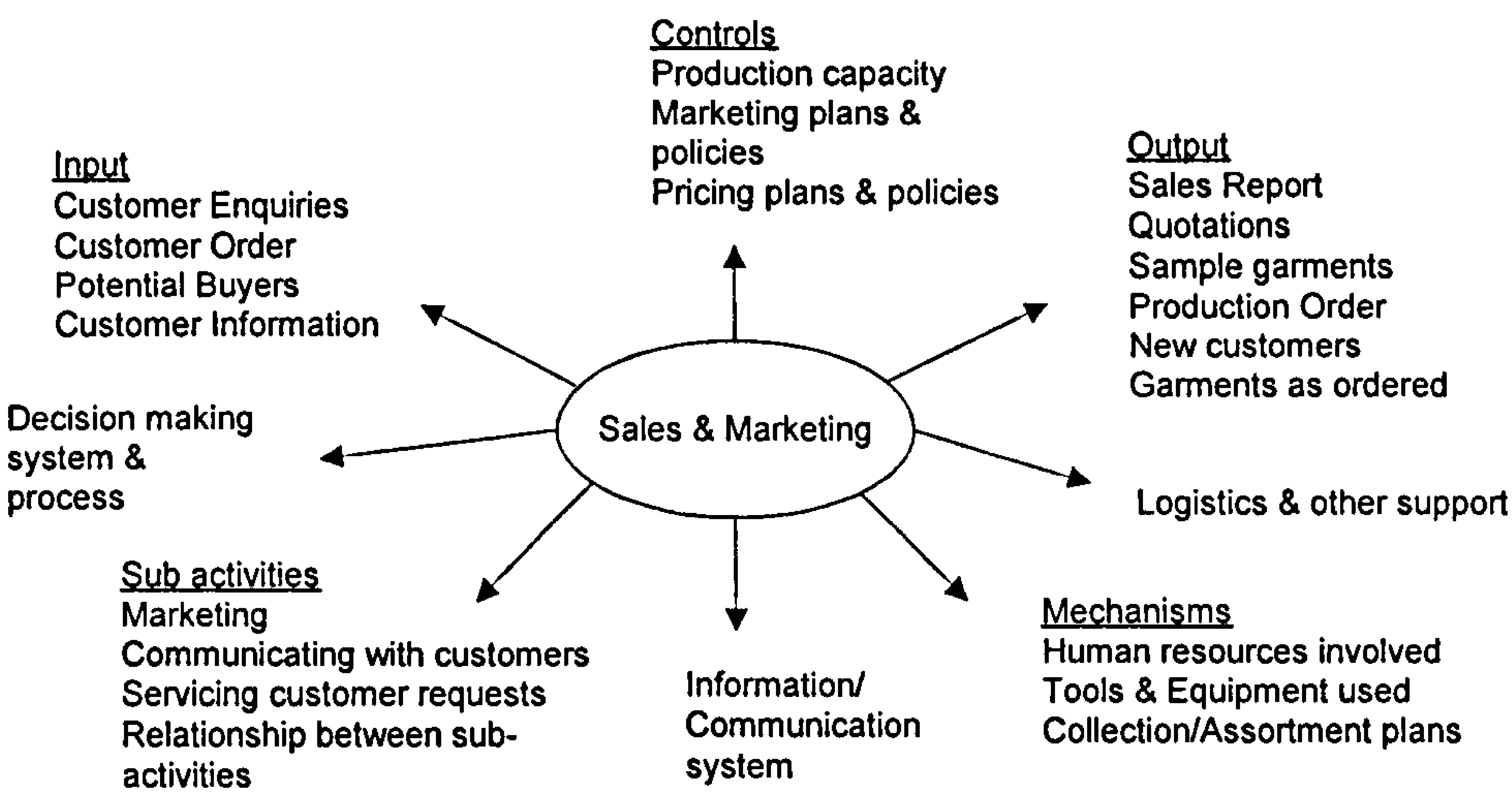

Figure 4.4 Information collected for the Sales and Marketing function

4.5.1 Node tree diagram

The node tree diagram shows the relationships between the various diagrams of the garment manufacturing system model. A node number references each diagram and links a child diagram to its parent diagrams. For instance diagrams A21, A22 and A23 are child diagrams of A2. The node tree diagram developed for the garment manufacturing system model is shown in figure 4.5. Given that the system model was developed to illustrate activities irrespective of the type of garment being produced, activities beyond the third level of details specifically dealing with activities associated with different types of garments are not shown. Also, the level of detailing was based on the suitability of the model as a guide for the formulation and assessment of alternative functional strategies rather than detailed process review.

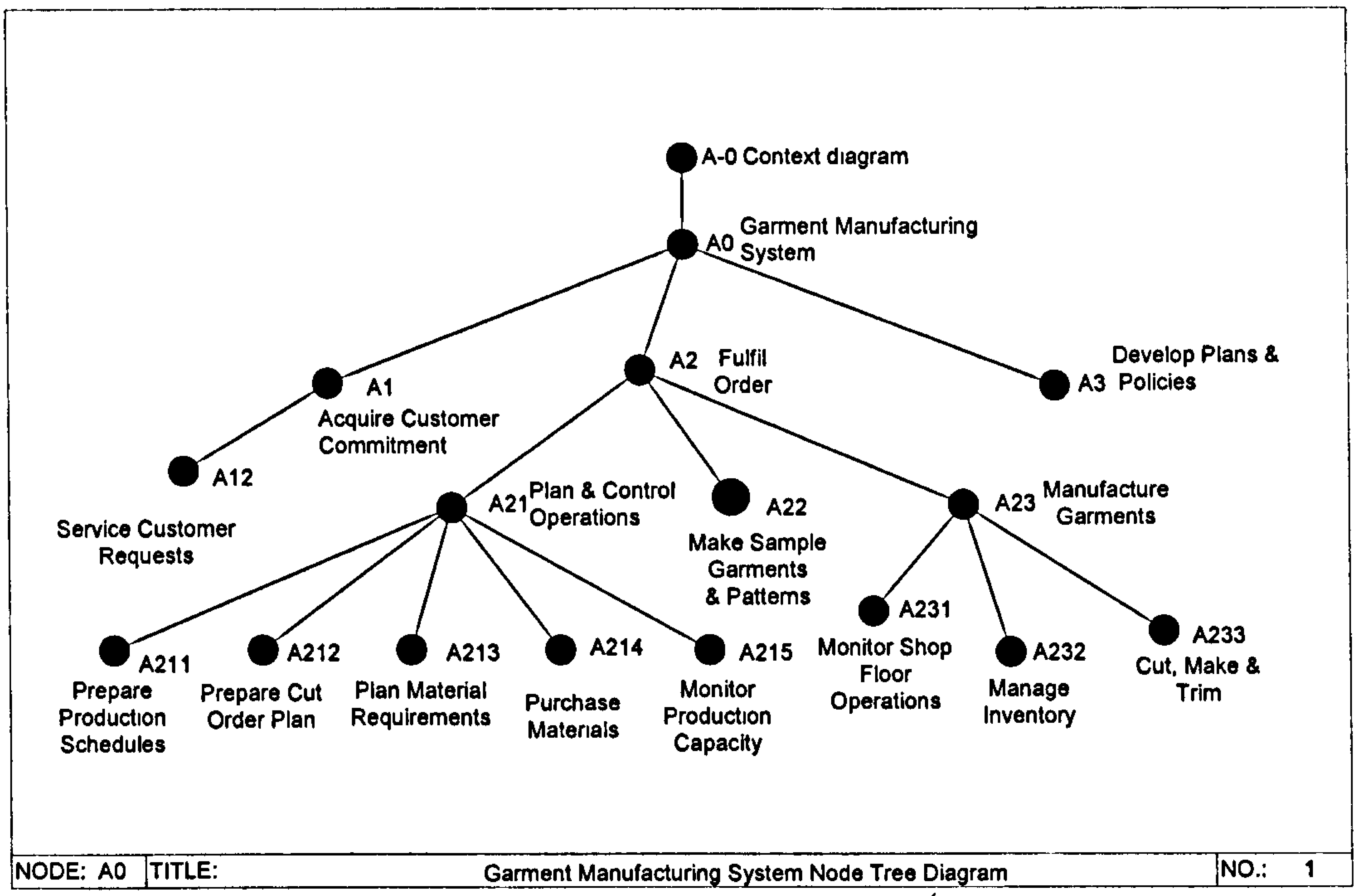

Figure 4.5 Node tree diagram of IDEF0 garment manufacturing model

4.5.2 Context diagram (A-0)

The context diagram provides an overview of the garment manufacturing system model illustrating the flow of information and objects in and out of the system boundary as shown in figure 4.6. Only the set of factors over which the organisation can exercise control and that directly influence the functional strategies have been considered for the modelling exercise. The input to the system thus consists of production orders, enquiries from customers or potential customers, information related to the customers, information related to suppliers, fabrics and trims, and information associated to tools and equipment among others. The input is usually processed and converted into value added output in terms of communication with customers, obtaining new customers, communication with suppliers, sample garments to buyers and potential buyers, garments as ordered to buyers, and rejects and scraps. The mechanisms, not consumed in the process, are ways and means used to add value to the inputs to convert them into outputs. These mainly constitute of the human resources and the tools and equipment used for the purpose. In order to ensure that the value added activities are efficient and effective, a number of controls are applied to the system. These include order details and customer approvals, quality control procedures and specifications, decisions associated with human and technical (tools and equipment) resource management and decisions associated with changes in market requirements (e.g. pressures on design and lead time). The completed context diagram for the garment manufacturing system model is shown in figure 4.6.

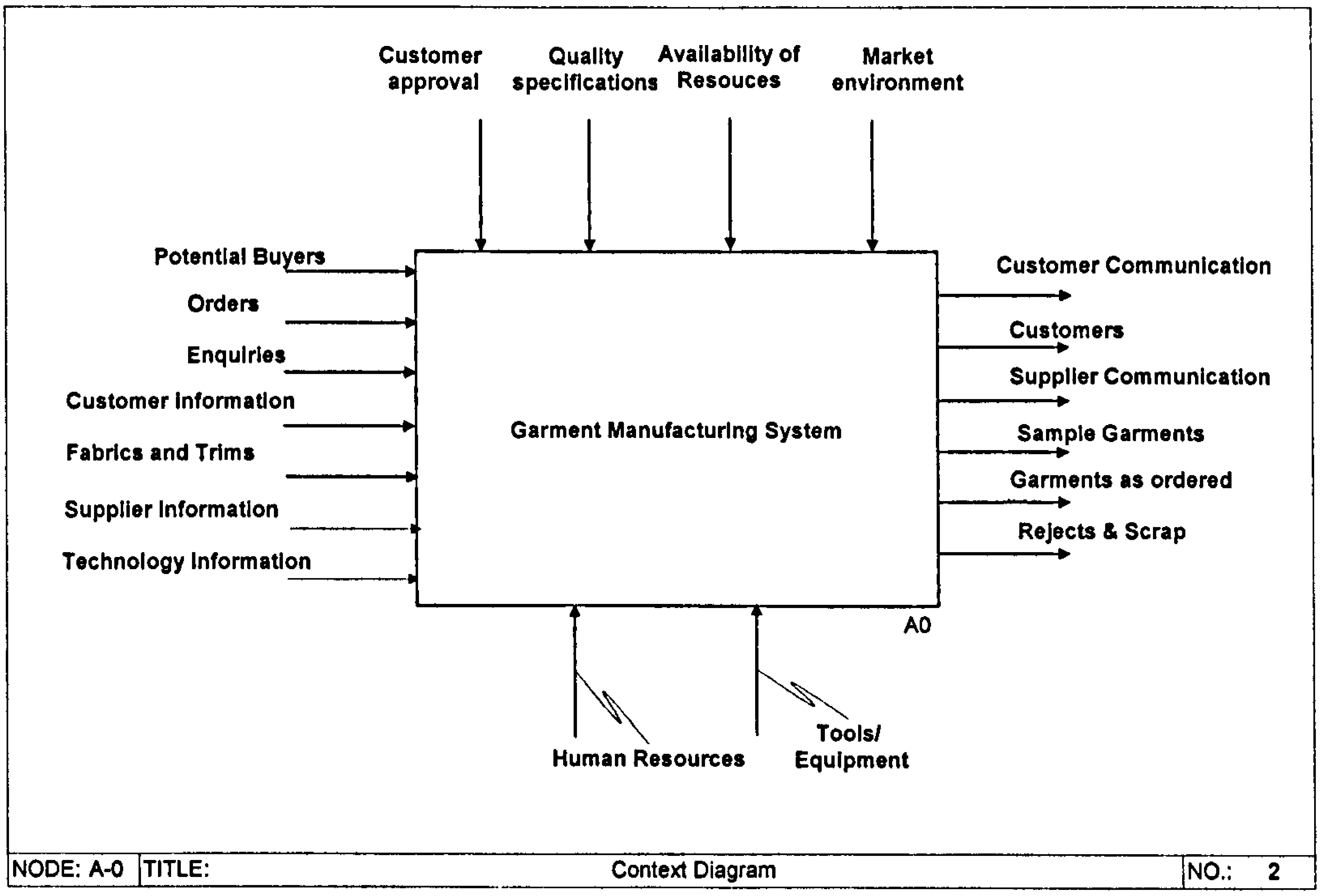

Figure 4.6 Context diagram for garment manufacturing system

4.5.3 Garment Manufacturing System Model (A0)

The top level decomposition (A0) of the garment manufacturing system model is an extension of the context diagram and provides a more detailed view of the main activities that take place within the manufacturing organisation. From the collected data it was observed that, for most of the companies, these activities were mainly oriented towards liaising with customers through the marketing/merchandising function, manufacturing the garments in line with customer requirements and developing/implementing plans and policies to maintain the competitiveness of the garments manufactured. These were modelled as Acquire Customer Commitment (A1), Fulfil Order (A2) and Develop Plans and Policies (A3) respectively (figure 4.7). All other functions within the enterprise were seen to fall under the above three main categories and hence were subsequently modelled as child diagrams of A1, A2 and A3.

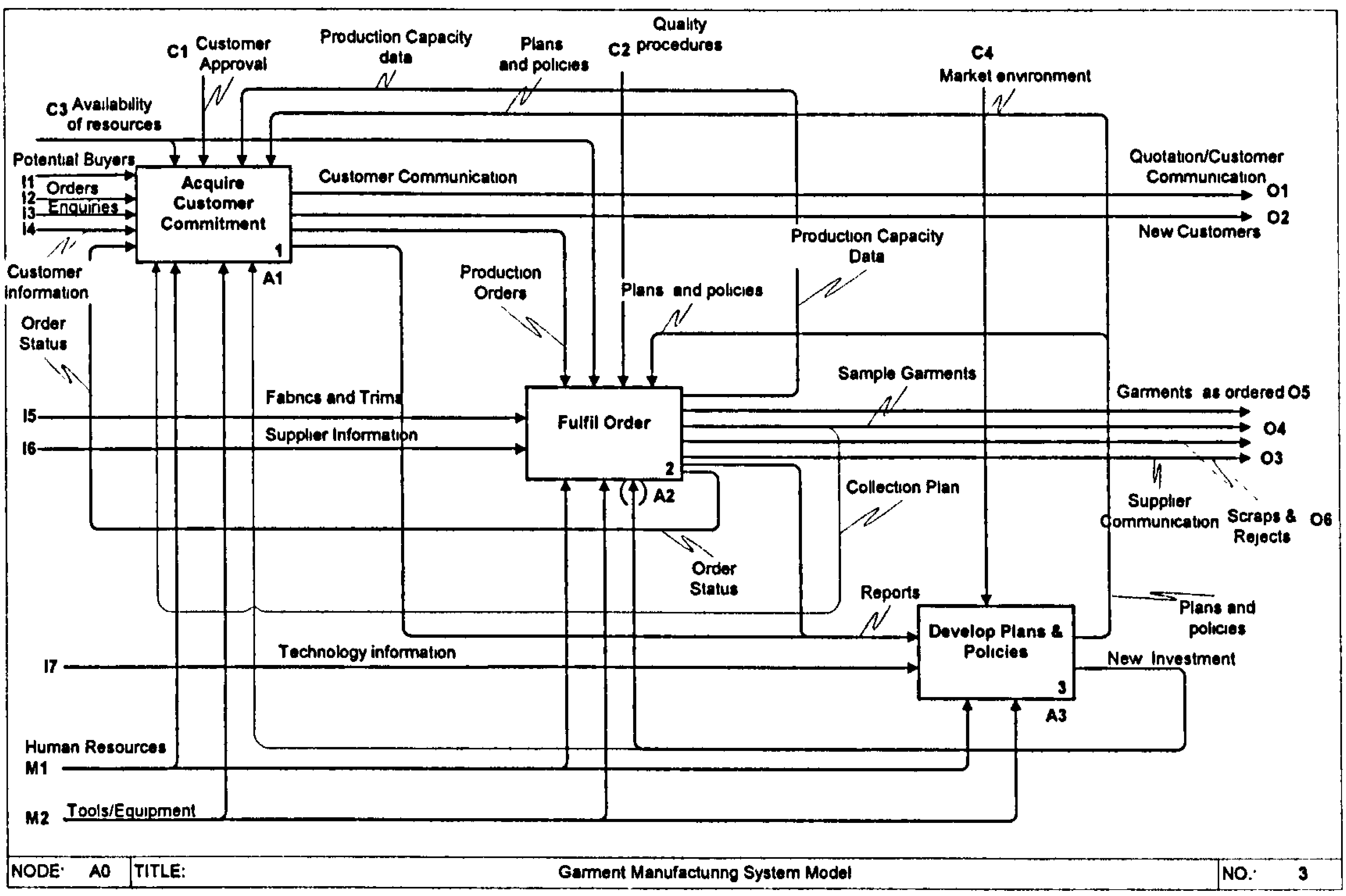

Figure 4.7 Garment manufacturing system model parent diagram

4.5.4 Acquire Customer Commitment (A1)

Acquire customer commitment is the process of getting potential buyers to place production orders and keeping customers informed about the progress of their order once the order is received. The process mainly involves sales, marketing and merchandising personnel and the activities can be considered in terms of Marketing the Production Capacity (A11), Servicing Customer Requests (A12) and Keeping Contact with

Customers (A13) as shown in figure 4.8. Marketing can be defined as being the set of activities associated with accelerating the movement of garments from the company to potential customers. It was observed during the data collection process that the majority of companies surveyed, instead of placing more emphasis on the marketing of their products, were more involved in the marketing of their production capacity. This explains the range of products that most of companies were found to be manufacturing. Marketing in the present scenario thus focuses on the reliability of the manufacturing system to deliver garments conforming with customer quality requirements and within a specified delivery time frame.

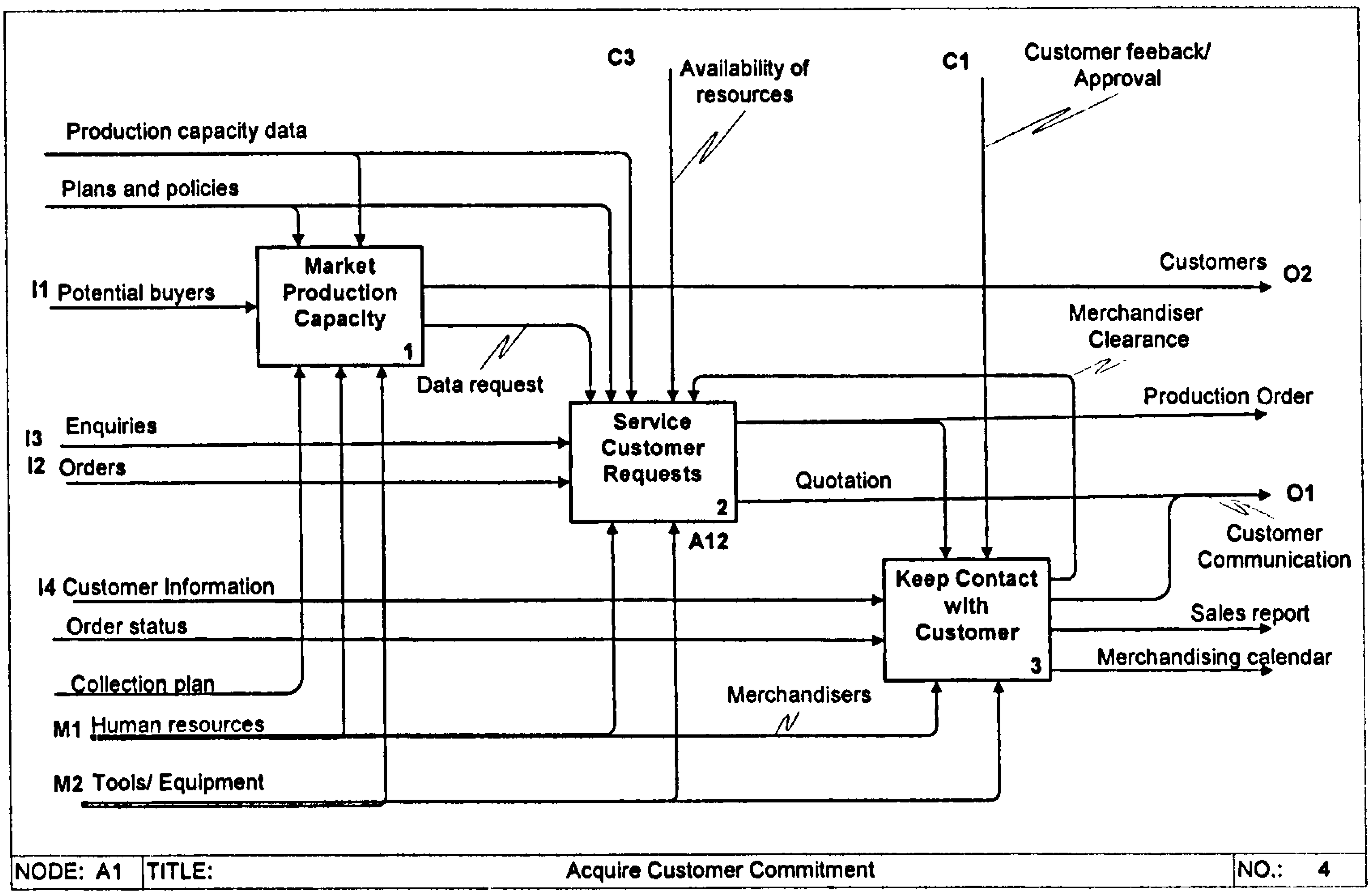

Figure 4.8 The Sales, Marketing and Merchandising activities

The Merchandising activity on the other hand deals with enquiries relative to potential or confirmed production orders and provides details of quotations and feasible delivery dates. Also, merchandising involves the development of a merchandising calendar; a plan for the development and presentation of different types of garments (assortment or collection plan) that are or can be manufactured by the company. The Sampling department is involved in the production of the collection plan. Potential buyers usually examine and compare proposals from merchandisers of different companies before placing orders. Upon receipt of a customer order (approved order), procedures are started for the issue of production orders. Merchandisers usually track the progress of the customer orders at each stage of the production process through progress reports, to keep customers informed of the status of the order.

Service Customer Requests (A12)

The service customer requests activity refers to the processing of enquiries and orders associated with the merchandising activity as shown in figure 4.9.

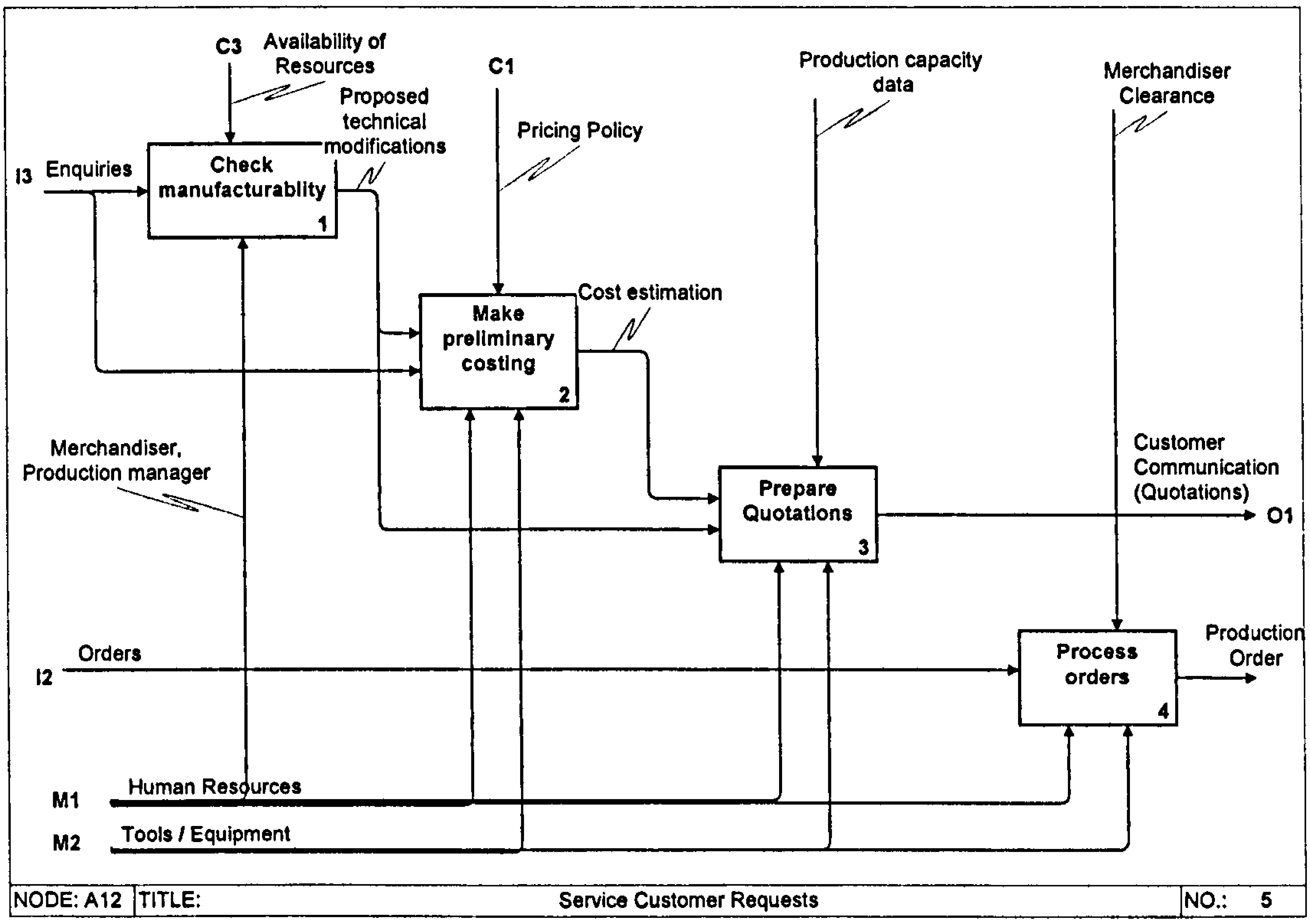

Figure 4.9 Merchandising activities

When an enquiry is received concerning a specific garment style, its manufacturability is first determined with the help of the production manager and the sampling department.

Usually technical modifications to the style, if any, are proposed with a view to facilitate the manufacturing process. Quotations are worked out accordingly. The potential buyer studies the proposal and after some negotiations in between, an agreement is reached on the details of the order (including delivery dates) before the customer issues a confirmed order.

4.5.5 Fulfil Order (A2)

Fulfil order refers to the activities carried out to Plan and Control Operations (A21), Produce Sample Garments and Patterns (A22) and Manufacture Garments (A23). Most of these activities were considered as shop floor operations within the companies visited. The planning activity is launched once a confirmed production order (PO) is obtained from the marketing/merchandising department. The PO is a sheet containing all the garment specifications (fabric, trims, accessories, size, colour, style, and delivery date). Schedules (purchasing, cutting, sewing) are developed by the Plan and Control Operations activity (A21) to ensure that delivery date is met.

Before production is launched, a pre-run order is usually carried out during which a sample of garments is made and sent to the customers for inspection and the main manufacturing order is released to the shop floor only when the approval of samples from the customer is received. It is not necessary that the samples be made from the fabrics that will be used for the order. During the manufacture of sample garments for a confirmed order, especially in the larger companies, work-study engineers made sure that the correct methods, processes and time standards are being used. The sampling activity equally involves the development of graded patterns for the garments to be cut out.

In the larger companies, employing more than 500 employees, the sample making activity was found to be part of the merchandising process for the preparation and development of collection plans. However, this was not the common practice in the other companies visited, as sampling was considered to be one of the responsibilities of the production department. Hence for modelling purposes, sampling has been developed as part of the fulfil order activity as shown in figure 4.10.

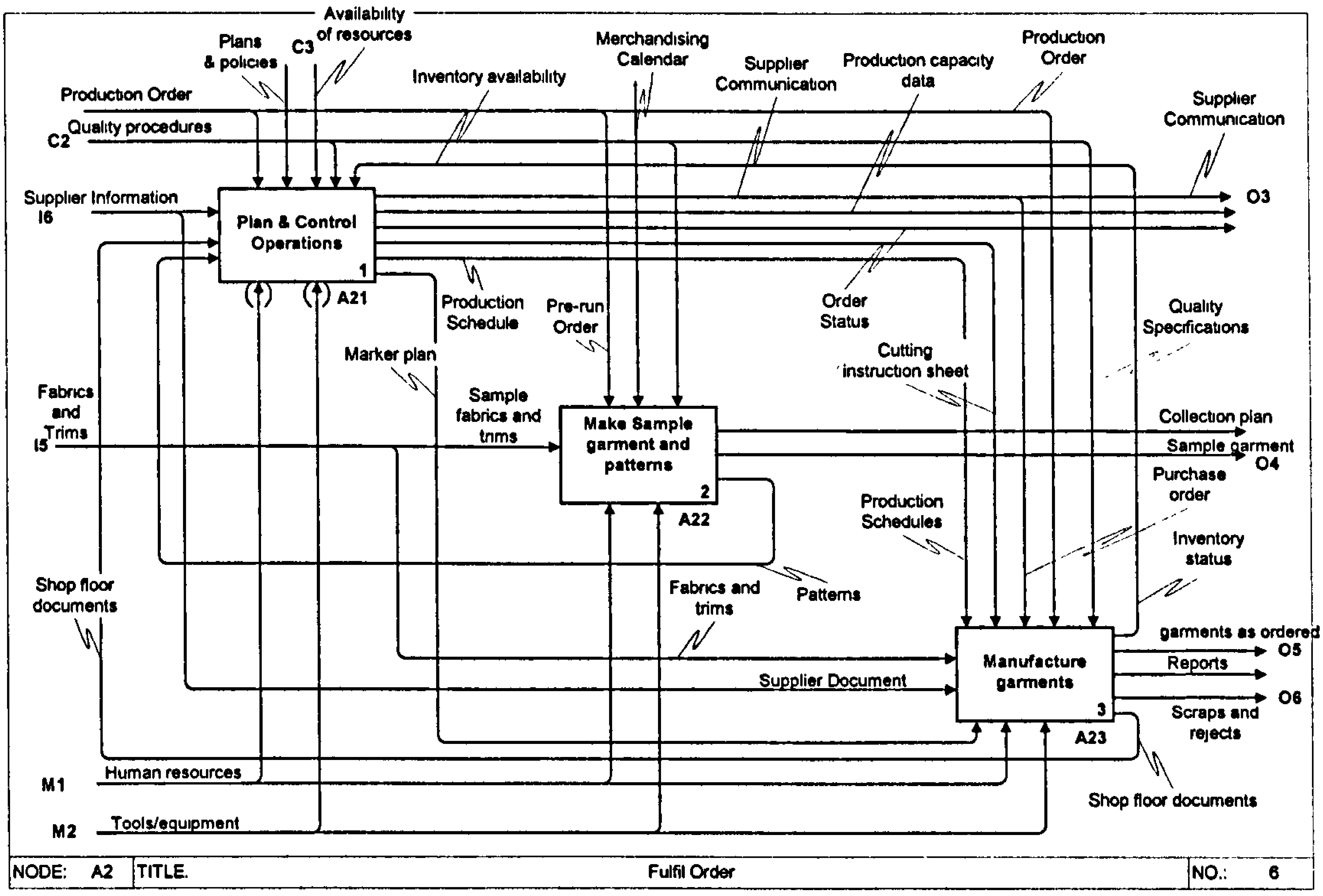

Figure 4.10 Shop floor activities within the garment manufacturing system

Finally, the fulfil order activity comprises the production of the garments which mainly involves cut, make, trim finishing and packing operations.

Plan and Control Operations (A21)

Plan and Control Operations (A21) covers the activities within the Fulfil Order (A2) process, which are associated with the planning and control involved leading to the actual production of the garments. The overall objective of this function is to ensure that the logistics of supply and production are planned so that labour, machinery and all other resources are available and utilised to the best advantage and the delivery of the ordered garments is achieved on time. The main sub-activities include the Develop Production Schedules (A211), Prepare Marker Plan and Cutting Instructions (A212), Plan Material

Requirement (A213), Purchase Materials (A214), and Monitor Production Capacity (A215) to maintain an up-to-date picture of the progress of each production order. The sub-activities associated with the Plan and Control Operations activity and interactions between them are shown in figure 4.11.

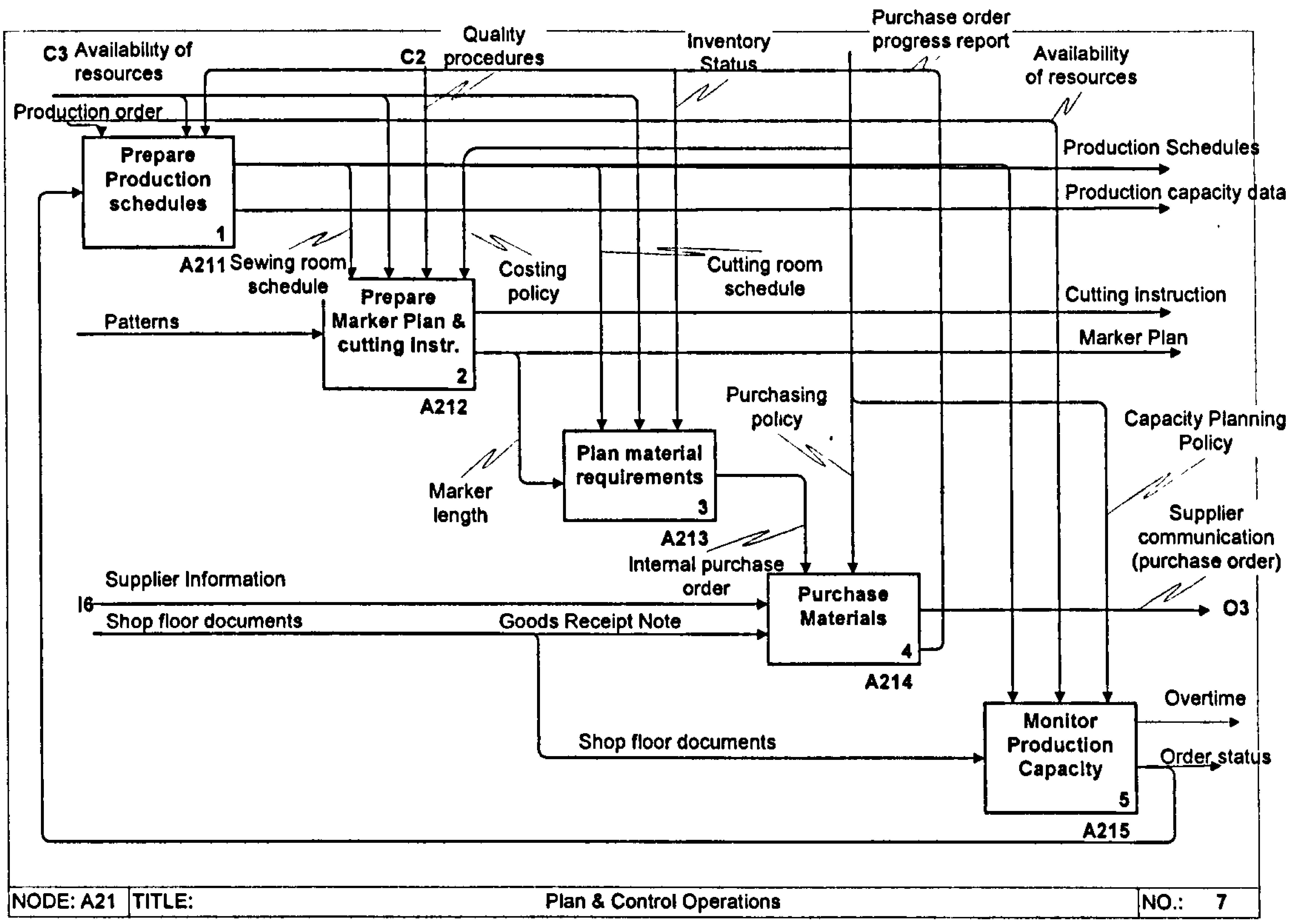

Figure 4.11 Plan and Control Operations activities

Prepare Production Schedules (A211)

A schedule shows the time at which operations are to be undertaken and the work stations at which they are to be performed with a view to meet the order delivery date as agreed between the company and the buyer. The delivery date is usually fixed and scheduling consists of subtracting the sewing room lead-time from this date to establish the start date for making up activities. The sewing room schedule is then used to prepare a cutting room schedule while establishing the date at which cutting of a manufacturing order must be started. Schedules are released only when the purchasing department has received all the material required for the order. Sewing is the core process in apparel manufacturing, which subordinates the cutting and finishing processes in line with its demands. The Prepare Production Schedules activity (Figure 4.12) equally involves keeping track of bookings made and progresses of orders to provide production capacity data to the merchandising department, which largely facilitates negotiations with potential buyers.

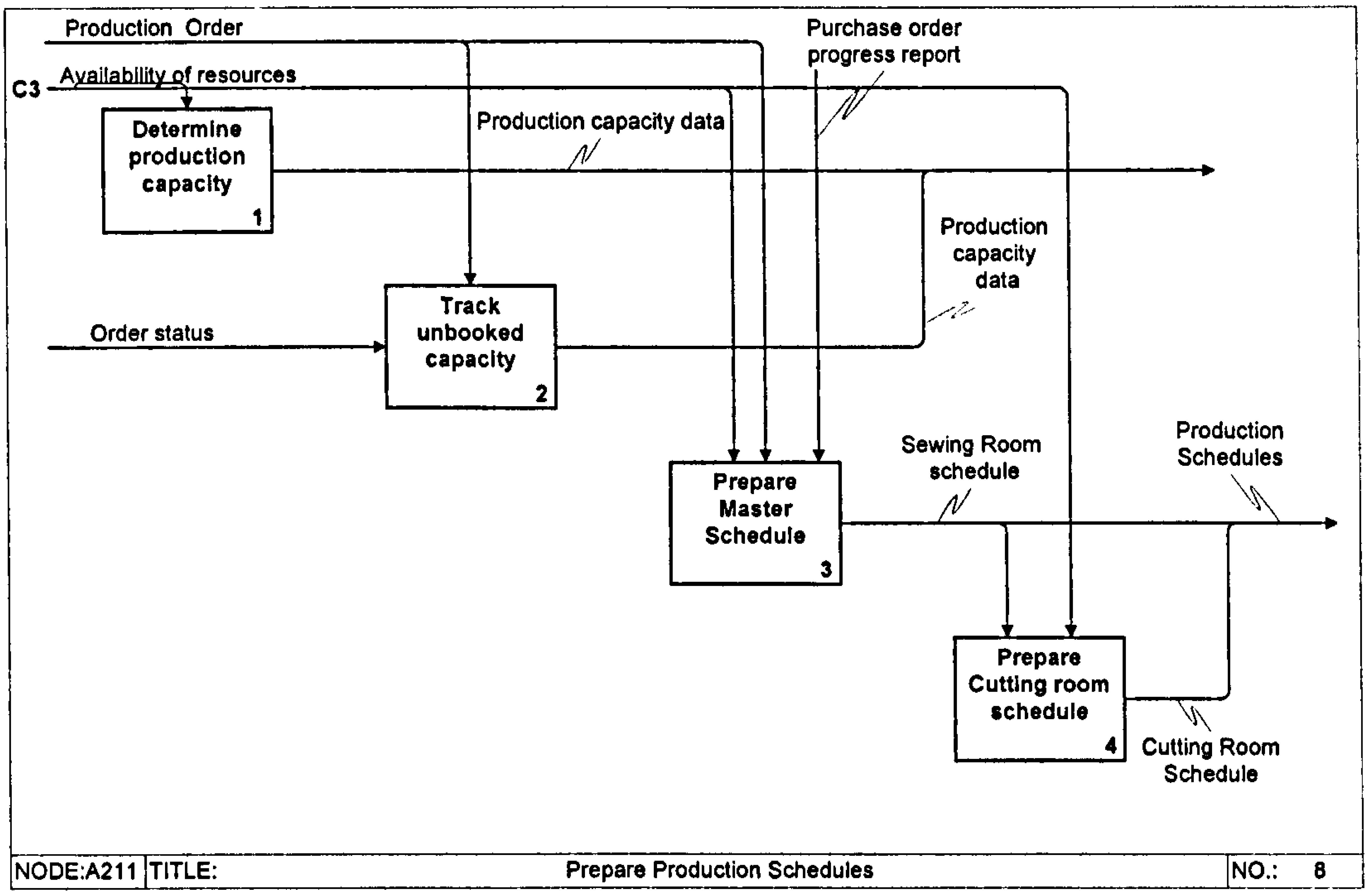

Figure 4.12 Prepare Production Schedule activity

Prepare Cut Order Plans (A212)

Activities associated with the Prepare Cut Order Plans (A212) involve the preparation and issue of cutting instructions and marker plans to the cutting room personnel as shown in figure 4.13. The cutting instruction sheet is the document containing details with regards to fabrics to be taken from store, spreading, cutting and work preparation of each batch to be processed in the cutting room. The marker plan specifies the minimum number and types of spreads required to cut an order at the minimum cost while satisfying quality requirements. It also gives the composition of these spreads as different colours are usually cut together to eliminate the need for shade matching of cut pieces for bundle preparation.

A marker plan is worked out using the garment patterns, obtained from the sampling department, either manually or by using a computerised system. The marker planner devises several plans based on different layout of pattern components. These plans are then evaluated taking into consideration length of fabric required by each plan to choose the most economic marker plan. The layout of pattern components is usually constrained by the cutting table dimensions, fabric specifications and garment design. For instance, a shirt made of checked or striped materials require matching which adds to the complexity of marker planning activity.

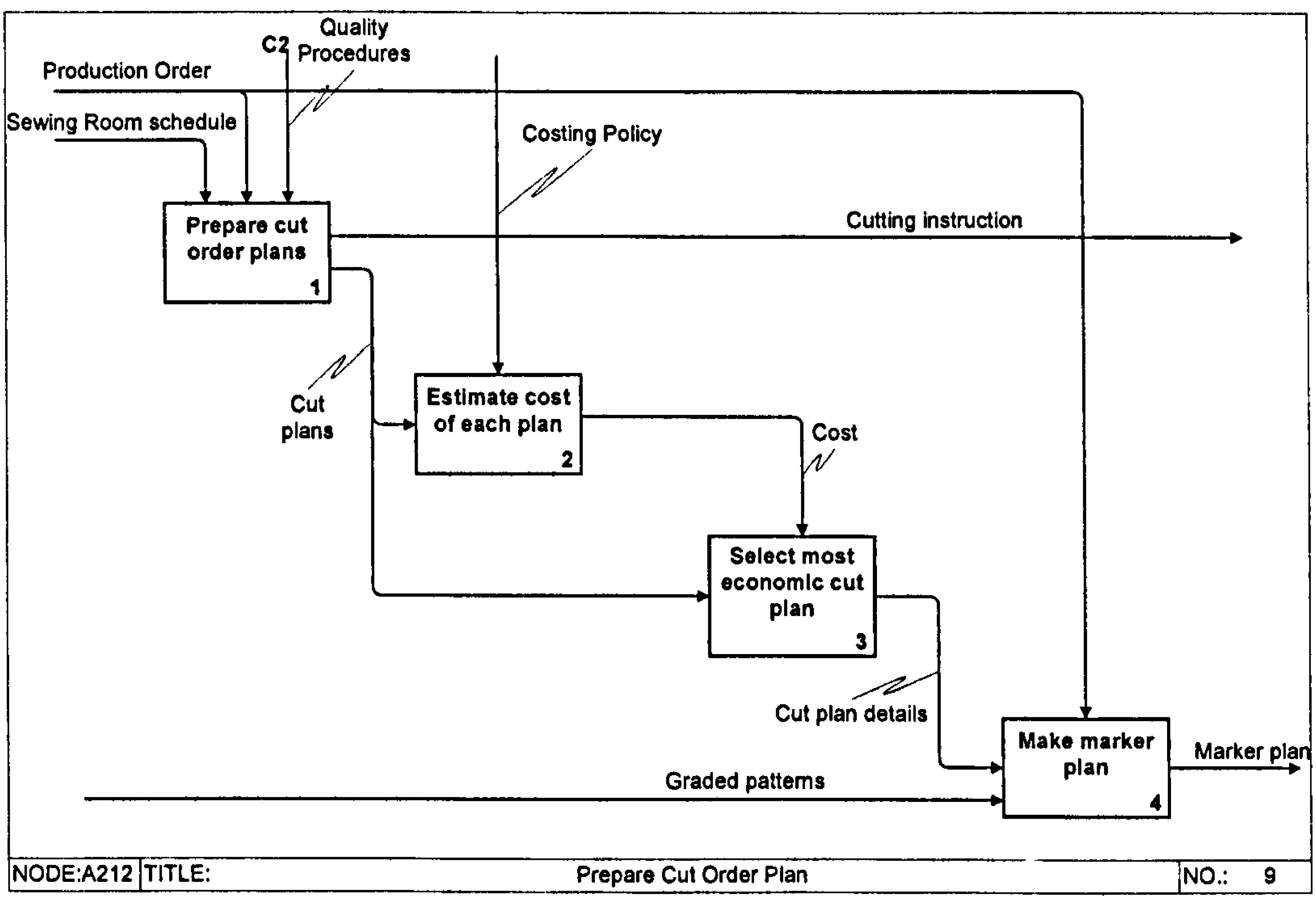

Figure 4.13 Prepare Cut Order Plan activity

Plan Materials Requirement (A213)

The Plan Materials Requirement function block is the activity that deals with Determine Material Requirements, Work Delivery Schedules and Issue Purchase Order as illustrated in figure 4.14. A few companies were found to use a material requirement planning (MRP) software for the purpose. The activity mainly deals with working out the requirements in terms of fabric and accessories (bill of materials) for an order and planning the schedules for purchasing. A purchase order is issued to the purchasing department based on lead times for acquisition of the materials. The purchase order specifies details pertaining to fabrics and trims required, the quantities required, delivery instructions and due dates for the materials. The materials delivery schedule is worked out from the cutting room schedule and states the dates by which materials are to be received at the latest for a smooth flow of material on the shop floor. This schedule takes into consideration present stock levels and stock levels required to buffer against unsatisfactory quality or late deliveries.

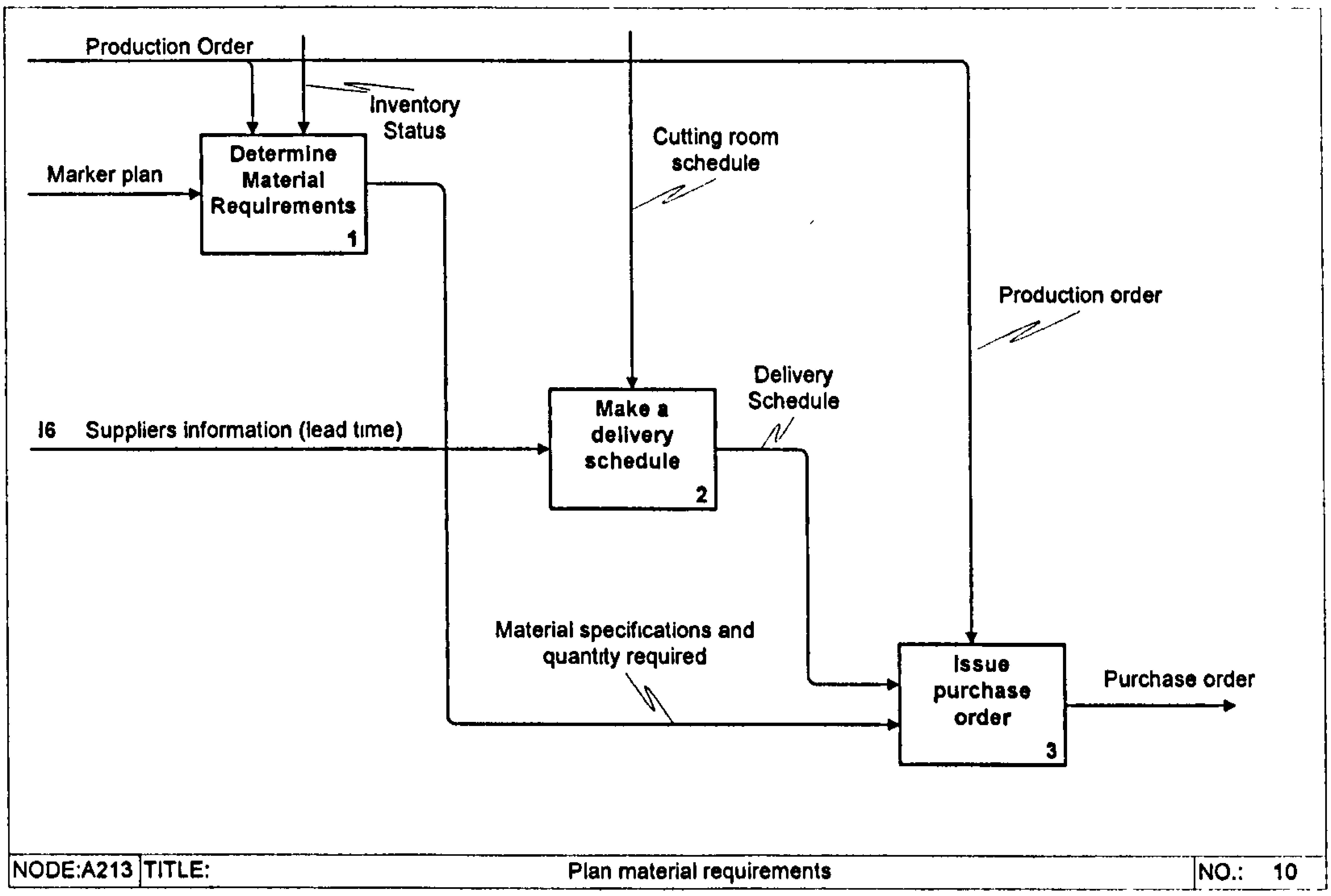

Figure 4.14 Planning Material Requirements activity

Purchase Materials (A214)

The main objective of the Purchase Materials activity (figure 4.15) is to supply the shop floor with a steady flow of materials to meet the requirements of the production order. The purchase materials process starts when a purchase requisition order is received from the planning department. The main material in the manufacture of garments is fabric, which is either ordered from local textile mills or from foreign suppliers. The main advantages of ordering from local mills are reduced costs and decreased supplier lead-time. A number of companies were found to adopt vertical integration policies such that the fabrics are manufactured in-house or by sister companies. However, the procedure for acquiring the fabric remained unchanged. This involved sending enquiries about the supply of fabrics to the regular suppliers who reply with a quotation specifying price and ability to meet required delivery dates.

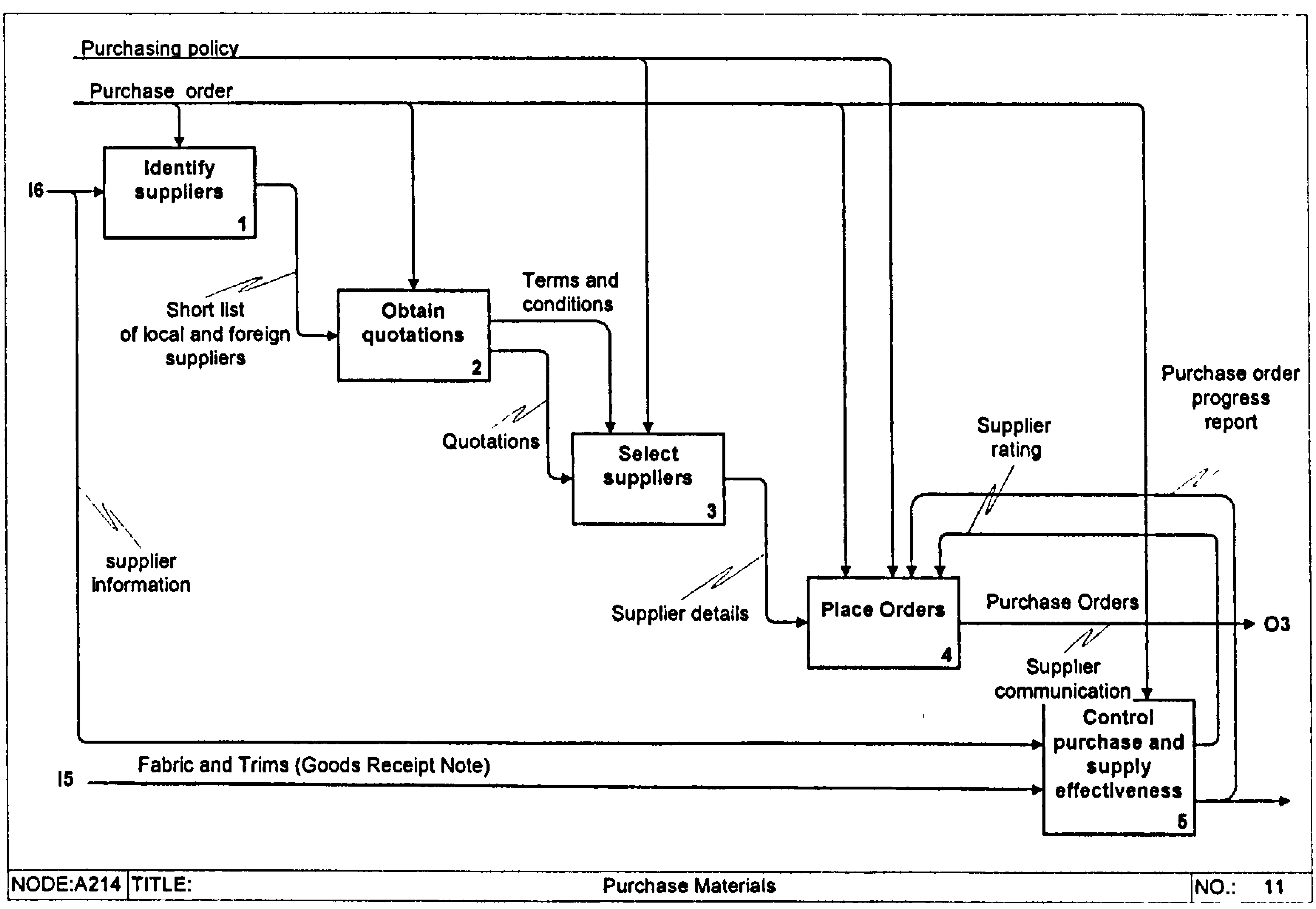

Figure 4.15 Purchase Materials activity

The selection of suppliers is made on the basis of price quoted and past performance (a supplier rating is usually used for the purpose) of the suppliers in terms of quality and delivery reliability. The activities related to the purchase materials function thus include Identify Suppliers, Obtain Quotations, Select Suppliers, Place Orders and Control Purchase and Supply effectiveness (Figure 4.15). In a number of cases it was found that the customers supplied their own materials. In these cases, the inventory data was updated as and when the materials were received in the store. Though purchasing and inventory (store) management functions are seen as being complementary, in most of the companies visited these functions were treated as separate entities with close interaction between them; the former being under the responsibility of the planning department while the latter being part of the responsibilities of the production department.

Monitor Production Capacity (A215)

The purpose of the Monitor Production Capacity activity details of which is shown in figure 4.16, is to ensure that production plans are implemented as scheduled.

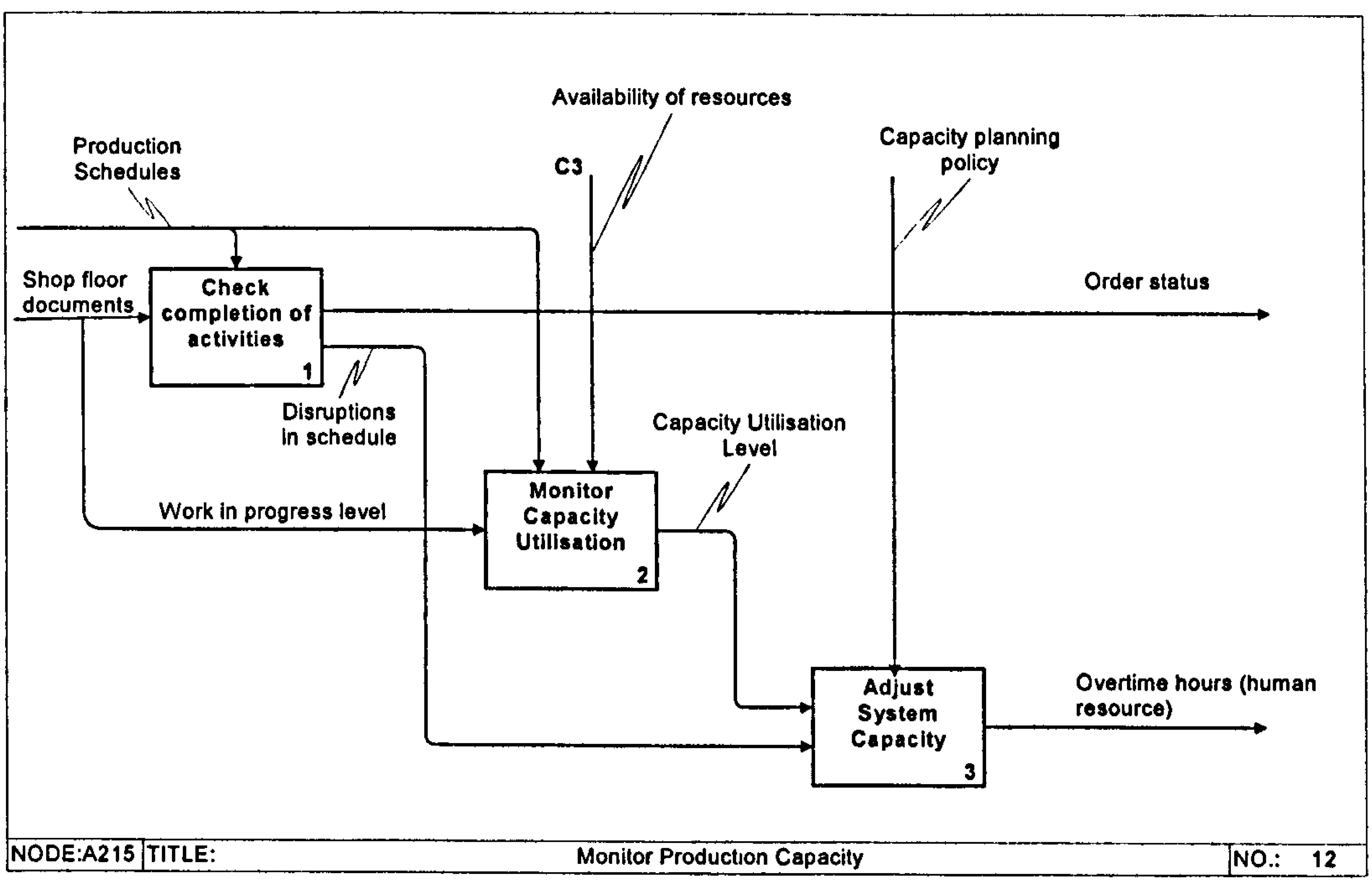

Figure 4.16 Monitor Production Capacity activity

This activity is used to monitor the order status at different stages on the production floor and compares actual states with intended states. The input to the Check Completion of Activity illustrated in figure 4.16 is the documents generated in the shop floor like work in progress levels, machine utilisation rates, and production capacity data among others. This information is fed to Monitor Capacity Utilisation activity to allow decisions to be taken for instance, on rescheduling of activities and on the number of overtime hours to be performed to ensure that there is no delay in delivery (Adjust System Capacity). The main output from the Monitor Production Capacity activity is the production order status report, which is shared with the merchandising personnel to allow them provide prompt answers to customer queries on the status of production orders.

Make Sample Garments and Patterns (A22)

The sampling process involves the manufacture of a pre-run order to supply customers with a sample of the finished product. This function is part of the Fulfil Order activity (A2) and begins with Analyse Order Requirement in terms of the design of the garment. The related information is usually obtained from the marketing or merchandising departments. Samples developed in-house without the involvement of customers usually take the form of a collection plan, which is used for marketing purposes. Pre-run orders are used for fixing details concerning the operations that are required in the manufacture of the garment (number of operations, time for each operation, tools and equipment to be used, methods etc...). Also, the sampling process allows the development of a garment pattern, which is unique for each order. Most companies use computerised systems for the Grade Patterns activity in terms of sizes that are required to be manufactured. Based on the sample patterns, the garments are cut and assembled. Quality controllers inspect the garments for conformance to quality requirements, before they are sent to customers via the merchandisers. The sub-activities for Make Sample Garments and Patterns are shown in figure 4.17

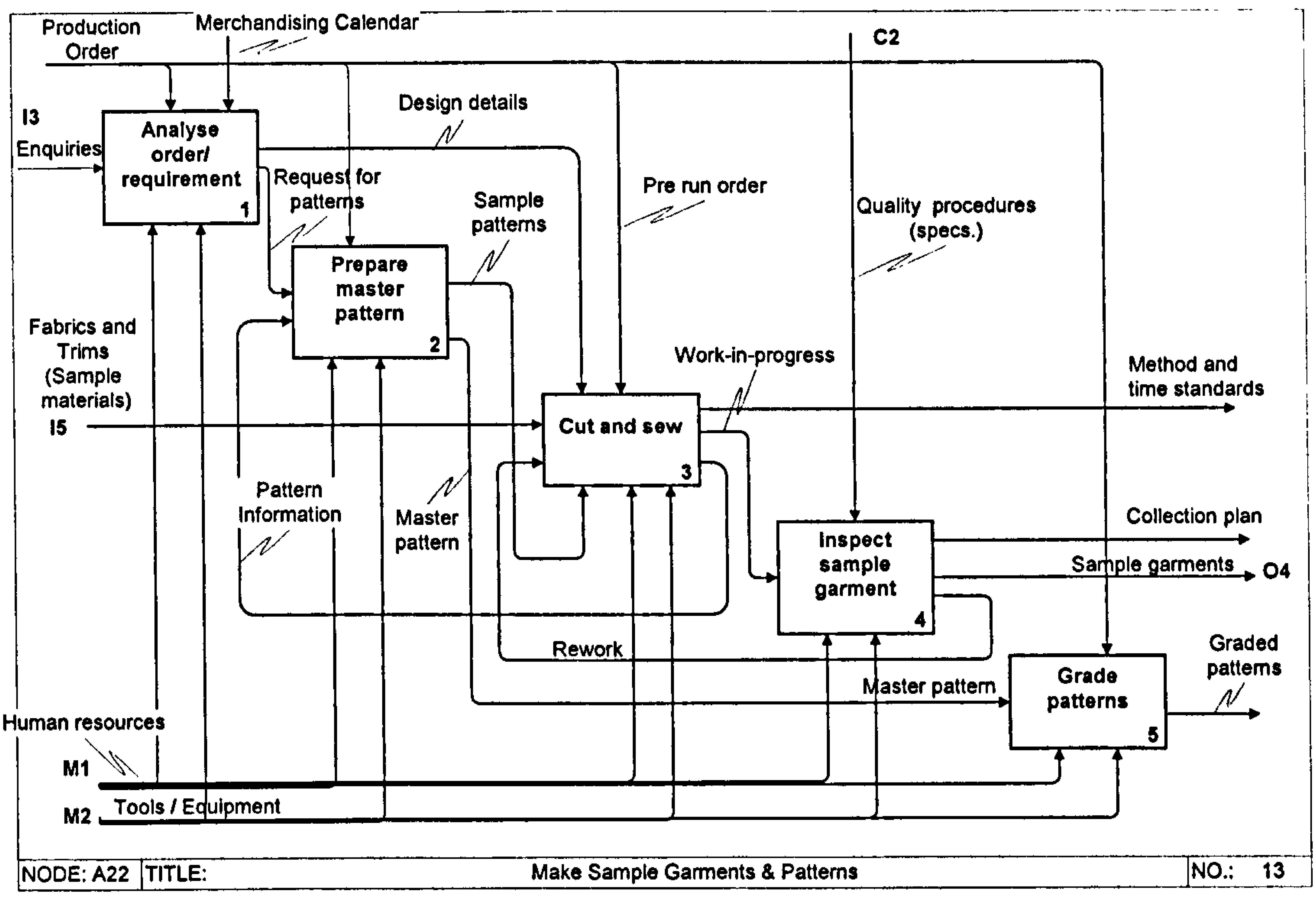

Figure 4.17 Make Sample Garments and Patterns activity

Manufacture Garments (A23)

Manufacture Garments is an illustration of all the activities that take place in the shop floor of the company. These mainly comprise Monitor Shop Floor Operations (A231), Manage Inventory (A232), Cut, Make and Trim operations (A233) and Finish and Pack Garments (A234) as illustrated in figure 4.18. The production manager is the person responsible for making sure that all the above activities takes place without any disruption and the finished goods are produced in accordance with the delivery schedules. Purchased materials ordered through the planning department are stored in a location within the shop floor area under the responsibility of the production manager, for easy access as and when materials are required. In accordance with the cutting and sewing schedules, materials are collected from the store and distributed to the various sections on the shop floor for the value added activities. Fabrics are cut in the cutting room and sent to the sewing room for preparation of the different parts before assembly. The final step consists of the application of finishing processes such as washing (where appropriate, for instance in the case of jeans) and pressing are performed in accordance with the manufacturing orders as well as work instructions. After a final inspection, the garments are ready to be packed and shipped in line with the instructions of the customer.

For control purposes, documents related to the shop floor activities are collected on the floor and sent to the Monitor Shop Floor Operations activity (A231) so that an order status report is issued to the Merchandising department for keeping track of the order.

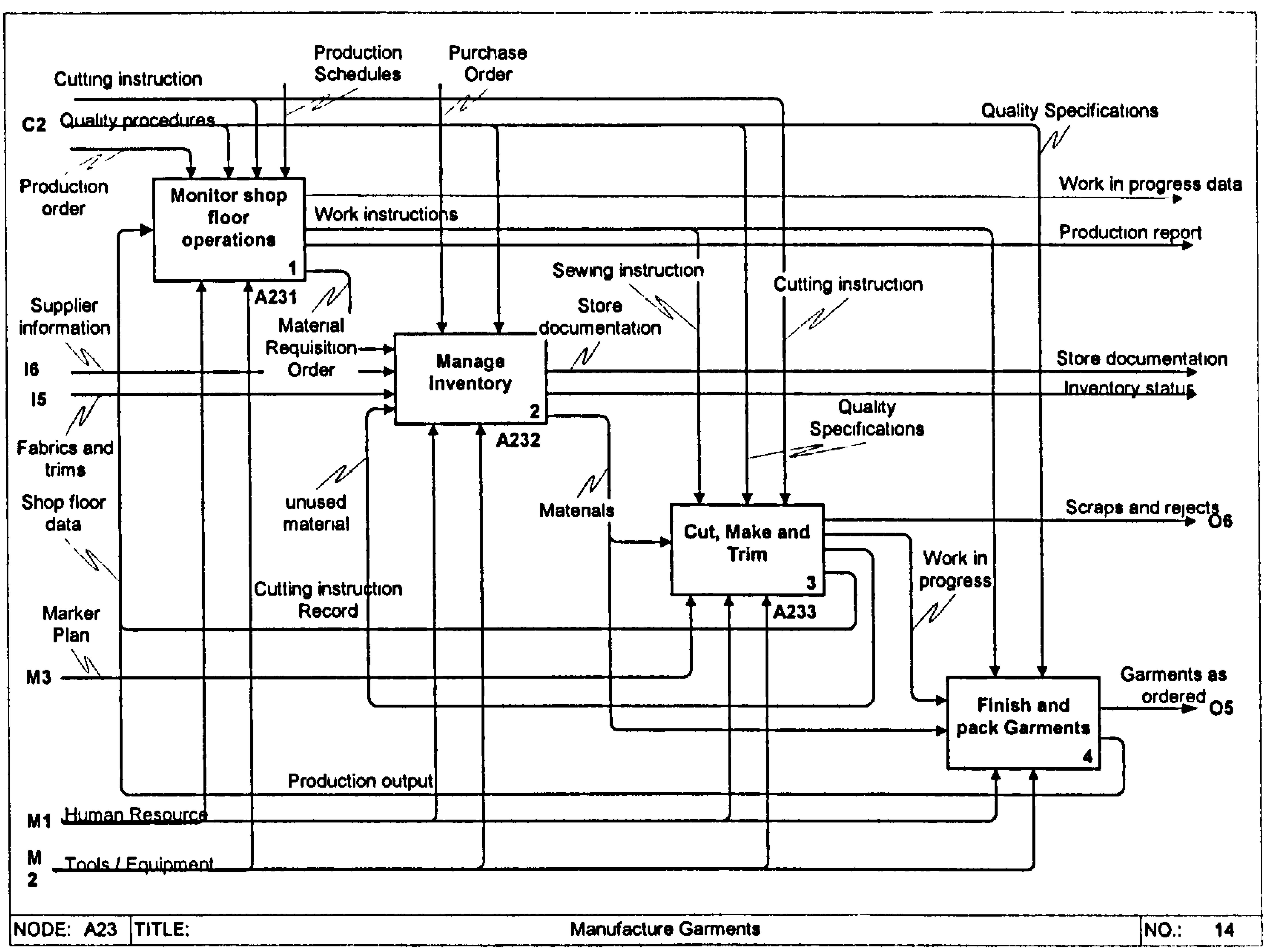

Figure 4.18 Manufacture Garments activity

Monitor Shop Floor Operations (A231)

This activity, details of which are shown in figure 4.19, concerns the control of the processes on the shop floor. Work Instructions (cutting, sewing, finishing and packing instructions) are issued by the production department for each style from the details specified in the production order and in line with the quality specifications.

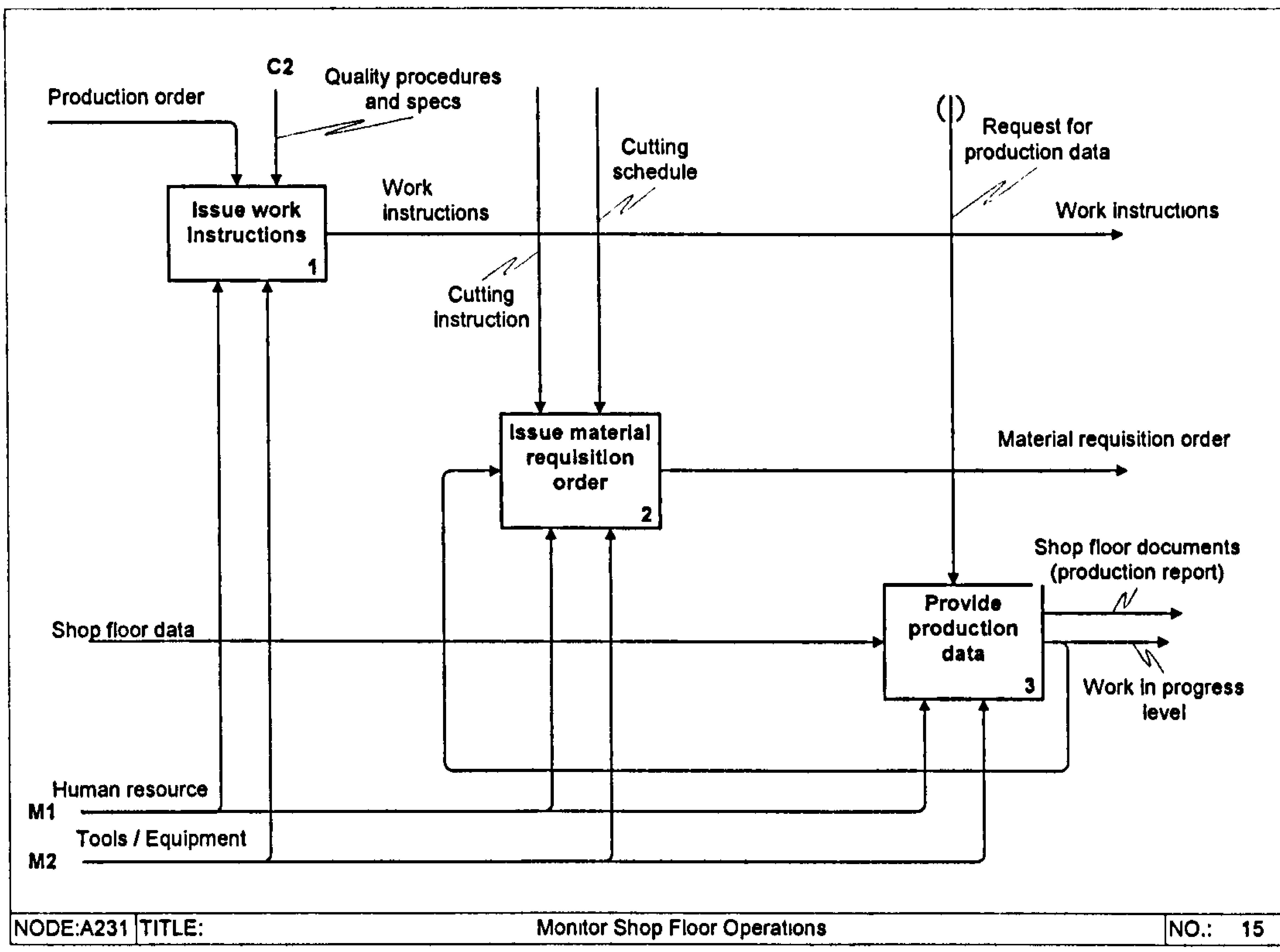

Figure 4.19 Monitor Shop Floor Operations activity

The Cutting Schedules and Cutting Instructions are used to Issue Material Requisition Order for acquiring material from the store for initiating the cutting activity. Supervisors and foremen are responsible for making sure that operators follow the work instructions and meet specified targets. Data is collected on an hourly basis on the output produced from each assembly line and a report is prepared and issued to the Monitor Production Capacity activity (A215) which is itself part of the Plan and Control Operations activity (A21). Feedback on work-in-progress level from the Provide Production Data activity is used for issuing material requisition orders (for pending materials for instance buttons and labels or missing materials) to the store.

Manage Inventory (A232)

Manage Inventory encompasses all activities occurring between the point at which materials are received from suppliers up to the point where they are issued to the production floor. The sub activities include Receive Goods, Inspect and Test Incoming Materials and Store Goods and Control Issue of Materials as shown in figure 4.20. Goods received are checked and tested where appropriate to ensure that quality specifications and quantities are in conformance with the particulars of the purchase orders. A goods receipt note (GRN) is then issued to the Purchasing department to share details of incoming materials. The materials are placed in the store until a material requisition order is received from the shop floor, for delivery. In certain companies the GRN is accompanied by details on the delivery reliability of the supplier (quality, quantity, on time delivery, communication system etc…). These are used to assign a rating to each supplier by the Purchasing department, which is consulted to make decisions with regards to future dealings with the same supplier.

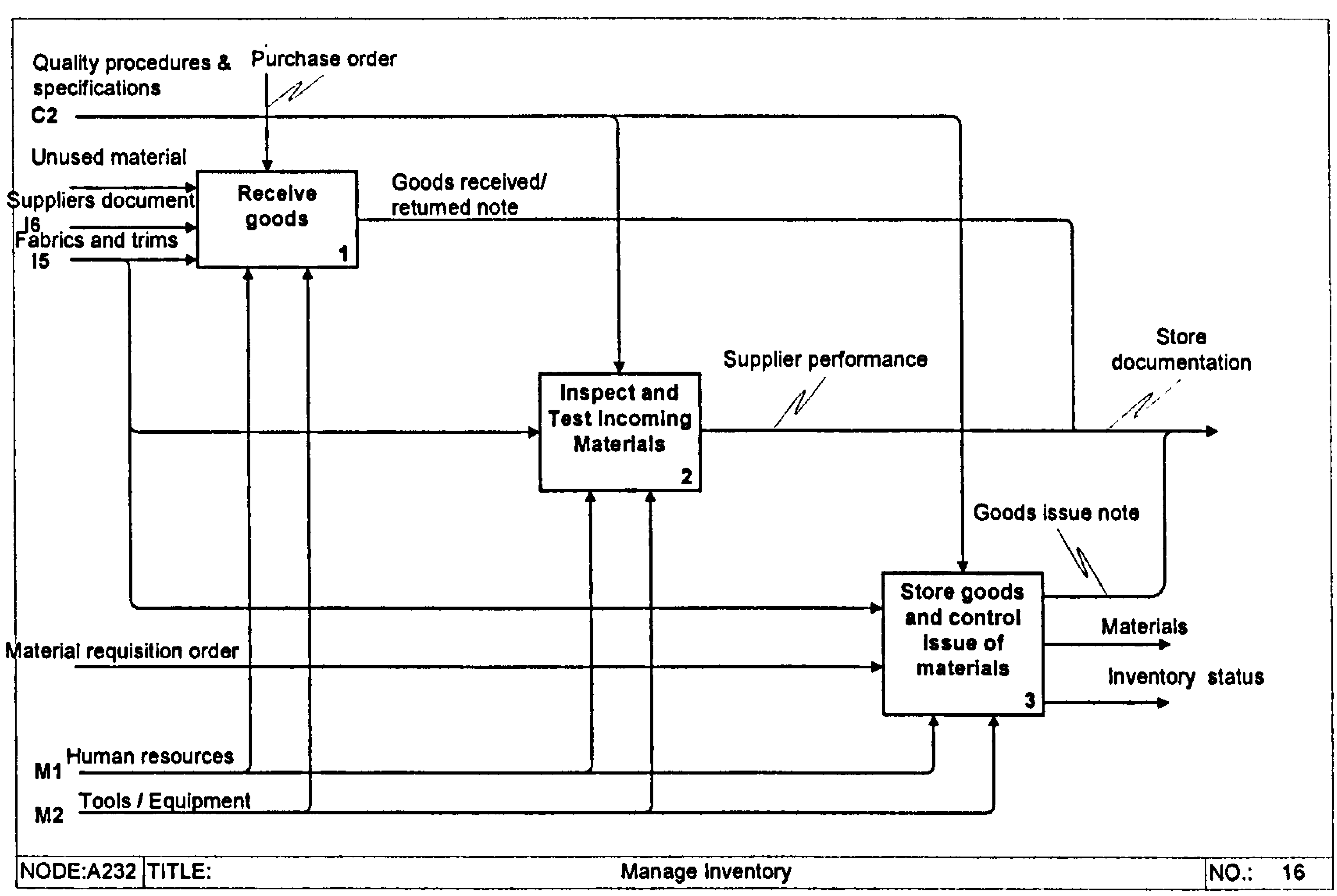

Figure 4.20 Manage Inventory activity

Cut, Make and Trim (CMT) (A233)

Cut, Make and Trim illustrates the main activities taking place for converting the raw materials into assembled garments (figure 4.21).

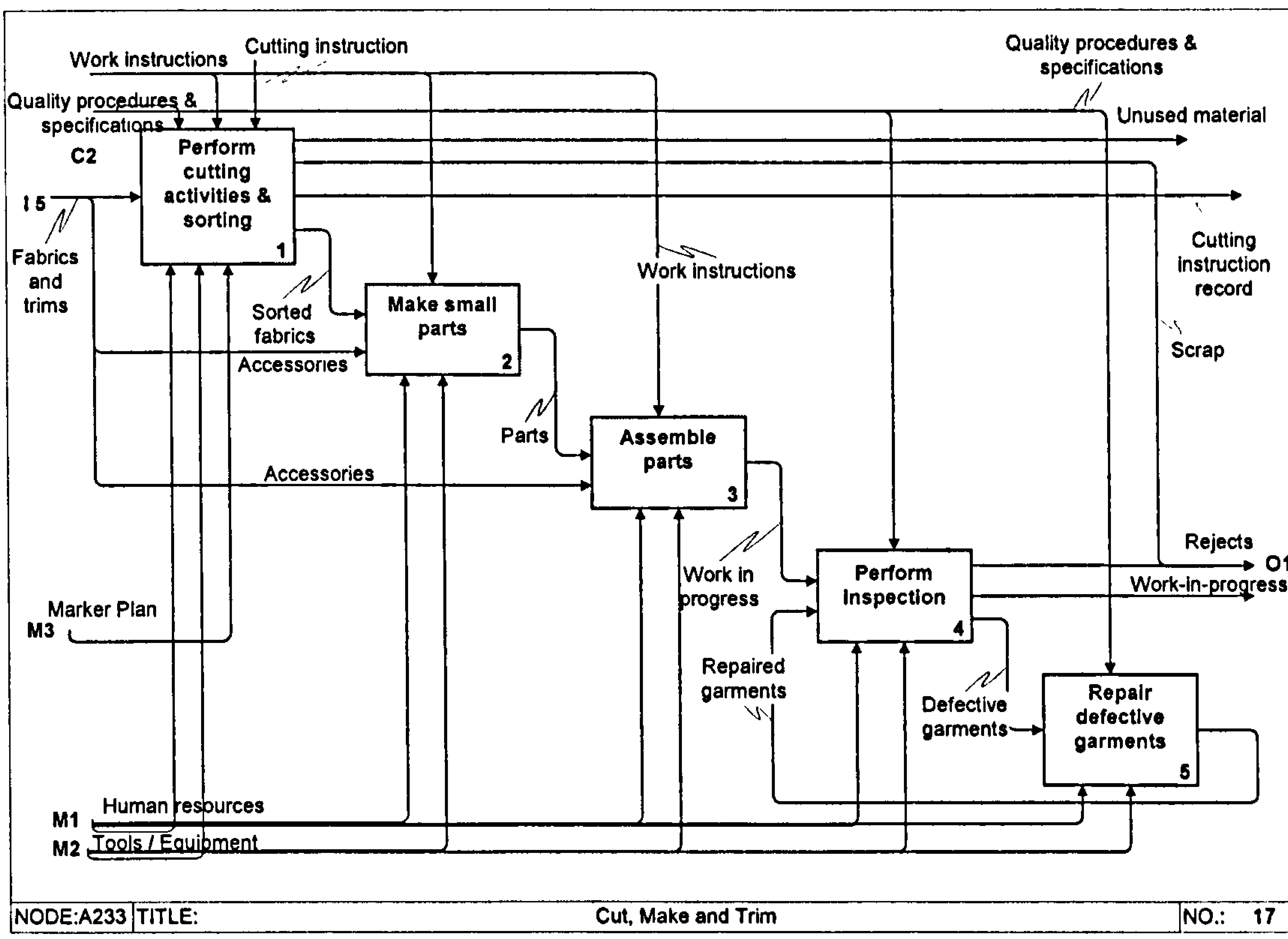

Figure 4.21 Cut, Make and Trim activity

Following receipt of work instructions, fabrics and interlinings (if required for a particular style) collected from the store are cut, sorted out and bundled according to cutting instructions and quality requirements. The supervisor decides upon the number of garments per bundle which most of time is a dozen. Note that most of the companies were using the progressive bundle unit (PBU) as the material handling system. In the event that an overhead material handling system was used, the cut pieces and all the required accessories were collected from the store, sorted out for each garment and were placed on hangers and loaded into the rail system at the start of the assembly line. A similar procedure is adopted for the PBU system except that in this case a bundle of cut pieces and accessories were tied together and loaded into the line. Carton boxes or push buckets were used for transferring the semi-finished bundle of garments from one workstation to the other. A production ticket was attached to each hanger or to each bundle for identification purposes.

Once cutting and sorting of cut pieces and accessories is complete, these are loaded onto the sewing line where small parts are first made (for instance for shirts, collars, pockets and cuffs are made) prior to the assembly of all the components into the garments in line with the sewing instructions. During and after assembly, all garments are inspected for defects and defective items are usually sent for repair, if feasible, on the production line. Garments that cannot be repaired are sold as scrap or rejects. Inspection is a prominent activity to ensure conformance to quality requirements and is usually based on 100 percent checks.

4.5.6 Develop Plans and Policies (A3)

Develop Plans and Policies (figure 4.22) refers to the set of activities, involving higher executives, associated with identifying means and mechanisms for meeting the goals set by the company for the medium and long term. The goals are mainly based on the evolution of the market environment and on the basis of the marketing, sales and production performance reports that are generated in-house. The plans and policies are vital elements of the garment manufacturing system as these serve as internal controls for all the activities taking place within the organisation. Also, it is these plans and policies associated with sales and marketing, purchasing, pricing, human resource management, plant maintenance, quality assurance, communication systems, among others that tailor the manufacturing strategy of the company. A change in the plans and policies hence has a direct effect on the manufacturing strategy of the company and eventually on the competitiveness of the manufactured garments in the world market.

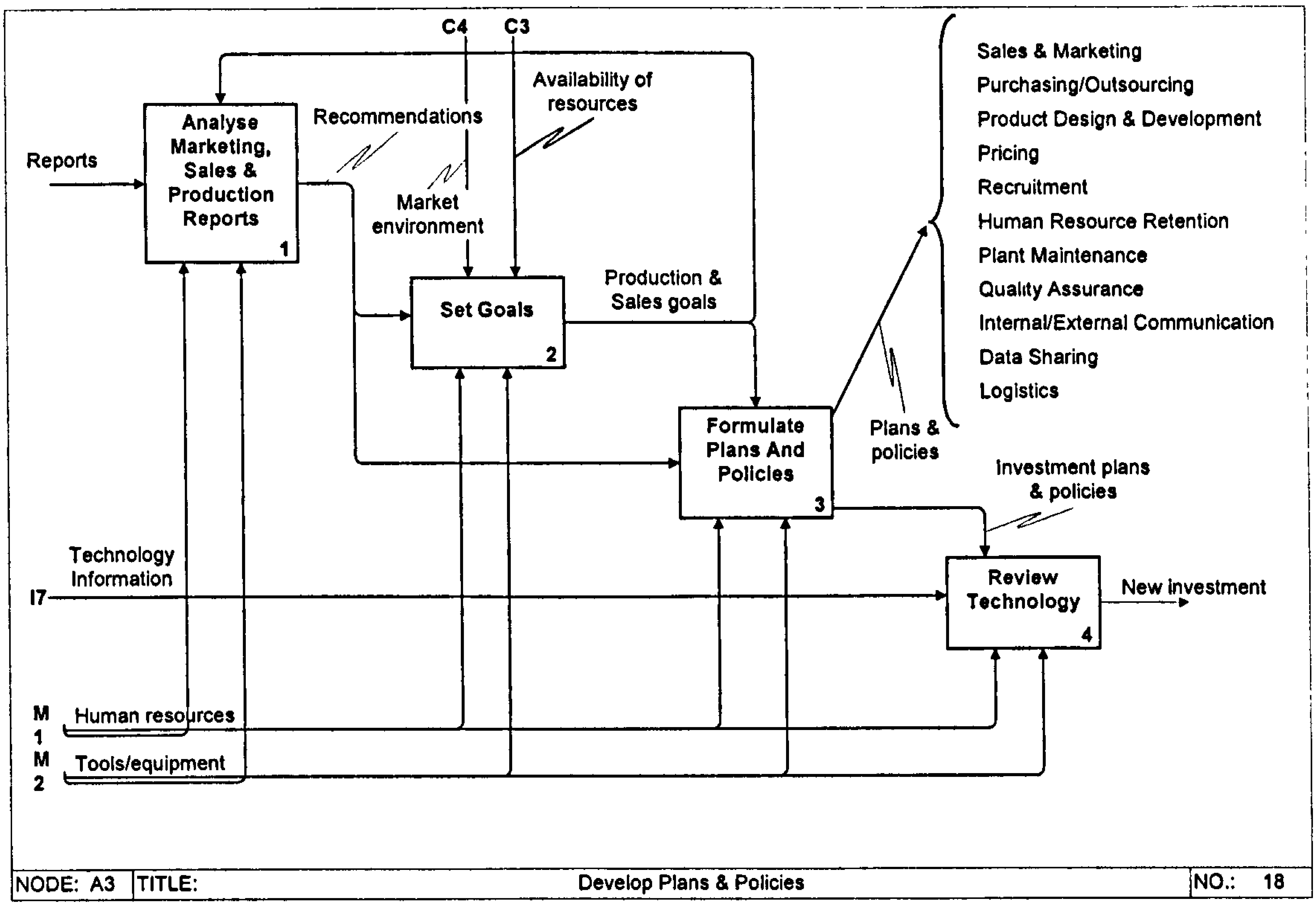

Figure 4.22 Develop Plans and Policies activity

4.6 Supportive Information System

The IDEF0 system model provides an effective illustration of the way activities involved in the process of garment manufacture are related to one another by means of ICOMs. The activities represented by function blocks clearly show the path a customer order follows, from inquiry to delivery. The model also serves to demonstrate how system concepts such as hierarchies, relationships and decompositions are used to describe and analyse the production system. In an effort to provide detailed descriptive information about the various ICOMs, a supportive information system was developed as documents and worksheets, which was accessible through the IDEF0 model for viewing purposes. It should be noted that the contents of the information system is only indicative of data that was used in the garment making companies. In spite of the commonalities in terms of functions within the companies, the information and communication systems were found to differ from one company to another. Hence for the purpose of feeding the model, the appropriate data were compiled from the sample of companies. The information system was linked to the ICOMs at the second and third level of decomposition within the IDEF0 model and mainly provides details about the human resources involved, the tools and equipment used, and documents and records that were in place in most of the manufacturing companies.

4.6.1 The Database Structure

The information system was constructed to provide supplementary details regarding the activities and sub-activities in the garment manufacturing system model. The database management software, namely Microsoft Access, was used to store most of the collected data and Microsoft Excel was used to store typical documents and records. Both the database and the spreadsheets were accessible through the IDEF0 model, which was developed on Visio Professional. Figure 4.1 gives a general picture of the structure of the information system.

A widely accepted definition of a database is a collection of data related to a particular topic or purpose. A database also contains objects to manage data, such as forms for entering and editing data and reports for printing data in the format that one requires. A database can contain any combination of six types of objects namely tables, forms, queries, reports, macros and modules. Given that the requirement of the project was to store information and display it in an appropriate format, only three components of the database was used namely Tables, Forms and Macros.

Tables are the fundamental structures in an Access database because they store the data one is managing. Within a table, data is organised into fields (columns) and records (rows). Forms are used to display and enter data in a convenient format that resembles fill-in-the-blank forms. Forms can be plain simple or quite elaborate with graphics, lines, and automatic lookup features that make data entry quick and easy. Forms can also include other forms (called sub forms) that allow data to be entered in several tables at once. A macro on the other hand, is a set of instructions that automates a task that one needs to do on a regular basis. When a macro is run, Access carries out the actions in the macro in the order in which the actions are listed. Without writing a single line of program code, one can define macros to automatically open database forms, print mailing labels, process orders etc… Macros enable a collection of tables, queries, forms, and reports to be assembled into turnkey applications that anyone can use, even if they know little or nothing about Access itself.

The database system consisted of a primary file called 'Production System Model' linked to several secondary databases (figure 4.23), which were created for the activities within the manufacturing system model that required further detailing. The primary database file contained all the information collected that was shared by the secondary files. Note that the database was designed such that information could not flow directly among the secondary files.

The database structure was chosen for the following reasons:

- It provides for data integrity. That is, whatever changes are made to a piece of data in any of the secondary files, the change will be updated in the primary database
- It offers data security. If there is some unintentional deletion of a secondary file, the information will still be available in the primary database file. Therefore the information can be retrieved and consequently the database file is restored.
- It provides limited access to data for instance, one can access only one secondary database at a time such that while viewing information concerning a particular activity, only the relevant information is displayed.
- The system is simple and easy to use and to navigate around. The use of several databases each containing information about a particular activity greatly reduces the complexity of the internal structure of a database. A database possessing a simple internal structure is easier for anyone to understand and to master. Thus maintaining the database if need be, will not be that difficult in the future. Figure 4.23 shows the way the databases were related and organised.

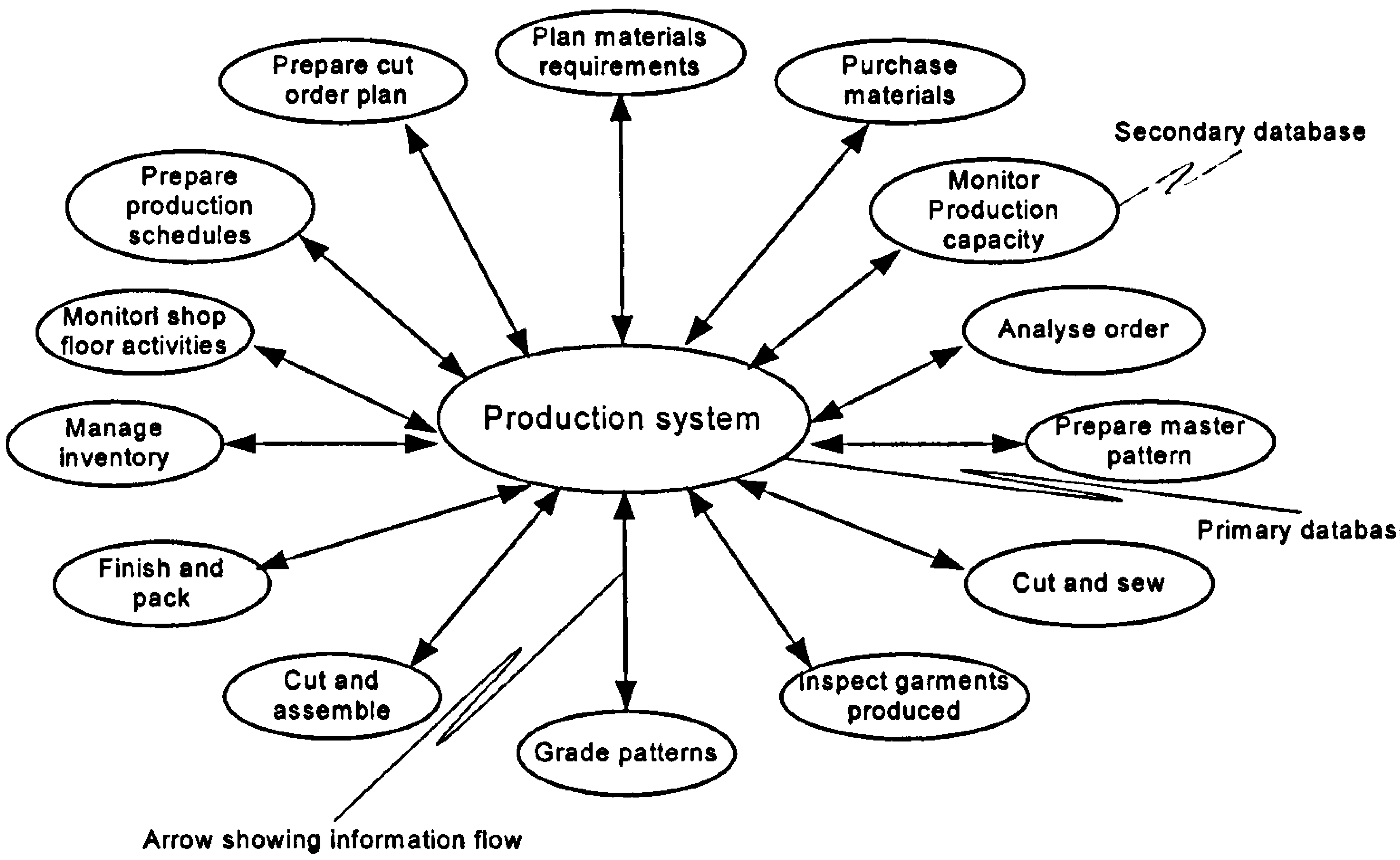

Figure 4.23 Relationships between databases.

The data collected are stored in tables within fields (columns) and records (rows). Thirteen tables, which constitute the primary database, were created. Table 4.5 summarises the list of tables and also gives a description of the type of data stored within each table.

The database information could be accessed either by using the hyperlinks available in the IDEF0 model or by accessing it independently through the primary and secondary databases.

Table	Description of Information Stored
Activity	A list of activities at the second level of decomposition within the manufacturing system model.
Human Resource	A list of all the persons responsible for the various activities and sub-activities
Material	A list of typical materials commonly used in the manufacture of a garment The materials can be grouped into three categories (main material, sewing accessories, packing accessories)
Suppliers	A list of typical material suppliers
Spare Parts	List of typical spare parts
Tools/Equipment	A list of the tools/equipment used in the fulfill order and its sub-activities. A brief description of the function of the equipment and the maintenance frequencies.
Maintenance	A list of the maintenance activities.
Quality Specifications	Details about typical quality specifications.
Pre run order	A brief description of the data on the pre run order
Manufacturing Order	A brief description of data present on the production order
Master Pattern	Information about the master pattern.
Pattern grading	The steps required for grading the patterns.
Work instructions	A list of work instructions associated to operations such as bundling, sewing cutting, assembling etc

Table 4.5 List of tables in the primary database

4.6.2 Documents and Records

Documents and records were constructed and stored on Microsoft Excel as it provided a convenient means of storing such data. Although the documents and records were developed on another software package, these could be easily accessed from the secondary database files or from the IDEF0 model, through the inbuilt hyperlinks. The following typical documents and records were compiled during the course of the modeling exercise and were linked to the garment manufacturing system model.

1. Cutting room schedule sheet
2. Sewing room schedule sheet
3. Costing of cut order plan sheet
4. Cut order plan sheet
5. Cutting instruction sheet
6. Cutting instruction record

7. Internal purchase order sheet
8. Purchase order sheet
9. Records of purchase orders
10. Material inventory sheet
11. Fabric inventory sheet
12. Material requisition form
13. Goods received note
14. Goods issue note
15. Good returned note
16. Work in progress sheet

4.6.3 Using the Information System

The working of the information system is as illustrated in the flowchart shown in figure 4.1. The operation of the information system lies with one fundamental feature called hyperlink. Hyperlinks are used to jump to information in a database, in an office document or in any software file provided the software supports hyperlinks. There are two working procedures for the information system namely the standard procedure by accessing the information from the IDEF0 model or the alternative procedure, which is to access the data directly on the main database. The standard procedure provides a more complete picture of the garment manufacturing system model.

The steps for the standard procedure are as follows:

Step 1 Open the Garment Manufacturing System model on Visio Professional and browse through the different pages (A0, A1, A12, A2, A21, A22, A23, A3, etc...) to have a complete picture of the model.

Step 2 Select any activity of interest from the model (e.g. activity Manage Inventory from Manufacturing Garments (A23) model) and the hyperlink opens the corresponding database file in Microsoft Access, in another window. The switchboard for the Manage Inventory activity is shown in figure 4.24.

Step 3 Select an option on the menu form to view the information. If the information is in the form of a spreadsheet, a hyperlink opens the corresponding Excel file in another window so that the document can be viewed or edited. Otherwise, the information can be viewed on the Microsoft Access database file.

Step 4 Close any Excel or Access file and go back to the Visio window and proceed from step 2, otherwise close the Visio file.

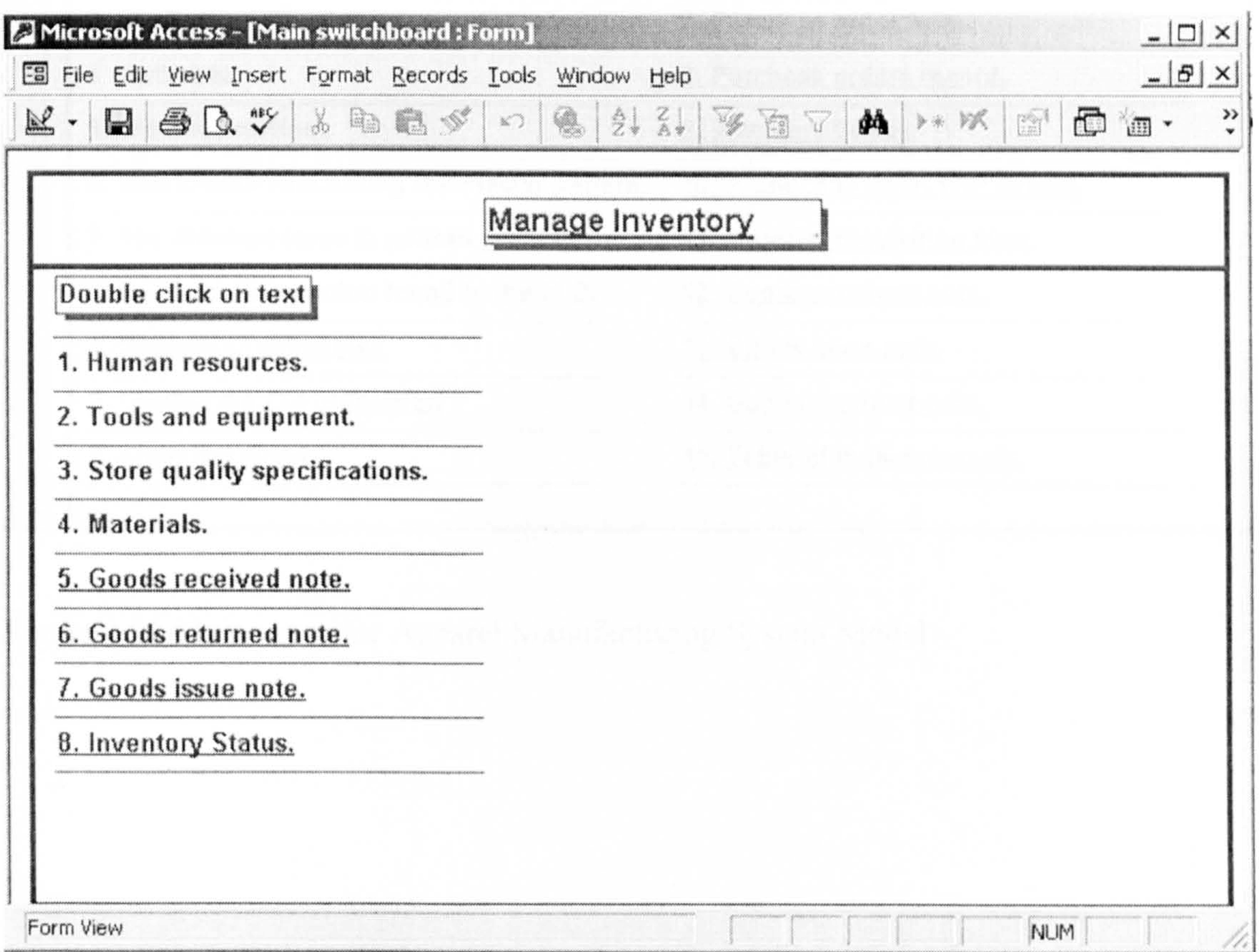

Figure 4.24 Menu form for Manage Inventory activity

The alternative procedure consists of opening the main database file in Microsoft Access to view or edit the data from the file. Figure 4.25 shows the main menu and the files that are accessible through the IDEF0 apparel manufacturing system model.

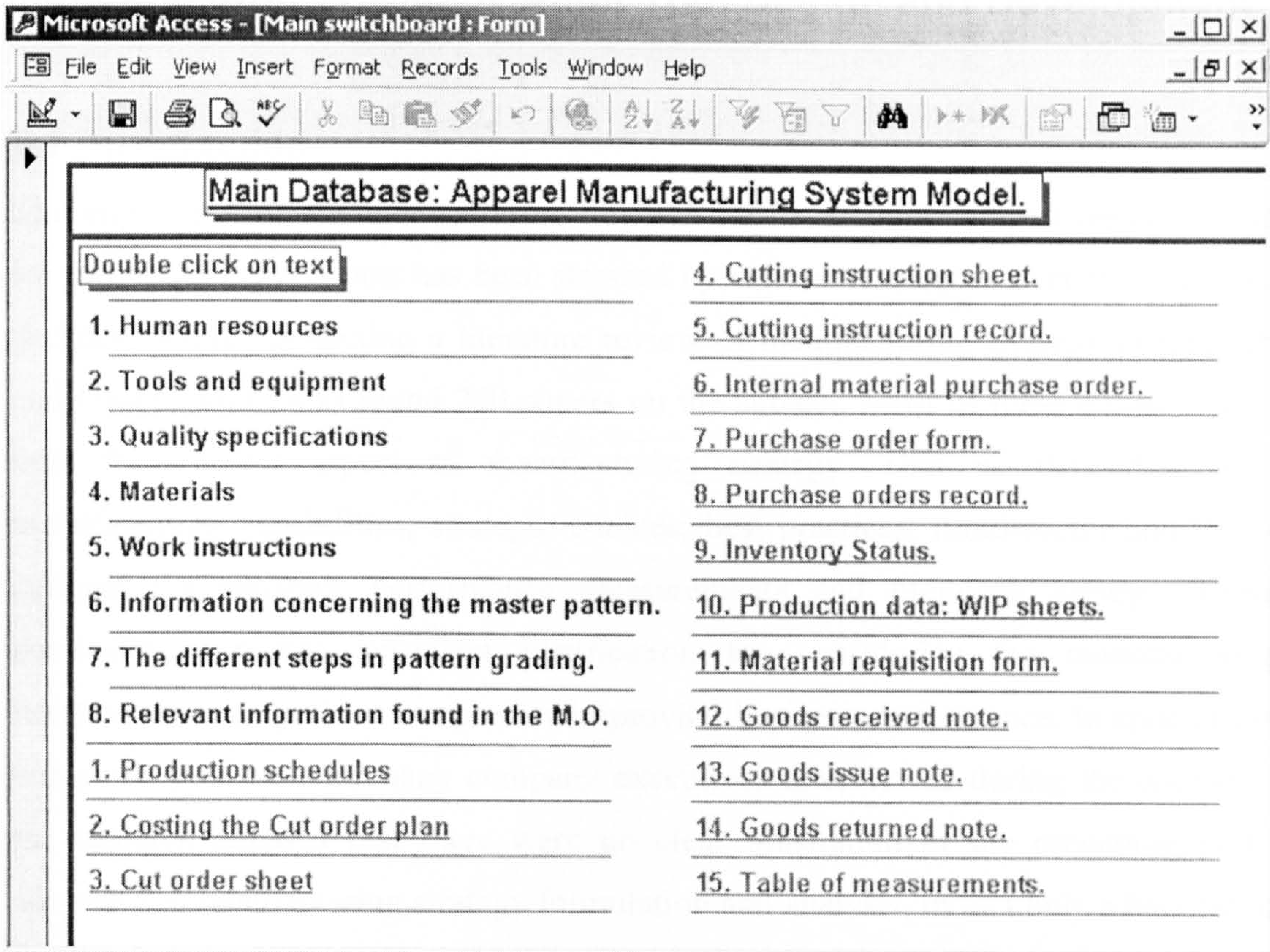

Figure 4.25 Main menu for Apparel Manufacturing System Model

Chapter 5
Manufacturing Strategy Audit Tool Design and Development

5.1 Introduction

The importance of the manufacturing function for developing competitive advantage for manufactured products has been stressed by various researches over the last three decades. While conducting a literature review of manufacturing strategy Dangayach and Deshmukh (2001) found 260 papers on the subject. Most of these papers (91%) treat the content aspect of manufacturing strategy. That is, they deal with manufacturing capabilities, strategic choices, best practices, multi-sector and trans-national comparisons, performance measurements and literature surveys. These publications provide sufficient justification for considering the manufacturing function as a competitive weapon for improving business performance. In spite of the numerous publications, many company executives interviewed during the course of the research stressed that there were no clear illustration of the procedure to be adopted for manufacturing strategy formulation and analysis. In fact only a handful of publications were found to deal with the setting up of an appropriate framework (Skinner 1969, Hayes and Wheelwright 1985, Fine and Hax 1985, Hill 1987) and the definition of a step-by-step process for the formulation and analysis of manufacturing strategy (Platts and Gregory (1990), Kim and Arnold (1996), Hill (1987), Mills et al. (1995), as discussed in chapter 3.

Though the frameworks and the processes provide a generic approach for the development of manufacturing strategy, there is little illustration of the mechanisms to be used by individual companies for deciding upon appropriate alternative strategies and for analysing their manufacturing systems following implementation of the strategies. Also, none of the publications specifically refer to the garment-making sector. This makes the process of manufacturing strategy even more of a myth to many of the garment making companies, which are interested on the use of a simple procedure for deciding upon and assessing the effectiveness of specific strategies. This chapter illustrates such a procedure; this has been designed and developed as a manufacturing strategy audit tool, specifically for garment making companies. Use of the tool has shown promising results in a number of companies in Mauritius and is seen as a vital instrument for companies in developing economies to achieve enhanced product competitiveness in a world of free apparel trade. Use of the tool in specific companies is illustrated in the next chapter.

5.2 The Process of Manufacturing Strategy

For the purpose of this research, manufacturing strategy has been defined as a planning mechanism to focus manufacturing activities in order to provide the required support to meet business objectives and achieve competitive advantage. In their definition of the term, Marucheck et al. (1990) state that

> *The strategy should be easy to articulate and understand; it should provide a basis for improvement; it should be difficult for competitors to match; it should focus only on a few key success factors; it should be durable; and it should imply internal performance criteria for measurement.*

The above was widely accepted by most company executives and in addition they emphasised the need to adopt a holistic approach towards manufacturing strategy. It was argued that all functions have an influence on the manufacturing strategy that is adopted by the companies and hence manufacturing could not be treated in isolation and limited to the shop floor operations. This is clearly visible from the manufacturing system model whereby the 'Develop Plans and Policies' (A3) activity has an influence on all the other functional activities taking place in the manufacturing organisation.

The process of manufacturing strategy is the step-by-step procedure to be adopted for the analysis, formulation, selection and implementation of manufacturing strategies. The most commonly cited process of manufacturing strategy includes those proposed by Skinner (1969), Hayes and Wheelwright (1985), Hill (1985), Hofer and Schendel (1978), Platts and Gregory (1990) and that of Mills et al. (1999). A complete literature review on the work of the above researches is given in chapter 3. It should be noted that all the proposals are generic in nature and so far only a few publications by the above named authors have treated the implementation aspects of the procedures for a limited range of manufacturing companies. Also the proposed procedures are lengthy and cumbersome such that companies usually require the help of an external consultant (with sufficient expertise on the use of the procedures) for embarking upon manufacturing strategy formulation and analysis.

Based on the definition for manufacturing strategy and the concepts supporting the generic frameworks developed by the various researches, a novel manufacturing strategy framework was developed with a view to provide a simple tool to manufacturing companies allowing them to assess their current manufacturing strategy and take appropriate decisions based on the results of the assessment. The framework shown in figure 5.1, which can equally be used in any other manufacturing scenario, was used as a guideline for the development of a manufacturing strategy audit tool for garment making companies. The process of manufacturing strategy development for the companies involved the use of the audit tool and the making of appropriate decisions for implementing change in the light of the results generated from the auditing exercise.

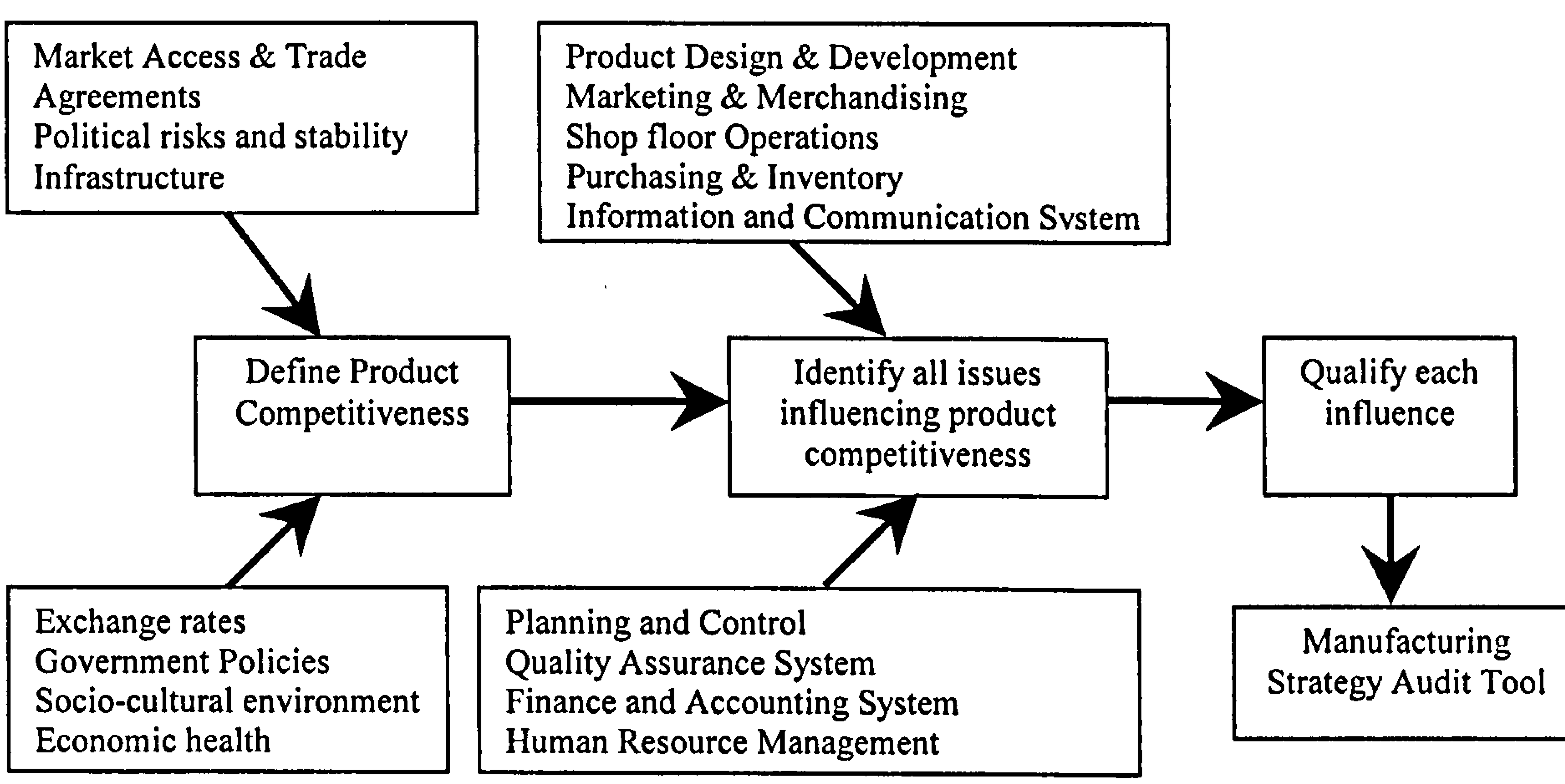

Figure 5.1 Framework for Manufacturing Strategy Audit Tool Development

The manufacturing strategy framework involves four main stages:

1. Definition of product competitiveness
2. Use of the IDEF0 manufacturing system model to identify all activities and issues influencing product competitiveness.

3. Quantification of and qualify the influences
4. Compilation of all the above information in a format, which can be used for manufacturing strategy assessment, selection and for benchmarking purposes.

Note that the data collected for the purpose was not limited to specific companies but aims to cover the practice within the industry. In the present case data was collected from all the seventeen garment-making companies selected and the views of key experts from EPZDA was sought to ensure that the maximum number of possibilities in terms of manufacturing practice was exploited.

5.2.1 Defining Garment Competitiveness

The competitiveness of a ready-made garment is its ability to gain acceptance in the market place in favour of similar garments offered by competing companies. The three attributes that dictate the competitiveness of garments in the world market include the following (see also section 3.4 for details on manufacturing strategy adopted by garment making companies):

1. The acquisition cost of the garment. This comprises of all the monetary charges associated with the purchase of the garment by the customer from the supplier company. The charges mainly include material costs, manufacturing costs, overhead expenses, transportation and distribution costs, profit margins and tariffs and duties. The definition for each of the charges comprising the acquisition cost of the garment is given in table 5.1.

   Competing on cost, referred to as achieving Cost Leadership by Porter (1980), implies that the manufacturing company aggressively seeks efficient facilities, employs tight cost controls, employs easy to use manufacturing technologies, promotes close supervision, and maintains standard operating procedures in order to be more efficient than the competitors.

2. The quality and/or performance standard of the garment. The quality of garments can be viewed as the serviceability and value that end users gain by purchasing the garment. Customers usually rely on a wide variety of cues to determine whether the garments meet their quality needs. These cues can be classified as intrinsic and extrinsic quality features (Kunz, 2000). Intrinsic quality is created during garment

design and manufacture and is dependent on factors such as properties of fibres, yarns, fabrics, styling and fit, cutting and assembly methods and finishing operations. The intrinsic quality features dictate the performance of the garment, usually not obvious to the end user. Extrinsic cues are more often used by retailers as indicators for intrinsic quality and to influence perception of quality, value and performance of the garments. These include for instance, garment prices, brand names, reputation of retailers, visual merchandising techniques, and advertising campaigns.

Material Cost Direct material Indirect material	Direct material comprise of fabrics, threads, trims and findings used in the manufacture of the garment. Indirect materials include materials that are used for the packing and packaging of the finished garment.
Manufacturing Cost Direct labour Indirect labour	Direct labour includes employees that are directly responsible to add value to the garment. These include cutters, sewing operators, and finishing operators. Indirect labour consists of service personnel, quality controllers, material handlers, helpers, mechanics and maintenance workers, security personnel etc...
Overhead Cost Variable Non Variable	Variable overheads include machine parts and repairs, marker papers, needles and other consumables used in the shop floor. Non-variable overheads include rent, depreciation, insurance, property taxes, security, machinery and equipment etc...
Administrative Overhead	Administrative overheads are indirect costs for operating the general offices and departments for instance, engineering, Research & Development, merchandising, marketing, accounting, management information systems, secretarial and clerical offices and personnel office that are not directly involved with the product line but are essential to the operation of the firm.
Transportation and Delivery Costs	Transportation costs involve the costs associated in moving the finished garment from the manufacturing company to the customer (store, warehouse or distribution centre). These include cost for inland transportation, sea or airfreight charges, insurances, taxes and duties paid to appropriate authorities.
Gross Profit Margin	Gross profit margin is the amount available to the manufacturing company to cover all the above costs and profit as determined by subtracting net costs from net sales.

Table 5.1 Definition of cost parameters (Adapted from Kunz, 2000)

Competition on the basis of quality and performance standard of garments is closely associated with the intrinsic quality features. Products sold at the lower end of the market usually provide adequate performance and quality to meet the requirements of low budget customers. Quality is thus a pre-requisite to market entry (Order qualifier as argued by Hill, 1985). Companies with a greater focus on intrinsic quality features usually achieve better results in terms of fabrics, creativity and innovation in design, styling and fit, exclusivity and uniqueness of garments and aim at the upper end of the market (designer and fashion wear).

3. The flexibility provided by garment suppliers in terms of products, product volumes, product mix, and product delivery schedules. Flexibility reverses the principles of mass production, which are typical of garment manufacturing systems operating at the lower end of the market. Flexibility involves the use of general-purpose capital equipment and multi skilled adaptable labour to produce a wide and changing range of garments to match the variety of garments in demand. It revolves around the ability to identify market trends before competitors, producing a variety of different products on the same line, switching between lines rapidly at lowest cost, concentrating on short runs, and developing new and modified products faster than competitors or the rest of the industry. In short, flexibility is about synchronisation of production in proportion to demand. In addition, flexibility encompasses the notion of time compression across the apparel supply chain to achieve quick response (QR).

   Hunter (2000) defines QR as a state of responsiveness and flexibility in which an organisation seeks to provide a highly diverse range of products and services to a customer/consumer in the exact quantity, variety and quality, and at the right time, place and price as dictated by real time customer/consumer demand.

   QR provides the ability to make demand information driven decisions at the last possible moment in time ensuring that diversity of offering is maximised and lead times, expenditure, cost and inventory minimised. QR places an emphasis upon flexibility and product velocity in order to meet the changing requirements of a highly competitive, volatile and dynamic marketplace. QR encompasses a strategy, structure, culture and set of operational procedures aimed at integrating enterprises in a mutual network through rapid information transfer and profitable exchange of activity.

It should be noted that even if companies are competitive in terms of price, quality and/or flexibility, there are a number of factors beyond the control of the manufacturing organisations that influence the decision of customers for purchasing of garments from specific suppliers or countries. These factors for instance, include:

1. Economic health of the supplier country (e.g. inflation rate, Gross Domestic Product, Income per capita)
2. Changes in monetary exchange rates to the advantage of the supplier
3. Political risks and instability in the supplier country (e.g. government take-overs, acts of violence against companies, frequent riots, revolutions, civil disorders and wars, frequent changes in government, ethnic violence)
4. Laws and regulations to protect the interest of the customer (e.g. transhipment, consumer protection, holidays)
5. Laws and regulations in line with international norms and standards (e.g. use of child labour, health and safety standards, labour exploitation)
6. Supplier country infrastructure (e.g. transportation, education and training, communication, access to technology and energy production systems)
7. Trade regulations (e.g. tariffs, quotas, taxes, trade agreements) between the countries
8. Written and spoken language in the supplier country
9. Religious beliefs including taboos

Given that the focus of this project is on the manufacturing strategy adopted by companies to achieve product competitiveness, the inside out approach to manufacturing strategy has been adopted; that is, studying the systems that can be reengineered within the company to achieve enhanced product competitiveness. It has been assumed that the external factors are favourable for conducting business and that there are no major barriers for trading with customers around the world. In the case of Mauritius for instance, the country has been experiencing sound economic health over the past 20 years, there is no political unrest, laws and regulations are in line with international norms, trade agreements allow for limited tariffs and quota restrictions, there is a sound public infrastructure and above all, the country has been manufacturing garments for exports for almost three decades now.

5.2.2 Influences on Garment Competitiveness

Garment competitiveness having been defined, the second stage in the manufacturing strategy framework involves the identification of all issues within the control of the manufacturing organisation that influence the competitiveness of the manufactured garments.

The consensual argument of all the manufacturing companies visited during the course of the present research in terms of their long-term goal was to remain competitive in the world market even after the phasing out of the Multi Fibre Arrangement (MFA). This competitiveness was almost always defined as achieving any one or a combination of low cost, high quality and enhanced flexibility for the manufactured garments. Also, it was generally accepted that the manufacturing strategy adopted by the company strongly influenced the competitiveness of the garments. However, to most people, including company executives who were interviewed during the research, manufacturing strategy implied the strategy adopted on the shop floor for the cut, make and trim operations. Manufacturing strategy was thus not only wrongly interpreted but was also viewed as a function in isolation, closely associated to the shop floor operations.

The IDEF0 garment manufacturing system model allowed the companies to have a holistic view of the concept of manufacturing strategy and appreciate the importance and the interaction between the various functions involved in the garment manufacturing process. The definition of manufacturing strategy when viewed through the IDEF0 system model confirmed the influence that other functional areas had over the strategy of the company and vice versa. The Develop Plans and Policies activity (A3) is linked to both the Acquire Customer Commitment (A1) and the Fulfil Order (A2) activities and defines the overall operating principles to be adopted for meeting the organisational goals. At a lower level within the IDEF0 model, the plans and policies are regarded as the functional strategies to be adopted within the company. These, for instance, include strategies for Product Design and Development (A22), Sales and Marketing (A1, A12), Cut, Make and Trim (A23, A231, A233, A234), Purchasing and Inventory (A214, A232), Planning and Control (A211, A212, A213, A215) and supporting functions to the IDEF0 model, like Human Resource Management (M1), Finance and Accounting, Maintenance of Tools and Equipment (M2), Logistics, Communication and Quality Assurance systems. The supporting functions are common to each of the modelled functional activities and hence have been treated as such while investigating the influence of different modes of operations on the manufacturing strategy of the companies.

During the data collection process, it was found that the interpretation of the term functional strategy differed from one company to another. This resulted in the compilation of an exhaustive list of functional strategies and manufacturing practices from the various companies. In order to have a uniform view of strategies that cut across all companies, the collected information was grouped under separate headings using affinity diagrams. This led to the listing of the most probable functional strategies for garment making companies. The list is given in table 5.2. It is a combination of these functional strategies that tailor the manufacturing strategy of the garment making companies.

It can be seen from table 5.2 that there are hundreds of possible combinations of strategies that can be adopted by companies for conducting business in the garment making industry. Though all the strategies listed have an influence on the manufacturing strategy of the company, only a few have a strong positive influence on the competitiveness of the garments manufactured. These functional strategies are listed in italics in table 5.2.

Functional Area	Functional Strategies
Marketing/Merchandising (A1, A12)	1. *In-house marketing/merchandising executives (M1)* 2. Customer markets the product (M2) 3. Use expertise of local/overseas sales agent (M3)
Product Design and Development (A22)	1. *Customer/Manufacturer collaborative design (D1)* 2. In-house design (D2) 3. Customer design (D3) 4. Use expertise of design agent (D4)
Planning and Control (A211, A212, A213, A215)	1. *Short term planning (P1)* 2. Medium term planning (P2) 3. Long term planning (P3)
Purchasing and Inventory (A214, A232)	1. *Supplier/customer partnership (I1)* 2. Single sourcing without partnership relationship (I2) 3. Multiple sourcing (I3)
Cut, Make and Trim (A23, A231, A233, A234),	1. *Batch production (C1)* 2. Long run production (C2)
Human Resource Management (A33)	1. *Maintain and develop effective workforce (H1)* 2. Take advantage of cheap labour (H2)
Finance and Accounting (A33)	1. *Promote new investment (F1)* 2. Limit expenses (F2)

Table 5.2 Functional strategies for garment manufacturing companies

A. Marketing/Merchandising Strategy

The purpose of the marketing function is to shape and strengthen the company image and its products through advertising/promotion campaigns and by positioning the company relative to target markets and competitors. Marketing equally involves other activities like conducting customer research and forecasting sales to ensure that the manufactured garments meet the delivery requirements of the customers. Merchandising on the other hand involves the planning, development and presentation of product lines for identified customers (target markets) with regards to prices, assortments, styling and timing. In most of the firms, the marketing and merchandising functions were lumped together such that they were the central coordinating point between the customers and the manufacturing company.

The typical strategies for the marketing/merchandising function include (see also section 3.4):

1. Consolidation of market position: Companies aim at expanding the sales of current products in the current market or with existing customers.
2. Market development: Companies aim to find new customers for the current product line.
3. Differentiation through diversification: Companies aim to develop new products for new customers.
4. Differentiation through fabric and garment design: Companies aim to enhance the quality of existing products by incorporating innovative features in terms of fabrics or garment design for existing customers.

All the above strategies require the companies' involvement in extensive market and product research for successful implementation. During the visits to the companies, it was found that in a relatively large number of cases, no such research was undertaken in-house. The market information was in fact available either from local/overseas sales agents or in a number of cases from the customers themselves. It is based on this information that the strategy for the garments to be manufactured, is developed. A few companies however were seen to have a fully operational marketing/merchandising department for both conducting market research and presenting/promoting product lines to potential customers for the purpose of securing confirmed orders.

B. Product Design and Development Strategy

Product design and development refers to the set of activities associated with the creation of garments for the company's product line that will meet or anticipate the needs of the target market and produce a profit. The strategy for product design and development usually follows that of the marketing/merchandising department. It was observed that fabric and garment design was mostly proposed by the customers who supplied the fabrics and accessories for the CMT operations. Collaborative design efforts between the customer and the manufacturing companies were also a common practice. However, the design function rarely became involved in research on fabrics or on different styles but was rather associated with the production of samples and graded patterns for the garments and investigating the most effective method for manufacturing the garment. In-house designs on the other hand involved bringing in improvements on existing designs or on design that are already available on the market. Hence in terms of strategy, product design and development was viewed in terms of the management plans and policies for this function rather than in terms of what can be achieved by the design function.

C. Production Planning and Control Strategy

Production planning and control is the process of coordinating the available resources to ensure that the finished garments are delivered in line with the customer requirements as per the agreed schedule. Planning of the CMT and other activities usually depends on the order size and the plant capacity and may cover periods ranging from weeks to months. It was common practice in the recent past (in the 1980s and early 1990s), for the majority of the companies to have long term planning covering periods of up to six months ahead. Many of the companies visited still favour long term planning strategies which facilitates sourcing of fabrics and accessories, human resource and capacity management and on time delivery. However, all the companies confirmed the considerable reduction in order size and on the order to delivery lead-time, which has necessitated changes in the planning and control strategy from the long term to medium or short term planning. Short term planning usually covers a period of up to eight weeks. Planning and control strategy has a high influence on the strategy that is adopted on the shop floor namely for the sourcing of fabrics and accessories and for the manufacture of the garments.

D. Purchasing and Inventory Management Strategy

Purchasing or sourcing strategy refers to the plans and policies of the company for the procurement of fabrics and garment accessories from the various suppliers to the garment industry. It should be noted that only a few companies were vertically integrated and manufactured their own fabric. In the majority of cases, fabrics were either obtained from the customers or were outsourced from local or overseas fabric suppliers. The strategies that were used for outsourcing involved the following:

1. Supplier/customer partnership: In these cases, the materials were in almost all cases purchased from specific suppliers (local or overseas) which whom the company had partnership agreements.
2. Single sourcing without partnership relationship: In these cases, in spite of no written agreement with specific suppliers, the materials were purchased in

preference with them usually because of past performance and the reliability of the suppliers.

3. Multiple sourcing: A large number of companies were found to rely on quotations from different suppliers before making decisions thereon.

E. CMT Strategy

CMT refers to the Cut, Make and Trim operations on the shop floor of the company. These constitute the main value added activities in the garment making companies whereby the purchased fabrics are cut in line with the garment patterns, sorted out and fed into the production lines for assembly, and finished (and packed) in accordance with the specifications that are provided by the customers. The CMT operations equally involved implementing quality assurance plans and policies for meeting customer requirements in terms of quality specifications. The plans and policies for the CMT function largely depend on the volume of the production order. It was observed that high volume production, involving long term planning with little variations in product range was the most preferred strategy for the CMT operations in the companies. However, with the continuous reduction in order size and lead-times and increased pressures on changing garments designs from the customers, a number of companies were seen to have embarked upon a batch manufacturing strategy; the aim being to achieve enhanced manufacturing flexibility and performance standards. Note that mass production strategy places high emphasis on the utilisation and on efficiency of each operation requiring maximum output for each unit of input (employee, machine, material etc...). The performance measurement policies for batch-manufacturing strategy on the other hand involves a range of criteria covering effectiveness of human resources, product quality, changeover times, inventory turnover, space, and material utilisation rates among others.

F. Human Resource Management Strategy

People are the firm's greatest resource (Kunz, 2000, p367). Discussions with employees within the companies led the author to believe that it is the people within the manufacturing organisations that influence the success or not of specific plans and policies. Many of the companies were seen to have limited plans and policies for motivating the employees to fully participate in achieving the goals set by the company. The most common strategy adopted by these companies was to take advantage of cheap labour for the CMT operations. This equally included employment of low cost foreign labour from Mainland China, India and Sri Lanka. On the other hand, a number of companies have adopted plans and policies to create a good working environment for their employees and provide all the support required to create a highly motivated workforce with a sense of belonging to the company.

G. Finance Strategy

The finance strategy is associated with the immediate and future plans and policies of the company for selective investment, growth or divestment in line with the corporate strategy of the company. The plans and policies for finance management are mainly based on the performance of the business for generating profits. The possibilities in terms of finance strategy were either to promote investment in terms of human resources, plant and equipment and other infrastructure or to place high emphasis on cost reduction across the supply chain.

5.2.3 Quantifying and Qualifying Influences

The third stage in the manufacturing strategy audit framework involved using the IDEF0 manufacturing system model as a guide for the listing of all the requirements for achieving any one or a combination of the functional strategies. These requirements were fully discussed with the participating companies and were formulated as a set of statements which provided detailed indications of the company's practice for each of the functional area, in terms of the input needed, the output generated, the control systems required, human resources needed, tools and equipment required, the time frame involved, the decision-making centres, manufacturing standards, and information/ communication systems in place, among others. This is equally illustrated in table 5.3. For instance, for the four possible strategies for product design and development, there were 100 statements listed which provided details of all possible practices within the industry in terms of each of the following:

1. The people involved in the design process
2. The tools and equipment used for design

3. Costing policies adopted
4. Differentiation features considered for the design of the garment
5. Compilation and use of design information
6. The communication system for data sharing between all parties in the design process
7. The drafting of specifications
8. The production of graded garment patterns
9. Lead times for agreeing upon designs
10. Evaluation of the design vis-à-vis market requirements
11. The reasons for adopting a specific product design and development strategy

In order to qualify the influence, each statement was assigned a score to illustrate an industry average or better practice (table 5.4). An industry average was allocated a score of 3 while a better practice a score of 5. Note that the score is qualitative and hence is only indicative of the practice. In fact, during the initial phase of the questionnaire design, a graded scale was used to designate poor, average and better industry practices. However during the validation exercise it was argued by the company executives that none of statements could be considered as poor practice as these possibly suit the requirements of the companies concerned.

The statements were validated by the company executives and by key experts from the Clothing Technology Centre of the Export Processing Zone Development Authority (EPZDA). The number of statements reached per functional area is shown in table 5.3; for instance, for the product design and development function the number of statements was 100. The complete listing of the statements for the product design and development function is given in table 5.4 and those for the other functional areas are given in Appendix E.

A similar procedure was adopted to quantify and qualify the practice adopted by the other functional areas namely Sales and Marketing, Production Planning and Control, Purchasing and Inventory Management, CMT, Finance and Accounting and Human Resource Management to compile all the possibilities, which led to any one or a combination of the listed functional strategies.

<table>
<tr><th colspan="3">Functional Statements in terms of</th><th>Manufacturing Function (no. of statements)</th><th>Functional Strategies</th><th>Manufacturing Strategy</th></tr>
<tr><td rowspan="7">Input
Output
Control Systems
Human Resources
Technology
Time
Decision making
Standards
Investment
Communication & Information System</td><td rowspan="7">Who
When
How
What
Why</td><td rowspan="7">Average Practice
Better Practice</td><td>Marketing/ Merchandising (117)</td><td>In-house marketing department
Marketing agency
Customer marketing</td><td rowspan="7">Cost Leadership
Manufacturing Flexibility for achieving Quick Response
High Value Added</td></tr>
<tr><td>Product Design and Development (100)</td><td>In-house design (including mother Co.)
Use of Design Agent
Manufacturer/Customer collaborative design
Customer design</td></tr>
<tr><td>Production Planning & Control (108)</td><td>Long term planning (6 months or more ahead)
Medium term planning (3 to six months ahead)
Short term planning (less than 3 months ahead)</td></tr>
<tr><td>Operations (118)</td><td>Long run production
Batch manufacturing</td></tr>
<tr><td>Purchasing & Inventory (105)</td><td>Supplier/Customer partnership
Single sourcing without strategic partnership
Multiple sourcing</td></tr>
<tr><td>Human Resource Management (74)</td><td>Maintain and develop effective workforce
Take advantage of cheap labour
Labour exploitation</td></tr>
<tr><td>Finance & Accounting (105)</td><td>Promote new investment and expansion
Promote company reputation
Limit expenses</td></tr>
</table>

Table 5.3 Number and Types of Functional Statements for Audit Tool

5.2.4 Data Compilation

The last stage in the manufacturing strategy framework involved the compilation of all the collected information in a format that would be most appropriate for use by individual companies for manufacturing strategy assessment, formulation and for benchmarking purposes. Given that one of the objectives of the research was to design and develop a simple manufacturing strategy audit tool, the best alternative was to convert all the collected information into a questionnaire with close-ended questions or statements. The auditing exercise for garment making companies would then simply involve filling in the questionnaire for analysis purposes. There were seven sections to the questionnaire; each section dealing with one specific functional area (table 5.3). The questionnaire for the Product Design and Development function is shown in table 5.4 and those for the other functional areas is given in Appendix E.

In addition to the listing of statements indicating the type of manufacturing practice within the company, a number of features were designed in the questionnaire to allow for manufacturing strategy assessment and benchmarking. These included:

1. Linking each statement to one or a combination of the functional strategies as appropriate.
2. Allocating a score to each statement indicating an industry average or better practice.
3. Allocating a best score for each leading statement. The best score is indicative of the manufacturing practice in world-class companies and these were set as the benchmarks for the garment making companies. The information associated to the best score was compiled both from the industry survey and from a survey of the literature on garment manufacture (Kunz, 2000, Kilgus 1998, Albernathy et al 1999, Bobbin Magazine various issues).

Table 5.4 illustrates the format used for the design of the questionnaire. For instance, there are four possible functional strategies for the Product Design and Development function namely D1, D2, D3 and D4. All statements that follow were categorised in terms of any one or a combination of these functional strategies. For instance statement 5 is linked to strategy D2 and statement 6 to D2 and D3.

Three strategies D1, D2 and D4 were considered as industry average and hence were each allocated a score of 3, while D3 was considered as the better practice and was allocated a score of 5. The same score allocation procedure was used for the other series of statements to indicate average or better industry practice. In the event that multiple answers were possible, the best score was calculated as a total of the best possible answers. For instance for statements 9 through 15, the ideal condition was to have all six departments involved in the design process and hence the best score was considered to be 30. Moreover, the best score is considered as the benchmark and for analysis purposes, companies scoring less than or more than the best score were considered to have room for improvement.

PRODUCT DESIGN AND DEVELOPMENT					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The strategy for product design and development is		*WHO*		*5*
1	*to obtain the design from the customer*		*D1*	*3*	
2	*to produce the designs using in-house expertise only (including experts from mother company, if applicable)*		*D2*	*3*	
3	*to work out the design as a joint effort between the customer and the PD&D department*		*D3*	*5*	
4	*to subcontract the design activity to a design agent*		*D4*	*3*	
	The extent of involvement of the customer in the product design process is:		WHO		5
5	the customer is not involve in the design process		D2	3	
6	the customer has little participation in the design process		D2/D3	3	
7	*the customer actively participates in the design process*		*D1/D3*	*5*	
8	the customer leads the design process		D1	3	
	In addition to PD&D department, the other departments *actively* involved in the design process include		WHO		30
9	*Sales and Marketing*		*D2/D3*	*5*	
10	*Planning and Control*		*D2/D3*	*5*	
11	*Purchasing and Inventory*		*D2/D3*	*5*	
12	*Manufacturing (CMT)*		*D2/D3*	*5*	
13	*Finance and Accounting*		*D2/D3*	*5*	
14	*Human Resource Management (Personnel)*		*D2/D3*	*5*	
15	XXX (not applicable/non of the above)		D1/D4	3	
	Data transfer between the PD&D department and the departments actively involved in the design process is through		HOW		14
16	*Informal meeting*		*D2/D3*	*3*	
17	*Formal meeting*		*D2/D3*	*3*	
18	*E-mail*		*D2/D3*	*3*	
19	*Local area network (company information system)*		*D2/D3*	*5*	
	The fabric design is obtained from		WHO		5
20	*In-house designers*		*D2/D3*	*5*	
21	The customer		D1	3	
22	Fabric suppliers		D4	3	
23	The design agent		D4	3	
	Garment specifications are		WHO		5
24	obtained from customer		D1	3	
25	determined in-house (including from mother company)		D2	3	
26	*worked between customer and PD&D department*		*D3*	*5*	
27	obtained from the design agent		D4	3	

PRODUCT DESIGN AND DEVELOPMENT					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	Garment patterns (graded) are		WHO		5
28	supplied by the customer		D1	3	
29	developed in-house manually		D1/D2/D3	3	
30	produced in-house using a CAD system		D1/D2/D3	3	
31	*produced in-house using a CAD/CAM system*		D1/D2/D3	5	
32	supplied by the design agent		D4	3	
	Fabric design is carried out using		HOW		5
33	a manual system (hand sketch)		D2/D3	3	
34	a CAD system		D2/D3	3	
35	*specialised fabric design software*		*D2/D3*	*5*	
36	XXX (None of the above, Not applicable, Don't know)		D1/D4	3	
	The garment design process involves the extensive use of		HOW		24
37	*Forecasting data*		*D2/D3*	*3*	
38	*Point of sale data*		*D2/D3*	*5*	
39	*End of season sales data*		*D2/D3*	*3*	
40	*Specialised apparel design systems (CAD, Electronic sketching systems, template programmes)*		*D2/D3*	*5*	
41	*Simulation systems*		*D2/D3*	*5*	
42	*past design*		*D2/D3*	*3*	
43	XXX (None of the above)		D2/D3	3	
	Aspects of garment serviceability which are most emphasized upon during the design process include		HOW		24
44	*Comfort*		*D2/D3*	*5*	
45	Durability		D2/D3	3	
46	Functional use		D2/D3	3	
47	*Creativity/Innovation*		*D2/D3*	*5*	
48	*Uniqueness*		*D2/D3*	*5*	
49	*Twist*		*D2/D3*	*5*	
50	*Shrinkage*		*D2/D3*	*5*	
51	XXX (Don't know)		D2/D3	3	
	Cost estimates for the garment are worked out		HOW		16
52	*based on past experience*		*D1/D2/D3*	*3*	
53	*using specialised software*		*D1/D2/D3*	*5*	
54	*based on customer expectations*		*D1/D2/D3*	*5*	
55	*based on competitor prices*		*D1/D2/D3*	*3*	

PRODUCT DESIGN AND DEVELOPMENT					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	In making garment choices manufactured by the company, end users mostly focus on		HOW		55
56	*Styling*		*D1/D3*	*5*	
57	Fit		D1/D3	5	
58	Fabrics		D1/D3	5	
60	Price		D1/D3	5	
61	Brand name		D1/D3	5	
62	*Product presentation*		*D1/D3*	*5*	
63	*Creativity in design*		*D1/D3*	*5*	
64	*Uniqueness of design*		*D1/D3*	*5*	
65	Durability		D1/D3	5	
66	Stability		D1/D3	5	
67	Aesthetics		D1/D3	5	
68	XXX (Don't know)		D2/D3	3	
	The lead time for agreeing upon a fabric design with the customer is		WHEN		5
69	*less than one week*		*D2/D3*	*5*	
70	between one to two weeks		D2/D3	3	
71	between two to three weeks		D2/D3	3	
72	more than four weeks		D2/D3	3	
	The average lead time for the design of a new product is (from sample request to confirmed customer order)		WHEN		5
73	*less than five days*		*D2/D3*	*5*	
74	between five and ten days		D2/D3	3	
75	between ten and fifteen days		D2/D3	3	
76	between fifteen and twenty days		D2/D3	3	
77	more than twenty days		D2/D3	3	
	Design of a product line involves		WHAT		19
78	*adding differentiation features to past designs*		*D2/D3*	*5*	
79	*designing completely different products*		*D2/D3*	*5*	
80	*preparing cost estimates (quotations) for manufacturing the product*		*D2/D3*	*3*	
81	*generating the product specifications*		*D2/D3*	*3*	
82	*producing the graded patterns*		*D2/D3*	*3*	
	Product design is evaluated against market place requirements through the use of		WHAT		16
83	*Market Surveys*		*D2/D3*	*5*	
84	*Product sales rate data*		*D2/D3*	*3*	
85	*POS data/EPOS data*		*D2/D3*	*5*	
86	*Fashion/trade shows*		*D2/D3*	*3*	

PRODUCT DESIGN AND DEVELOPMENT					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The differentiation features of the product vis a vis those proposed by competitors are in terms of		WHAT		28
87	the brand		D2/D3	5	
88	the price		D2/D3	3	
89	*the quality*		*D2/D3*	5	
90	*product fit*		*D2/D3*	5	
91	*the styling*		*D2/D3*	5	
92	*the service quality*		*D2/D3*	5	
93	XXX (Don't know)		D2/D3	3	
	The present strategy for PD&D is adopted because		WHY		5
94	it has paid off over the past		D1/D2/D3/D4	3	
95	of cost constraints for investment in more appropriate technology		D1/D2/D3/D4	3	
96	of unavailability of skilled designers		D1/D2/D3/D4	3	
97	of unavailabity of skilled labour for running CAD/CAM systems		D1/D2/D3/D4	3	
98	of the policies of the mother company		D1/D2/D3/D4	3	
99	*it is most competitive*		*D1/D2/D3/D4*	5	
100	Don't know		D1/D4	3	

Table 5.4 Questionnaire for Product Design and Development function

The questionnaires for the various functional activities provide all the possibilities in terms of practices in the garment making industry. Companies willing to undertake strategy assessment were asked to fill in the questionnaire, a detailed analysis of these indicated the current functional strategies of the company. In order to have sensible results from the auditing exercise, it was vital that companies justify and provide evidence, wherever applicable, for the statements that were selected.

Given the large number of statements (there were about 100 statements per functional area) and the range of possibilities in terms of functional strategies, the analysis of the completed questionnaires was found to be a cumbersome and tedious exercise. Also, manually, it was difficult to benchmark manufacturing practices and make multiple company cross sectional analysis. The above limitations were overcome by developing and using a software tool, which was designed and developed for the purpose of conducting the manufacturing strategy auditing and analysis exercise.

5.3 Manufacturing Strategy Audit Tool

In order to allow companies to make a self-assessment of their current practice and to benchmark current practice with the better practices in the industry, a manufacturing strategy audit tool was developed as a software programme. The objectives of the tool were as follows:

1. Provide an interface for manufacturing companies to fill in the audit questionnaires. The interface should equally provide access to the IDEF0 manufacturing system model for viewing details of activities and sub-activities and the information associated to the activities.
2. Store all information with regards to company details and previous functional audits
3. Produce reports in terms of current practice for each of the functional areas
4. Produce comparative charts for companies to view their current status and show better practices within the industry
5. Produce a statistical summary for the functional strategies of all the companies put together to enable sector-wise manufacturing strategy analysis.

The flowchart of the software developed using Microsoft Access and Visual Basic is shown in figure 5.2. While Visual Basic was used to develop the interface for the user, Microsoft Access was used to create databases to store and manage all the information that was input into the system.

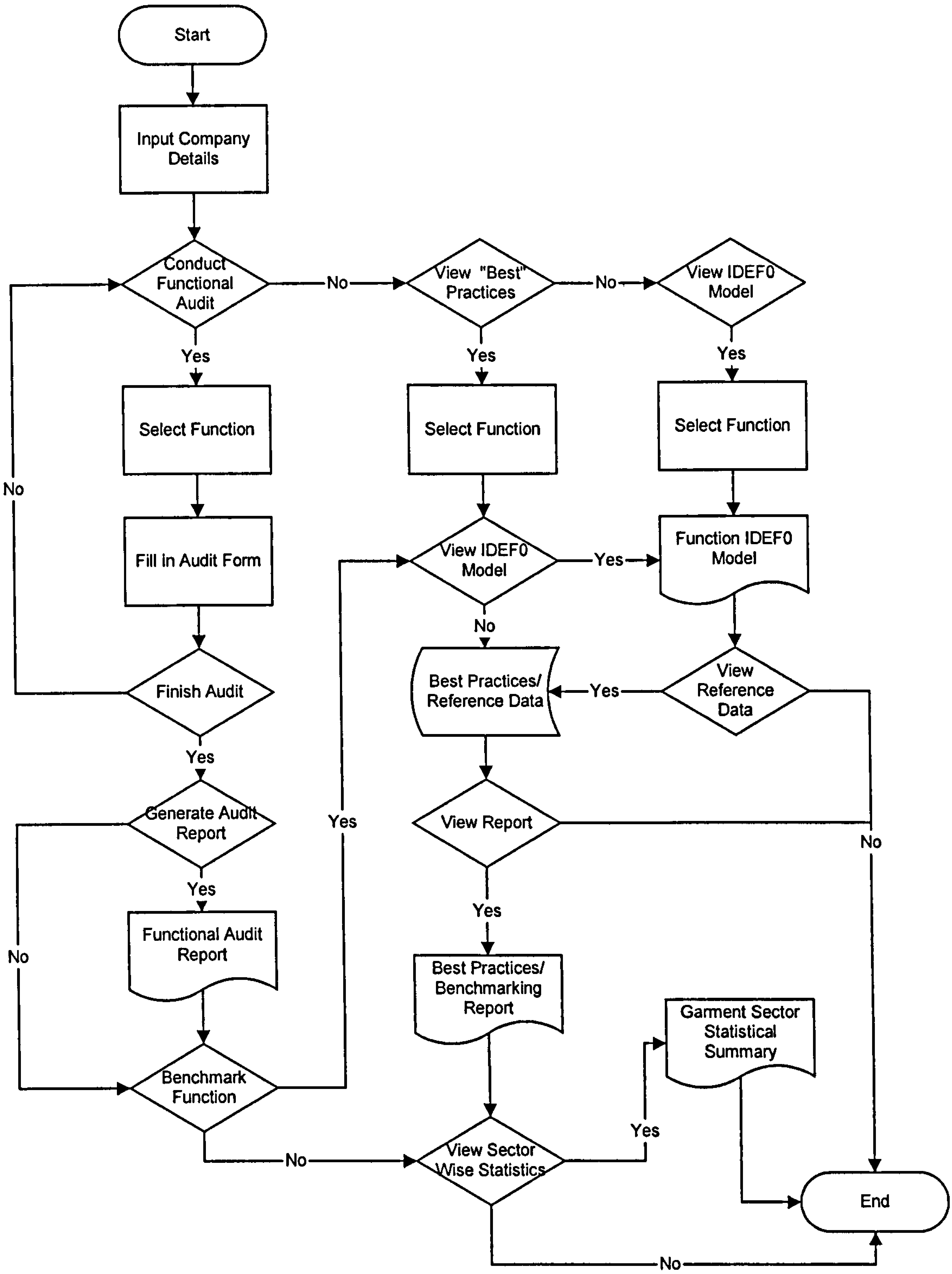

Figure 5.2 Manufacturing Strategy Audit Tool Architecture

5.4 The Software

The software was designed with a view to provide a simple mechanism for companies to make a self-assessment of their current practice and to help them investigate the possibilities for change. The programme, written in Visual Basic and using the Structured Query Language (SQL), is self-executable such that it can be installed on any personal computer with the usual Microsoft Office application software (Visual Basic, Microsoft Access, Microsoft Excel). However for accessing the IDEF0 manufacturing system model, one needs to install the Visio Professional software. Once installed the programme creates the required user interface and the database management files.

5.4.1 User Interface

The user interface is the set of menus (created using Visual Basic) that are available for accessing the various options on the audit software. The main menu shown in figure 5.3 allows access to the form for entering company details (figure 5.4), for conducting functional audits (figure 5.5) and for viewing the best strategies and sector statistics for each of the functional areas.

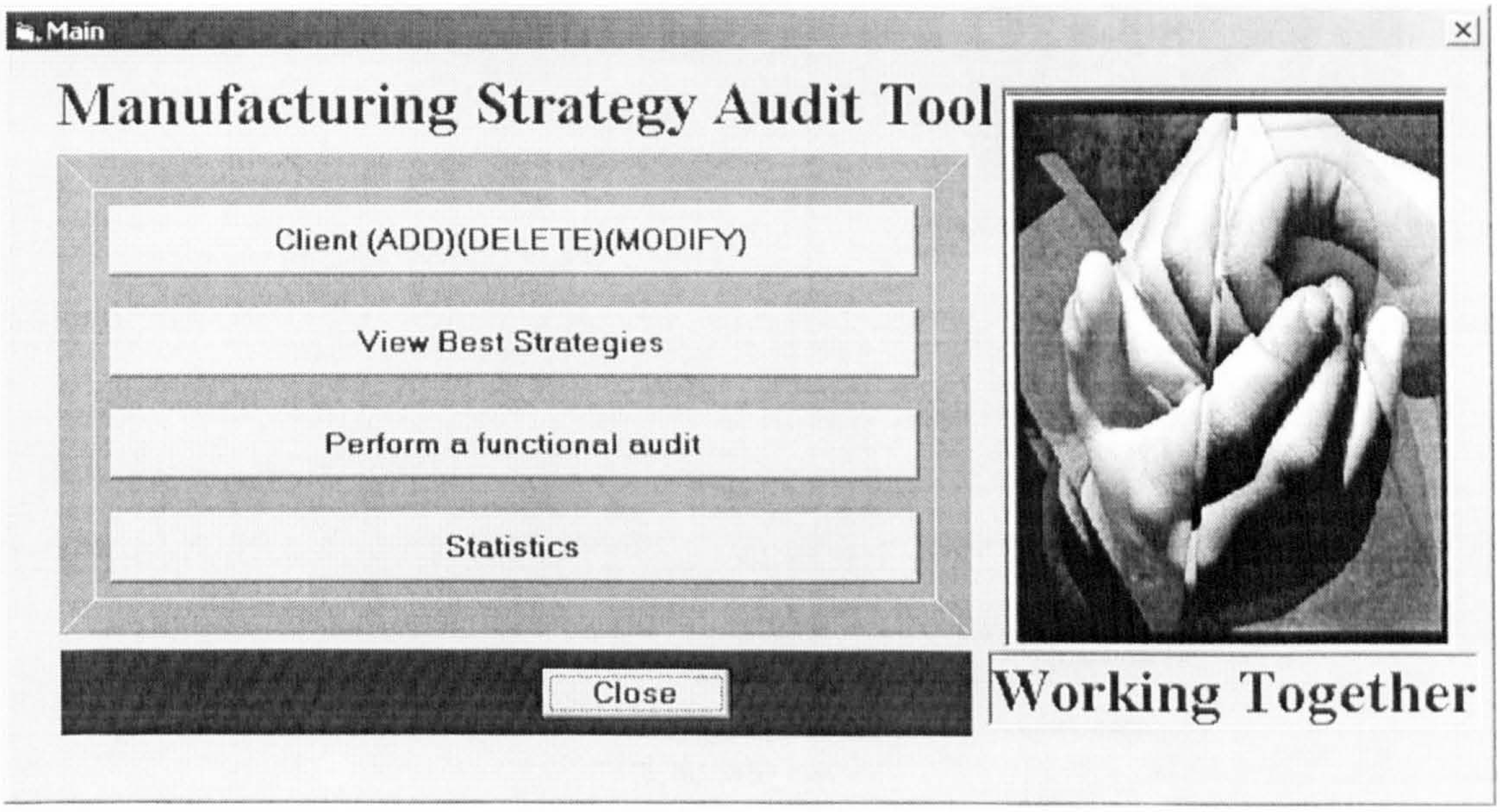

Figure 5.3 Main Menus for Audit Tool

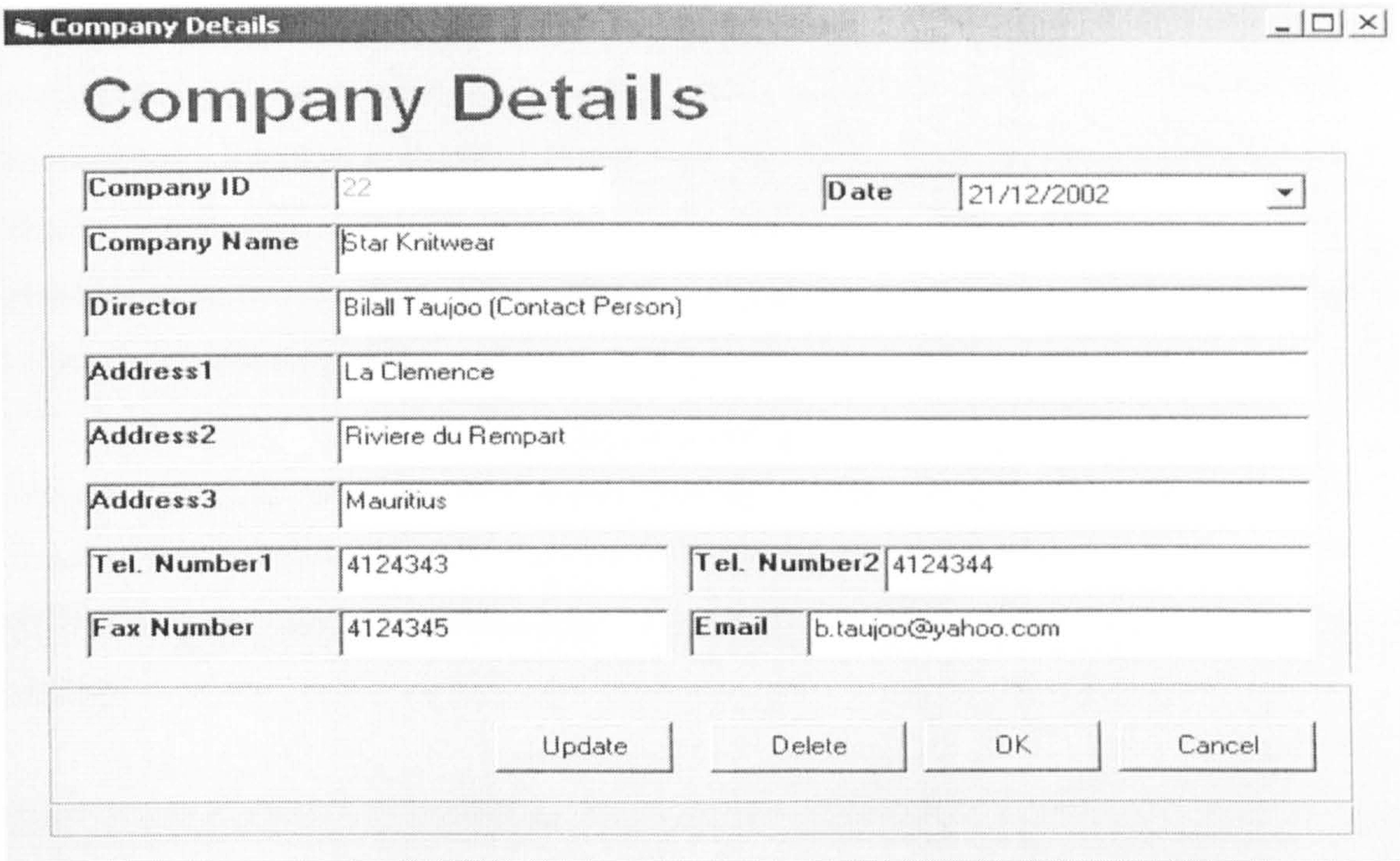

Figure 5.4 Company Details Form

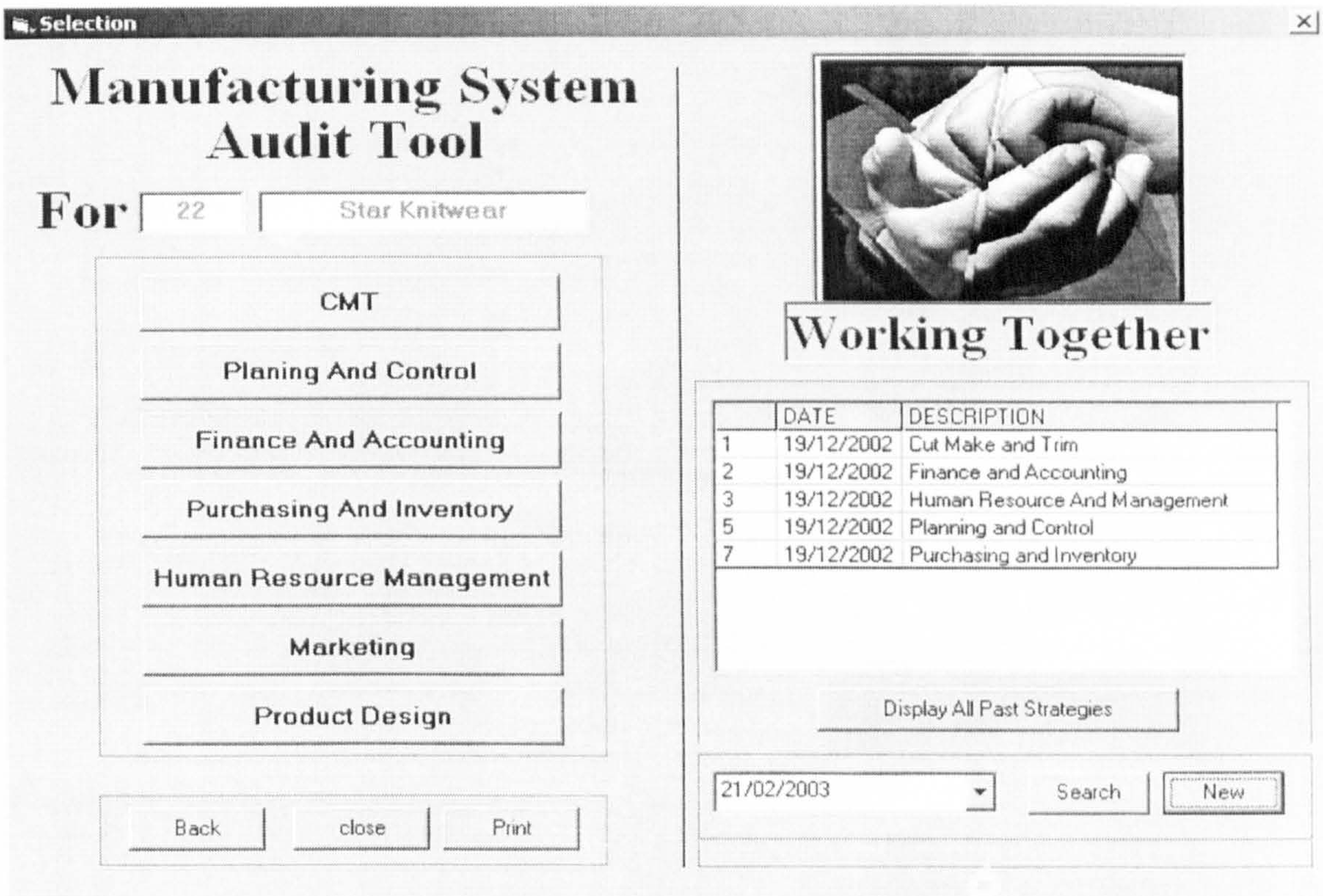

Figure 5.5 Functional Audit Menus

The Functional Audit menus allow access to the audit forms and to the IDEF0 manufacturing system model. A typical audit form for the Product Design and Development function is shown in figure 5.6. The forms for the other functions have a similar design such that only one set of statements is visible at any one time. This prevents respondents from being biased by answers to previous questions, while filling in the questionnaire.

Also, a hyperlink connects each of the functional areas to the corresponding IDEF0 diagram that can be viewed for reference purposes (see chapter 4 for details on the IDEF0 diagrams and the information accessible through the manufacturing system model).

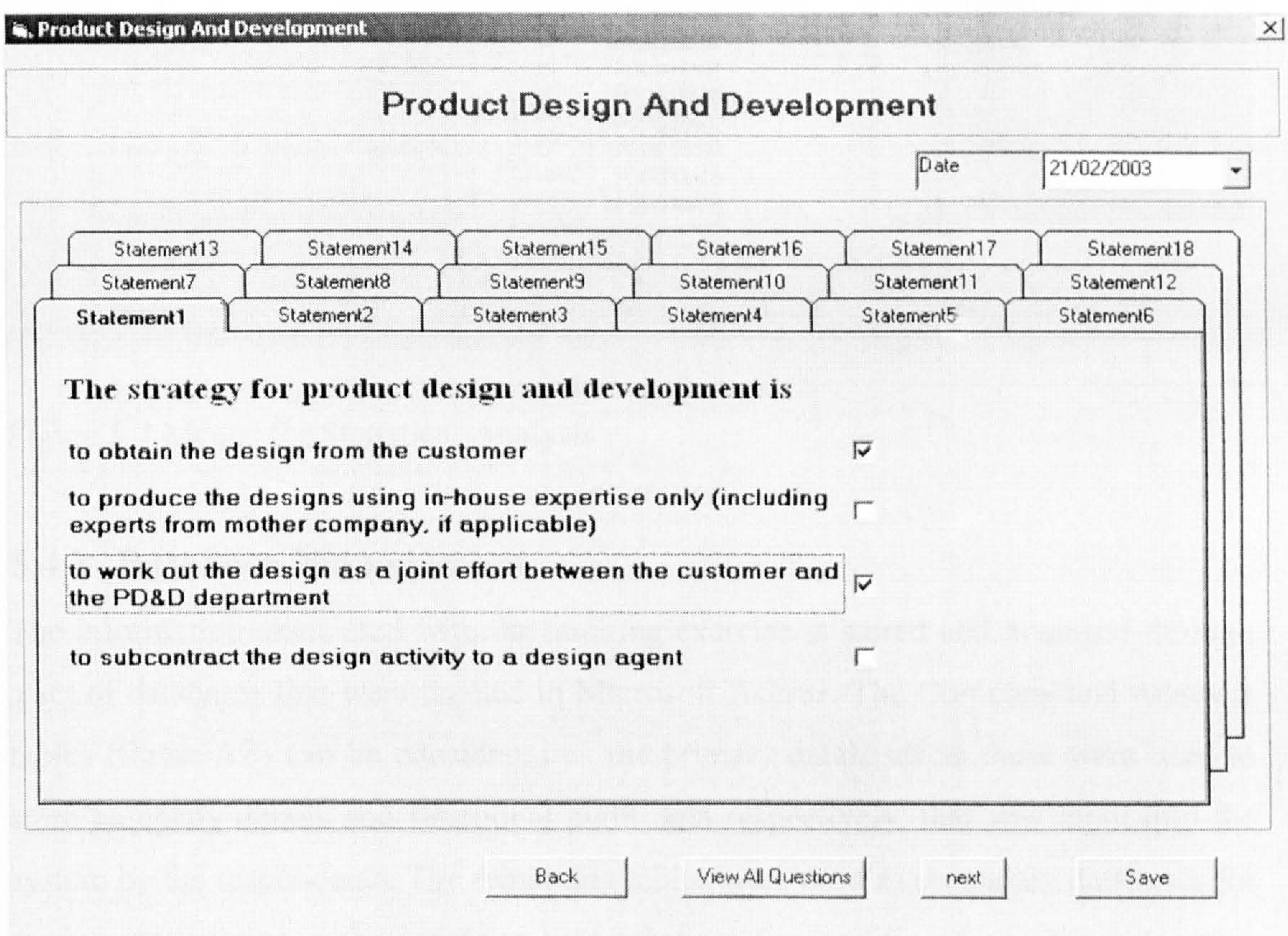

Figure 5.6 Product Design and Development Audit Form

Once the auditing exercise is complete the respondent can view the report for the current strategy and compare it with the reference set of data for 'Best Practice' within the garment making industry.

Also, the programme allows for making a sector wise analysis in terms of current practice for policy decisions to be taken at the level of the garment making industry. The menus for conducting statistical analysis are shown in figure 5.7.

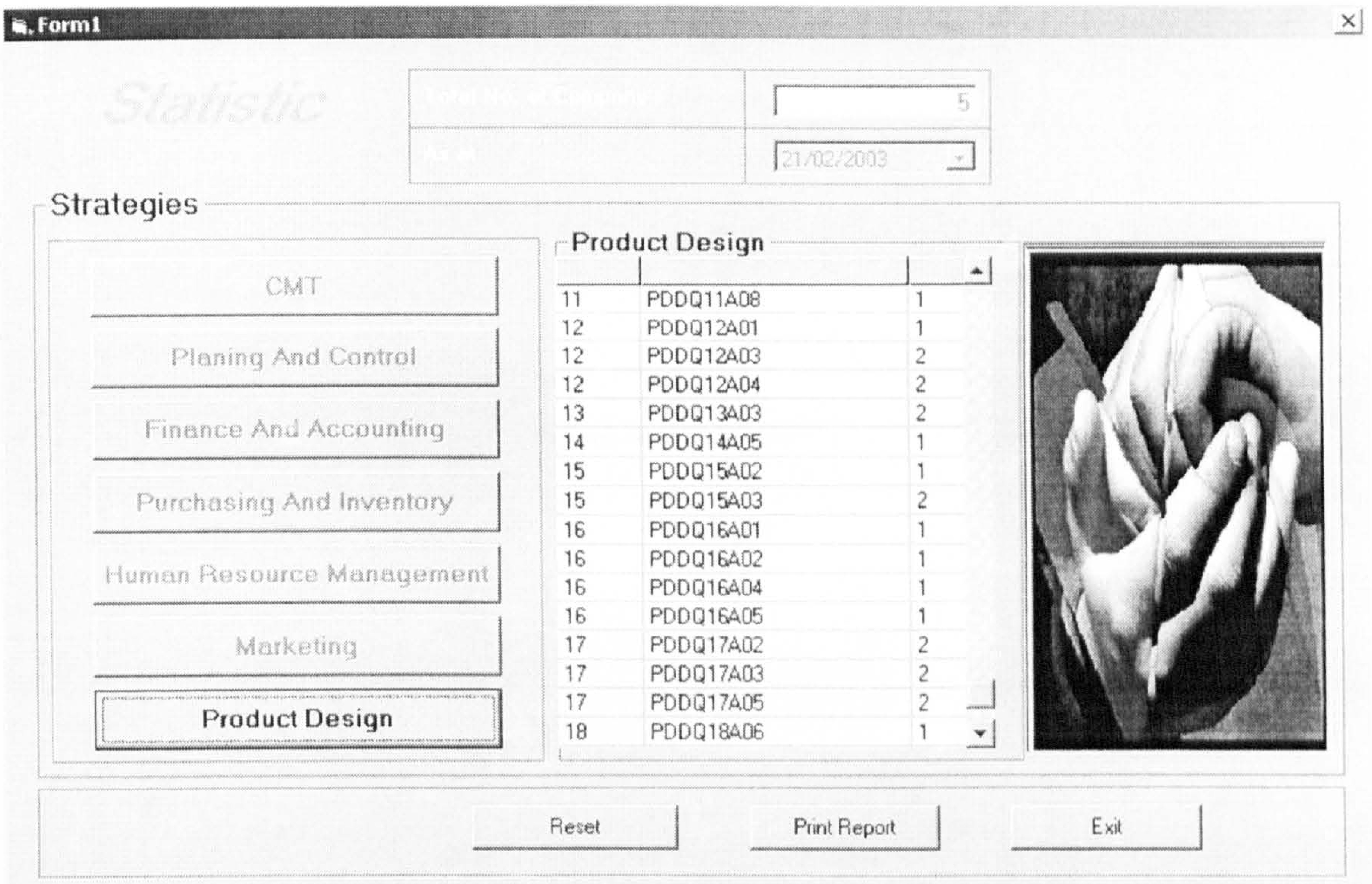

Figure 5.7 Menus for Statistical Analysis

5.4.2 Database Management

The information associated with the auditing exercise is stored and managed through a set of databases that were created in Microsoft Access. The Company and Answers tables (figure 5.8) can be considered as the primary databases as these were used to store company details and functional audit data respectively, that was input into the system by the respondents. The remaining tables were used as secondary databases for storing information with regards to best practices for specific companies and within the industry, past data for companies and statistical results based on information compiled for all the companies that have used the software for auditing purposes. Note that the database is not accessible through the manufacturing system auditing software. It is only used as a back up filing system from which the data is extracted in various formats for producing the desired reports (Functional Audit, Best

Practices/Benchmarking, Garment Sector Statistics). Figure 5.8 shows the tables that were created in Microsoft Access. The Answers table is linked to the Company and Department (Functional Area) tables and was used to store all the statements that were selected by the respondents during the auditing exercise. The Company table was used to store the profile information about the various companies using the software. The Department table is used to codify the functional areas, which is used in all the other tables. The Best Answer table is a compilation of the better practices from within the industry and is used for benchmarking purposes. The Percentage and Total Question tables are used to compile the total number of times specific answers were selected in order to produce the statistical reports with regards to the practice within the industry. The Past Answers table is used to store a backup of all the information within the database. This is useful in the event that companies update their responses following implementation of specific strategies.

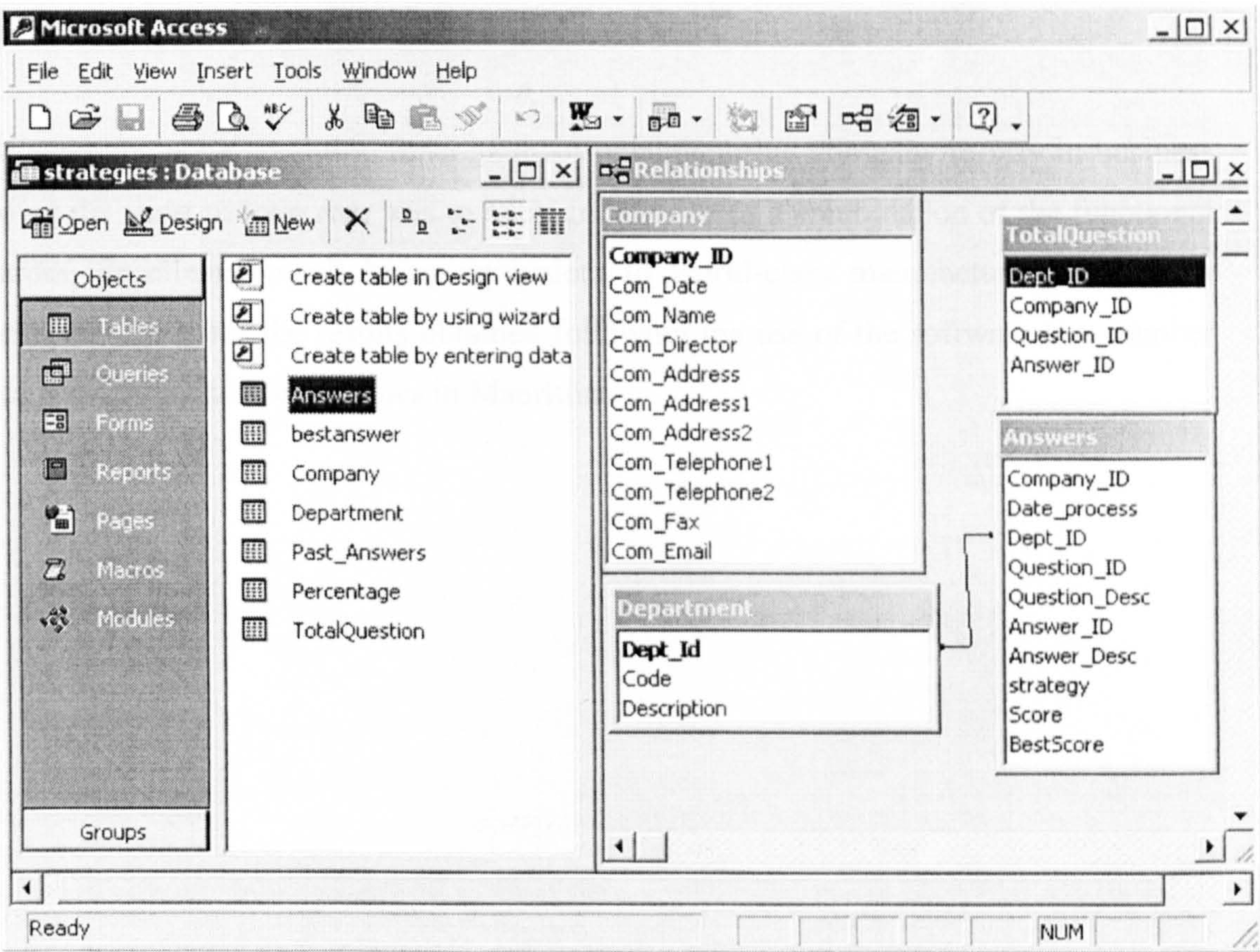

Figure 5.8 Database structure

5.5 Using the Audit Tool

Use of the software for functional strategy assessment simply involves selecting the function to be audited and selecting statements that most closely fit the company's current practice. It is vital to input the company profile before conducting any audit, as these are stored in the database for enabling a sector wise analysis. Note that the functional strategy and the scores associated to each statement are not visible/accessible to the user in order to limit biased responses. Once an audit is complete, the software can be used to generate reports with regards to the functional area selected indicating the company's strategy and areas of average and better practices. The best practice data for the industry is in fact compiled in a separate database against which companies can benchmark the current practice in terms of any of the functional areas. Moreover, the audit tool can be used to view details relevant to each of the functions in terms of input, output, control and mechanisms through the garment manufacturing system model which is equally accessible through the audit software.

A sine qua none condition for a garment manufacturing company to stay in business over the short to long run, was to excel in any one or a combination of the functional areas: excellence in all being equivalent to world-class manufacturing. The next chapter illustrates the results obtained following the use of the software in a number of garment making companies in Mauritius.

Chapter 6
Manufacturing Strategy Auditing: Case Studies

6.1 Introduction

The garment manufacturing system model and the manufacturing strategy audit questionnaire have been developed to represent the architecture of typical garment making companies and the manufacturing practices within the companies, respectively. During the data collection and compilation process, it was ensured that all possibilities in terms of in-house activities and the required hardware and software used for meeting the requirements of low cost, quick response and high value added strategies were exploited. The manufacturing audit tool was structured to help garment making companies make a self assessment of their current manufacturing practice and benchmark it against better practices from within the industry in order to embark upon implementation programmes for achieving enhanced product competitiveness.

In the first instance, the survey method was used to assess the strategy adopted by the seventeen companies that constituted the sample for the research. The survey was supplemented with a series of interviews of company executives to ensure accuracy of the collected information. Moreover, during the analysis of responses, it was observed that the survey method had some inherent limitations for generating conclusive results. The case study method recommended by Yin (1994) was eventually used to overcome the limitations and to test the use of the audit tool for manufacturing strategy assessment and formulation.

Three case study companies were selected for the audit. The selection of companies from the sample was based on the interest shown by the companies and on other factors such as size of company, garments manufactured and, above all, the claimed manufacturing strategy prior to the auditing exercise: the objective being to analyse the extent to which the companies were meeting the requirements of the claimed strategy and to advise the companies in the light of the results generated by the audit tool. In order to ensure that the tool was used in the most effective manner to generate sensible results, a methodology for its utilisation was developed and tested in the case study companies. The case studies provide a better insight of the auditing system and allowed for participatory action research to be undertaken within the selected companies.

6.2 Manufacturing Strategy Auditing

Following the development of the manufacturing strategy audit tool, it was vital to test the effectiveness of using the tool in manufacturing companies. Two methods were used for carrying out the tests; firstly through use of the survey method and, secondly, by the use of the tool in case study companies. The two approaches were complementary because the use of a survey allowed a number of companies to be contacted but without great details whilst the case study approach allowed the detailed investigation of a few companies. The former method involved little interaction between the author and the companies and mainly consisted of collecting the data by leaving the audit tool for filling in the companies. The collected data was then analysed and recommendations made to the companies based on the output generated by the audit tool. The latter method on the other hand involved very close interaction between the personnel filling in the questionnaires and the author to ensure consistency and accuracy of responses.

Though both methods seemed appropriate for the auditing exercise, it was found that in this case, the survey method had many limitations because of the subjectivity in the interpretation of information by the respondents and difficulties associated with confirming the accuracy of the responses. Also, the survey method provides few possibilities for investigating the HOW and the WHY of current manufacturing practice. The use of case studies was invaluable in giving the depth of knowledge necessary to complete the research.

6.2.1 Survey Method

The manufacturing strategy audit tool is self-contained such that any garment making company can use it for the purpose of strategy formulation and analysis. However, given that the concept was new to most of the companies, on the site presentations were organised to demonstrate the appropriateness of the exercise and the scope of the auditing tool. Following the presentation, a copy of the software was left within the company for staff responsible for each of the main functional activities, to fill in the relevant sections. During the analysis of the responses from the various companies it was observed that there were major contradictions between the responses. For instance, the lead-time for obtaining fabrics was three weeks (response from Purchasing Department) while the order to delivery lead-time was again three weeks (response from CMT Department). It was also observed that many of the statements were either misunderstood; hence, the response was misleading, or the personnel selecting the statements from the audit tool had the tendency to tick the best practice instead of the actual practice within the enterprise in order not to expose the weaknesses of the department concerned or to pretend that the company had the better practices in place. Also, the auditing was equated to a simple questionnaire filling exercise for academic purposes and little attention was paid to the accuracy of responses. In a number of cases, only one person, usually the personnel manager or a representative from the personnel department, was requested to fill in the whole questionnaire. These were the main shortcomings of the pilot auditing exercise, the results of which were of little use for analytical purposes and for drawing sensible conclusions.

In order to ensure collection of factual information, the respondents were contacted again to review their responses wherever applicable. However, as this was a survey of manufacturing practice, the respondents had no obligation for providing supporting evidence. In spite of the limitation of the method, following the survey, an audit report was submitted to each company to illustrate the findings of the audit and to indicate possibilities for implementing alternative strategies. A summary of the audit results for the complete sample of companies is presented in the next chapter where the implications for the industry are discussed.

The limitations associated with the survey method were lengthily discussed with the executives of two companies (Firemount and Job Textiles) and it was agreed that the use of a structured methodology could overcome the subjectivity and other limitations associated with the completion of the questionnaires. It was equally argued that such a methodology should necessarily involve the participation of focus groups from the company in order to generate conclusive results. This prompted the use of the case study method for conducting the audit.

6.2.2 Case Study Method

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence is used (Yin, 1994). This definition was found to ideally fit the context of the research in terms of testing of the manufacturing strategy audit tool within a company. While the audit tool provides answers to questions associated with the manufacturing practices within the garment making companies (in terms of What, Why, When, How and Why among others), case studies are used to confirm the Why and How aspects of the responses and to provide explanatory dimensions to the research. Also, given that the practice in each company is likely to be different, the case study method provides the mechanism for conducting in-house inquiries and ensuring that the recommendations for change are tailored in the light of the findings together with the outcome of the audit. The methodology developed for conducting the case studies for manufacturing strategy assessment and selection was designed to ensure minimum external interference (from the author) such that in the long run the auditing exercise becomes part and parcel of the common in-house activities of the companies.

The designed methodology is largely adapted from that proposed by Yin (1994) for data and evidence collection while conducting case studies. It involved the following stages:

1. Once the approval of the chief executive of the company was obtained for conducting the audit, the first stage involved the organisation of a case study seminar to present the objectives of the audit and the software to representatives from each of the functional areas from within the company. It is these personnel that would be assigned the responsibility for filling in the questionnaire and for producing evidence for the responses that are selected from the audit tool. It is vital to have the seminar chaired by the chief executive or his/her representative in order to stress the importance of the exercise and to have the full collaboration and commitment from all parties concerned. The seminar should equally be used for

attending queries from the participants and to emphasise the need for having accurate responses with supporting evidence wherever applicable.

2. Following the first meeting with the personnel, each staff is given one working week to fill in the questionnaires and collect as much information as appropriate to provide evidence for the correctness of the statements that were selected from the audit tool. The evidence could be in terms of documentation, archival records, observations or physical artefacts as applicable. This phase may require the support of a facilitator (for instance the author, in this case) to clear any misunderstanding with regards to the statements and advise on the type of evidence that was being sought.
3. The third stage consists of a workshop involving the same personnel, whereby each representative is required to present the findings for his/her department (selected responses from audit tool together with evidence where applicable) in the presence of the chief executive or his/her representative. The main purpose of the workshop is to share information and ensure that there is consistency in terms of responses from the various departments. Any inconsistency/inaccuracy should be cleared at this level such that the responses selected in the audit tool are unanimously accepted as being an exact replica of current practice within the organisation.
4. The last stage involves presenting an analysis of the manufacturing strategy audit exercise (case study report) to the management of the company in the presence of the participants. In addition to the strengths and weaknesses of the current practices within the organisation, the possibilities in terms of alternative practices (benchmarks) and strategies, for achieving enhanced product competitiveness, are presented. This session is an ideal forum for the company executives to ponder over the medium to long-term strategies of the company and over the actions that should be initiated to embark upon alternative strategies for gaining competitive advantages.

A summary of the methodology is shown in figure 6.1

The main advantage of the above methodology is that it involves case study investigators from in-house personnel, usually those responsible for specific functional areas who are fully conversant with the system and to whom the study, its results and strategies for change, are of immediate concern. Also, there are no concerns for confidentiality of information and the working sessions equally allows the participants to brainstorm on issues that need attention for bringing in improvements in the day to day operations of the company.

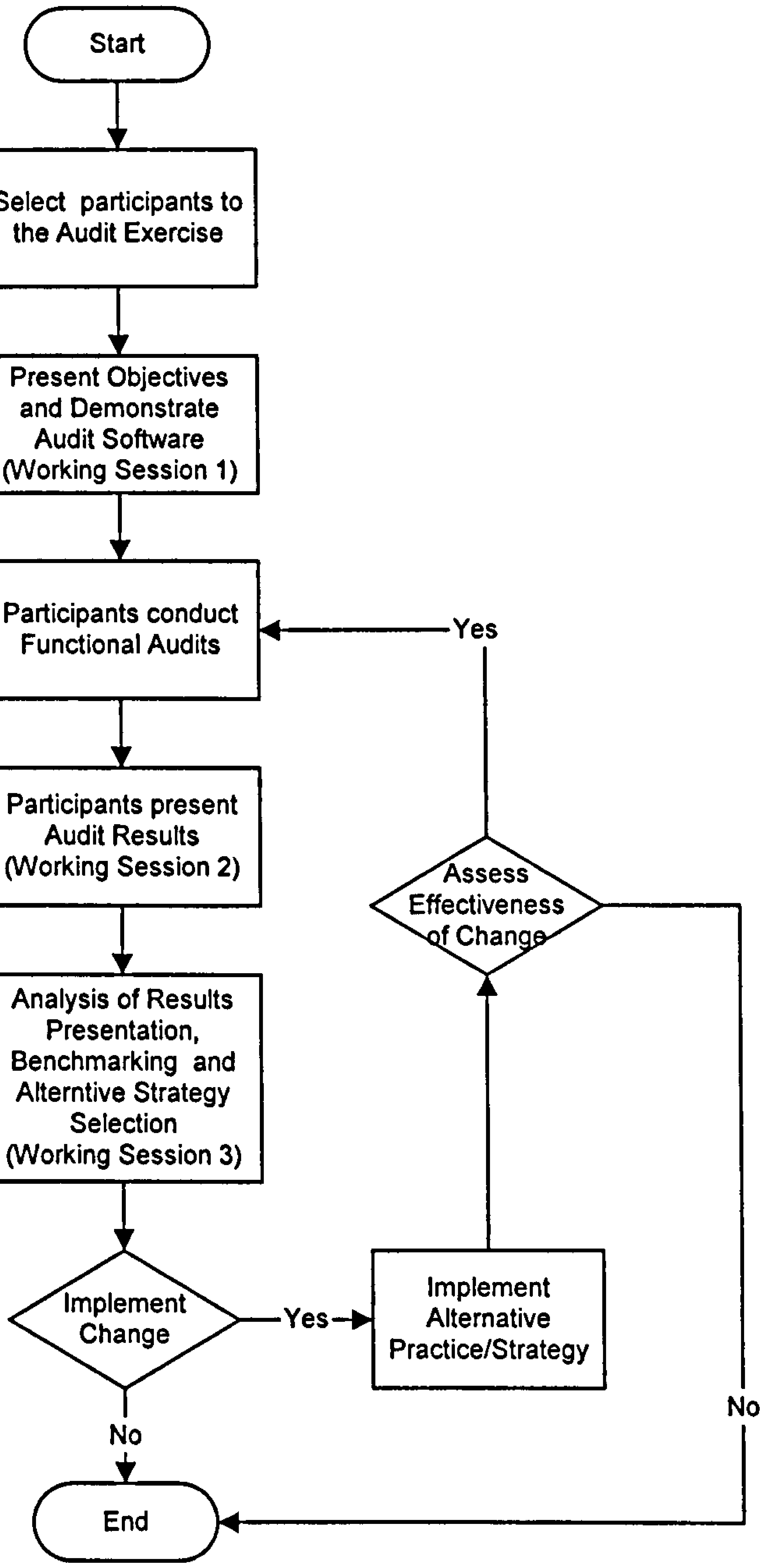

Figure 6.1 Methodology for conducting functional audits

In a quest to address the strategy issue on a regular basis, the methodology can be used as and when required either to review the progress made since the previous auditing exercise or to assess the effects of implementing change on the competitiveness of the garments that are manufactured by the company.

6.3 Case Study Companies

The new methodology for conducting the audit exercise was presented to the chief executives of all the companies from the sample who agreed that the case study method, if used together with the audit tool, can be a useful means for deciding upon strategic issues. Once started, it was feasible to conduct the audit within a period of three weeks. Each working session was expected to last for at least half a day. However, in spite of the willingness of the company executives, the scheduling of the working sessions with all the participants concerned together with the chief executive or his/her representative was not straightforward as the personnel, most of the time, were taken up with their day-to-day work.

In a number of cases, the first working session, after being scheduled, had to be called off at the last minute because of unavailability of some of the personnel or the chief executive. It soon became apparent that it was not feasible to conduct an audit in each of the survey companies and an alternative approach had to be found.

This prompted the selection of an exemplar of companies from the sample for each type of strategy, namely high value added, low cost and quick response, for conducting the case studies. Secondary issues considered in the selection of companies were the types of products manufactured and the variation in the size of the companies. Table 6.1 shows the list of companies and details of the main products manufactured, the number of employees and the claimed manufacturing strategy by the company (obtained from the initial survey of the companies). The companies that were selected and which agreed to participate in the audit exercise were Tee Sun as an exemplar of high value added strategy, Firemount Textiles as a low cost strategy and Job Textiles as a quick response strategy company. These three companies equally cover the three main types of products exported by the garment sector in Mauritius namely, T-shirts, trousers and shirts.

No.	Company Name	Main Product Manufactured	No. of employees	Claimed Strategy
1	Star Knitwear Ltd	T shirts/Polo shirts	1300	High value added
2	Tee Sun Ltd	T shirts/Polo shirts	1200	High value added
3	Sinotex (Mtius) Ltd	Trousers, skirts, dresses	1340	High value added
4	Leisure Garments Ltd	Shirts, Denim wear	1950	Low cost
5	Firemount Textiles Ltd	Trousers/Denim wear	800	Low cost
6	Kentex Garments Ltd	T shirts/Polo shirts	760	Low cost
7	World Knits	T shirts/Polo shirts	700	Low cost
8	Hong Kong Garments Ltd	T shirts/Polo shirts	500	Low cost
9	Overseas Garment Ltd	Shirts, blouses, dresses	400	Low cost
10	Richfield Textiles Co. Ltd	T shirts/Polo shirts	390	Low cost
11	Avant Ltd	Kids wear, T shirts	350	Low cost
12	Nigma Gloves Ltd	T shirts, jogging suits	250	Low cost
13	Manupan Ltd	Shirts, Trousers, Jackets	200	Low cost
14	R S Fashion Ltd	Denim wear	175	Low cost
15	Job Textiles Ltd	Shirts, Blouses	250	Quick response
16	Noblesse Co. Ltd	Shirts, blouses, underwear	225	Quick response
17	L'Inattendue Ltd	T shirts/dresses/kids wear	200	Quick response

Table 6.1 Companies surveyed by product type and size

Note that in addition to testing the effectiveness of the audit tool, the case studies have equally been used to verify the extent to which the companies were meeting the requirements of the developing manufacturing strategy. The complete audit report, as generated by the audit tool, for each of the case study companies is given in appendix F.

6.3.1 Case Study 1: Exemplar of Low Cost Strategy

The first case study was conducted at Firemount Textiles Ltd. The company claimed to use the low cost manufacturing strategy to gain competitive advantage and win orders in the market. Eleven out of the seventeen companies claimed to be using a similar strategy. The company was set up in 1989 with 300 employees as part of a delocalisation strategy to shift manufacturing operations from the UK to Mauritius in order to take advantage of the lower labour cost and the host of incentives provided by the Mauritian government to attract foreign direct investment in the garment sector. The company has expanded its operations since then and now occupies a space of about 20 000 square feet in the industrial estate building at Goodlands, employs 800 people, and specialises in the manufacture of denim wear for the ladies market. The main product includes ladies trousers (85%), shorts (10%), jackets and skirts (5%) with growing demand for the trousers. The average production capacity is 15 000 garments per day. Most of the garments are exported to the UK, Ireland and Germany for which, Mauritius enjoys both duty and quota free access. The annual turnover of the company for the year 2001 was £8.2 Million.

The following sections illustrate the results of the auditing exercise as presented during the second working session of the case study, by the personnel responsible for each activity within the company. It was ensured that the respondents provided appropriate evidence during the presentations for the statements that were selected from the audit tool and these being agreed by all participants present as being factual information. The author acted as the facilitator both for the identification and collection of the evidence and for the presentation sessions. An analysis of the results and recommendations for the company are presented in section 6.6.

❑ Marketing

The marketing strategy of the company has mainly been to use the facilities offered by local and overseas sales agents[1] for presenting the products to potential buyers. The company deals with three sales agents for the purpose; one is based in Mauritius and two in the UK. Note that while dealing with sales agents, the company does not have any contact with the eventual buyer and the products are sold to the sales agent.

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[1] *A sales agent mainly consists of a team of marketing and merchandising personnel involved in conducting market and product research and acts as a bridge between garment manufacturing companies and buyers. Sales agents, also referred as contract manufacturers, work in collaboration with the manufacturing companies to design the garments, which is marketed to a network of buyers. Once an order is confirmed, the sales agent subcontracts it to the manufacturing company. A typical sales agent is the US based MAST Industries Inc. (see www.mast.com) which has sales offices in 17 countries, including in Mauritius and a network of garment manufacturing companies in 37 countries around the world.*

However, the company regularly participates in international fashion/trade shows and advertising/promotion campaigns for marketing its products directly to wholesalers and retailers. Participation in these activities equally allows the company to undertake market surveys to identify the requirements of customers. About 4% of the annual turnover was spent on the marketing function over the year 2001 for the purpose with a view to enhance direct contacts with the potential buyers and decrease the reliance of the company on sales agents. Over the same year, 20% of the manufactured garments were sold directly to wholesalers with the remainder sold through the sales agents. Note that the price offered by sales agents is usually 5 to 8% less than that offered by wholesalers. The market category serviced by the company is the lower end, which includes department stores and retail chains.

The chief executive of the company is responsible for the marketing function, which equally involves a merchandiser who works in close collaboration with the product design department for the development of the collection plan. Marketing is usually carried out using designs that have been manufactured in the past and those with added differentiation features in terms of style, fabric and finish (dyeing and washing). The company has a range of sample garments (collection plan) that are used for the purpose. The lead-time for marketing of the products (start of process to confirmed order from the customer) varies between three to six months. This includes the time for preparing and agreeing upon the specifications of new samples in line with the requirements of the customer. Given that the average daily production capacity is 15 000 pieces, the preferred order size is in terms of tens of thousands of pieces and one of the objectives of the marketing function is to have as large an order size as possible, which enables the company to achieve higher labour productivity and manufacturing efficiency.

❑ Product Design and Development

The company mostly relies on its customers (including sales agents) to provide the design of the fabric and the garment to be manufactured. The fabric is purchased either from local or overseas suppliers. The design engineer and the merchandiser are involved in making sure that the requirements of the customer can be met in terms of the quantity, quality, style and the finish using the facilities available in the company.

This process equally involves the contribution of personnel from the planning, manufacturing, finance and human resource management departments through formal meetings, whereby the feasibility for meeting the requirements of the design is discussed and agreed upon. Once the design requirements are defined, a sample garment is manufactured and presented to the customer together with details of the costing which is worked out by the merchandiser and approved by the director. The working out of the costing is based on past experience, customer expectations and on prices offered by competitor companies in the market. Any modification to the design is effected at this stage until the approval of the customer is obtained. Software like Adobe Imaging suite (Photoshop) and Corel Graphics suite are used together with hand sketches (Chalk display) for presenting possibilities in terms of the fabric design and finished product appearance.

The design process takes between two to four weeks and mainly involves adding differentiation features (fabric appearance and styling) to past designs and working out the cost estimates until a confirmed order is secured from the customer. The customer order is accompanied by the specifications for the fabric and the garment. While working with sales agents however, the agent proposes the initial design and the process mainly involves working out the feasibility for production and agreeing upon cost estimates. In many cases, sales agents provide the graded patterns for manufacturing. Otherwise these are created manually using in-house resources.

❑ Planning and Control

It is common practice for the company to have confirmed orders for up to six months ahead. Also, every effort is made to secure orders at least three months in advance to facilitate the planning process, which is carried out manually by the production manager. Planning involves producing material requirement plans, issuing purchase orders, scheduling manufacturing activities, conducting line balancing, and preparing procedures for the shop floor quality control activities based on the specifications provided by the customer. All the above activities are conducted manually with considerable reliance on past experience and data. Supporting documents from the planning department include material requirement forms, purchase requisition orders, cut order plan, cutting instructions, sewing instructions and schedules, quality control instructions and record sheets among others. The planning activity is usually conducted in collaboration with purchasing and the manufacturing departments and the information is shared with the marketing department. Figure 6.2 illustrates the main activities and the time span involved for an average order requiring three weeks of manufacturing operations. The shaded regions indicate the minimum time.

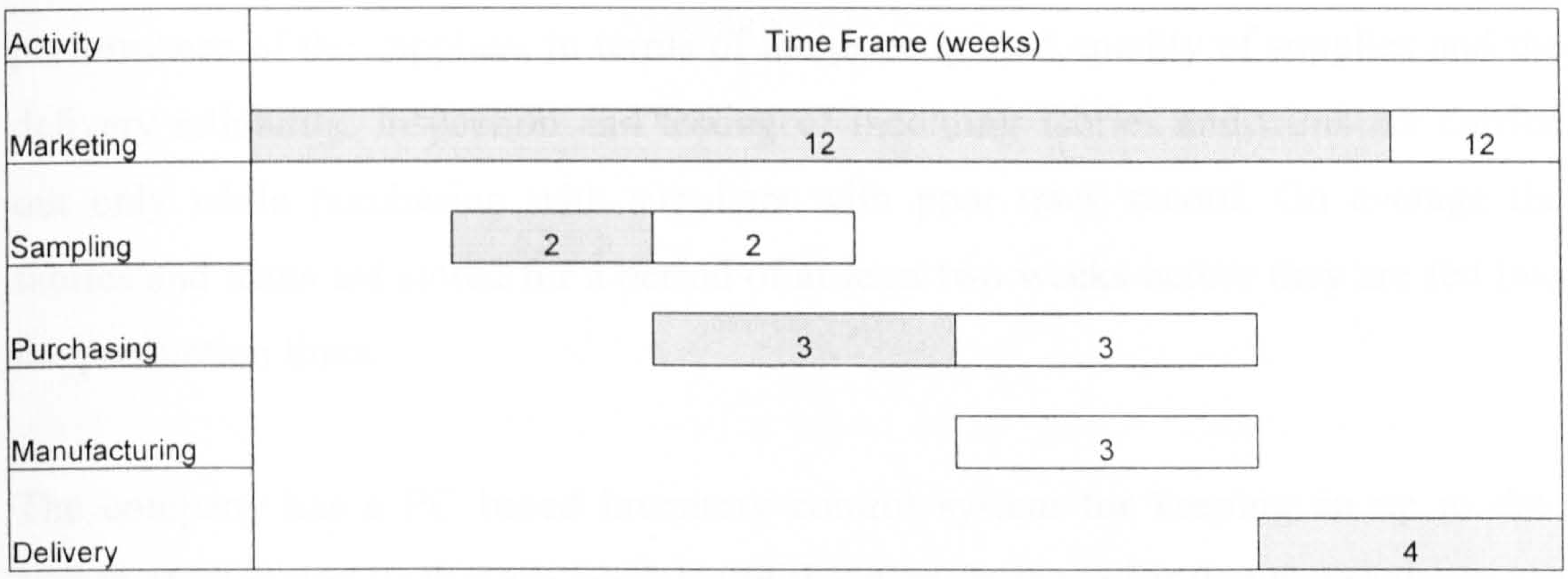

Figure 6.2 Minimum and maximum time frame for major activities

It usually takes up to three weeks for acquiring fabrics and trims from local suppliers. However, when imported the lead time is almost double. The most common practice in the company is to acquire the fabrics and trims in bulk for one order at least two weeks before production starts (in many cases the fabrics were seen to be stored for about four weeks). The master production schedule (schedule for manufacturing operations) for the factory covers a period of four weeks. The planning department is equally involved in maintaining standards for all operations in the shop floor. Time standards for sewing operations are set up based on past experience and the company employs a team of work-study officers to ensure that the correct methods are used and time standards are met. Method and time studies are normally conducted only at the start of a new manufacturing order. Quality control during the manufacturing process is mainly ensured by the foremen and on line supervisors. Moreover all assembled garments are thoroughly inspected by quality controllers before packing for shipment. On average the amount of rework is between 6 to 8% per order and these are fed back into the production lines. The amount of defects/scrap is about 2% per order.

❑ Purchasing and Inventory

The purchasing strategy for fabrics and trims is to compare quotations both from local and overseas suppliers and select suppliers providing the materials at the most competitive price. However, the company has most of time been dealing with a limited number of suppliers and this has created an informal partnership relationship between the company and the suppliers. The company usually keeps record of the performance of the suppliers in terms of the price quoted, quality of supplies and the delivery reliability. Inspection and testing of incoming fabrics and trims are carried out only while purchasing with suppliers with poor track record. On average the fabrics and trims are stored for a period of at least two weeks before they are fed into the production lines.

The company has a PC based inventory control system for keeping an up to date record of all materials that are available in the store. In the event that materials are out of stock, they are ordered as and when required from local suppliers. The ordering procedure is manual such that once a purchase request order form is received from the planning department, quotations are sought from potential suppliers and the purchasing officer decides on the supplier. An order is placed through the use of a purchase order form, which is approved by the purchasing manager. Purchase orders worth more than £100 require the approval of the director. The telephone and fax are used for communicating with both local and overseas suppliers. Once a production order is complete, it is shipped within one week following manufacture and hence is not treated as an inventory (is not entered into the inventory control system).

❑ Manufacturing

The manufacturing strategy of the company is to attain the least cost possible associated with the manufacturing and other operations within the factory thus maintaining the cost competitiveness of the garments. In order to achieve optimum efficiency and productivity it is preferred to have long production runs. The company lays heavy emphasis on specialisation of employees for the purpose. The shop floor (sewing operations) is organised in a line layout with a manual rail system for the transfer of work in progress from one station to the other. Operator performance is monitored through the use of bar codes, which accompany each work piece on the production line. The bar code readers fitted on the workbench of each operator are connected to a computerised control system shared by the production manager for performance monitoring and the finance section for computing employee wages. The average monthly salary for a sewing machine operator is £105 (computed on piece rate basis) while working at 45 hours per week. Employees are paid overtime rates for all additional working hours.

The manufacturing operations start in accordance with the planning schedule. Note that the production manager equally assumes the responsibilities of the planning manager. Fabrics and trims (accessories like threads, buttons, zips, linings) are first issued to the cutting room from the store. A Computer Aided Design (CAD) system (Lectra system) is used to produce marker plans, which are reproduced on the marker sheet for cutting. Spreading of the fabric on the cutting table and the cutting operation (through the use of band knives) are performed manually. While the cutting operation is in progress, the trims and accessories are prepared. For instance, fusing is carried out on linings wherever applicable with flat bed presses. Following cutting, the cut pieces and the accessories are sorted out and placed on hangers, such that each hanger contains all the parts that is required on the sewing line for the assembly of the product. Each hanger equally carries a job ticket providing details of the operations to be carried out and bar codes, which are used to identify the employees that are involved with the assembly process. The planning department prepares the job tickets and bar codes. Most of the sewing machines on the assembly line are semi automatic, fitted with control devices to facilitate the assembly operations requiring minimum skills from the machine operator. The layout of the assembly line is reviewed for each manufacturing order and in the event of line balancing problems but as far as possible the operators are assigned the same operations.

On average, the percentage of defects per order is 8%. These include defects in terms of fabric (2-4%), wrong transfer marks (2%), poor fusing (2%) and those attributed to incorrectly formed stitches (2%). Defective items are usually sent back on the shop floor for repair (if feasible), else these are sold at mark down prices in the local market.

❑ Human Resource Management

There was considerable debate during the presentation session on the human resource strategy of the company. Though the personnel manager and the director claimed that the strategy was to maintain and develop an effective workforce, it was argued that the strategy was more in terms of taking advantage of cheap labour. The majority of participants agreed to the latter strategy. The justifications were in terms of the absence of motivation and training programmes for the operators and personnel at management level.

The percentage of indirect labour to direct labour is less than 6% (48 for 800 employees). Indirect labour includes the directors, managers, supervisors, foremen, mechanics, clerks, storekeepers, finance officers, cleaners, helpers, transport officer, drivers etc...) while direct labour includes machine operators and other personnel (e.g. dyeing and finishing) which are directly involved in adding value and changing the state of the product. The annual indirect and direct labour turnover ratio is 12% and 5% respectively. 40% of the machine operators have been recruited on a contract basis from India to cope with the increasing cost and unavailability of skilled labour locally.

Operator productivity is assessed using data collected through bar codes from the shop floor. Employees with above average performance are offered production bonus as a motivation measure. Also, employees are considered for promotion as and when vacancies arise within the company. In order to prevent absenteeism, which is of the order of 8% per day (on average), the company offers an attendance bonus and promotes personal communication between the employees and the personnel department for addressing issues associated with absenteeism.

❑ Finance

In general, the low cost strategy exemplar tended to limit investment on capital-intensive equipment. The finance strategy of the company was to limit expenses. The exception to this occurred in 2001 when the company invested 12% of the total sales earnings in the purchase of state of the art equipment for the dyeing and finishing departments. Investment decisions were based on the quest to improve productivity, quality and promote the creation of new product lines.

The costing structure for a typical order is given in table 6.2. The garments are most of the time shipped to the customers by sea. However, in certain cases for instance while orders are late or when the customer decides to have part of the delivery effected early air freight is used. The cost of airfreight is about three times that of surface shipment. On average, the company achieves 85-90% of on time shipment.

Factor	% Cost per order (Average range)
Shipping	5-10
Air freight (applicable in certain cases to less than 10% of order)	15-20
Direct labour	20-30
Indirect labour	10-15
Fabrics and trims	15-20
Miscellaneous (Rents, electricity, logistics etc...)	10-12

Table 6.2 Costing structure for typical production orders (LC strategy)

6.3.2 Case Study 2: Exemplar of High Value Added Strategy

The second case study was conducted at Tee Sun Ltd, which is part of the Palmar group of companies and is Mauritian owned. The group is involved in the manufacture of a range of knitted products including sweaters, polo shirts and T-shirts. Tee Sun was set up in 1987 and presently has a labour force of 1 200 with a monthly production capacity of 500 000 garments and an annual turnover in excess of £10 million. Most of the garments are exported to the UK (25%), France (40%), Italy (10%) and to the US (10%). The company is vertically integrated (starting from raw yarn that it imports principally from India, the manufacturing process includes following: Knitting, dyeing, finishing, making up, printing, washing and embroidery) and is one of the few companies in Mauritius to have invested in heavy automation facilities for achieving enhanced productivity.

❑ Marketing

The company has its own marketing department for conducting research for identifying new customers and channels of distribution. Marketing is mainly carried out through participation in international exhibitions, undertaking of promotion and advertising campaigns and through personal contacts with wholesalers and hypermarkets. About 2% of the annual turnover is spent on the marketing function. So far the products are mainly exported to wholesalers who are involved in the distribution of the products to various retailers in the EU and the US. However, over the past two years, the trend has now moved to direct sale to hypermarkets. The competitiveness of the products is mainly in terms of the quality/cost combination and the company usually has production orders covering periods of up to twelve months of production capacity. One could also say that Mauritius continues to play a predominant role in the export of garments principally because of its infrastructure, qualified labour force and reliability. On average the lead-time for marketing is about three months and the company aims at marketing similar products for which it has developed the expertise and skills.

The market segment served by the company includes independent and specialised stores (moderate price, high quality, low variety and high volume). Moreover, the company was equally involved in batch manufacturing, dealing smaller orders (less than 50 000 pieces) as and when needed. Marketing is usually carried out using designs that have been manufactured in the past and those with added differentiation features in terms of style and fabric. The marketing department works in close collaboration with the customers and the product design department for producing garment designs in line with the requirements of the market.

❑ Product Design and Development

The design of garments is worked out as a joint effort between the customer and the product design department in collaboration with the merchandising personnel from the marketing department. The fabric and garment design are most of the time designed in-house, through the use of Lectra systems, Adobe Imaging suite (Photoshop) and Corel Graphics software packages, as per the requirements of the customer to ensure the sales potential of the garment. The company usually has a collection plan, which is used for marketing purposes.

The design process (fabric and garment design following a request from a customer) takes between two to three weeks and mainly involves producing a design as per the requirements of the customer and working out the cost estimates per garment. The costing is based on past experience and customer expectations. Once a production order is secured, the customers provide the final specifications. Graded patterns are produced in-house using the Lectra system.

The design department equally comprise of a team of work-study engineers who are involved in setting the methods and time standards for the sewing operations. These standards are mainly worked out using the General Sewing Data software. Method and time studies are equally conducted on a regular basis during production to monitor any deviation from the set standards and initiate appropriate action.

❑ Planning and Control

It is common practice for the company to have confirmed orders for more than six months of production capacity. The planning of operations within the company (producing material requirement plans, issuing purchase orders, scheduling manufacturing activities) was one of the responsibilities of the marketing/merchandising department and was conducted through the use of a computerised MRP system. Given that the company has confirmed orders covering long periods of time, the scheduling of activities is firm and changes proposed by customers in terms of order size or delivery dates following confirmation of production order are accommodated with much difficulty. The master production schedule for instance, (schedule for manufacturing and other operations) covers a period of up to six weeks.

The operations are planned such that fabrics, trims and accessories are received in the factory based on monthly work orders (up to three weeks in advance). The acquired material is placed in the store until required by the production department as per the manufacturing schedule. The production department works out the cutting and sewing schedule as per the expected delivery date for the production order, which is worked out by the planning department. The lead-time between confirmed customer order and delivery is usually three months. However, customers have the tendency to book the production capacity for longer periods through unconfirmed production orders. The planning activity is usually conducted in collaboration with the purchasing and the production departments to ensure that the delivery date is met.

❑ Purchasing and Inventory

The company is vertically integrated and hence is involved in the purchasing of the trims and accessories only. The fabrics are manufactured in-house. The planning department controls the purchasing activity. The purchasing strategy for trims and accessories is to compare quotations both from local and overseas suppliers and select suppliers providing the materials as per the specifications at the required time. Quality and delivery reliability are the decisive factors in the selection of the suppliers. However, given that the company has been dealing with a limited number of suppliers over a long period of time, it has developed an informal partnership relationship with the reliable suppliers. Transactions are carried out with the use of EDI with suppliers, which have such systems.

The purchasing department is equipped with a computerised inventory control system, which is used for inventory management and for sharing inventory data with the planning department. All material is purchased in bulk for the complete order. Sample tests are carried out on the incoming goods, where appropriate to ensure quality of products before purchase records are updated into the information system. On average the fabrics and trims are stored for a period of two to three weeks before they are fed into the production lines. Once a production order is complete, it is shipped within one to two weeks. All goods are bar coded in accordance with the Universal Product Code and the Universal Carton Code.

❑ Manufacturing

In spite of the size of the company, its manufacturing strategy is geared towards batch production such that a number of production orders are manufactured simultaneously. The factory has a product oriented layout with automated computerised over rail system for material handling. Employees are trained to develop multiple skills such that they can switch from one operation to another as and when required. The production department is managed by a group of personnel comprising one production manager, ten assistant production managers, supervisors and foremen. The team of production managers is responsible to plan and control all operations on the shop floor (developing cutting and sewing schedules, cutting instructions, cut order plan, conducting line balancing, preparing procedures and instructions for the shop floor quality control activities among others).

The company has a highly automated system in the cutting room. The Lectra CAD/CAM system is used for marker making and for the cutting operations, which largely provide the required flexibility for dealing with large number of different orders. Also, spreading is carried out using an automated spreading machine with fabric control devices. The only manual operation in the cutting room is the sorting of the cut pieces and trims, which are placed on hangers and loaded into the production line. A job ticket providing details of the operations to be carried out and bar codes, which are used to identify the employees that are involved with the assembly process accompanies each hanger.

The company uses the state of the art programmable sewing machines for the assembly operations for three of its production lines. The remaining assembly lines use semi automatic sewing machines fitted with control devices to facilitate the assembly operations. The layout of the assembly line is reviewed for each manufacturing order.

The company places high emphasis on the quality of the garment produced and employs a team of quality controllers who are involved in the inspection of the semi finished products on the assembly line. 100% inspection of the finished products is carried out to ensure zero defect. On average the amount of rework is about 2% per order and these are fed back into the production lines for repair. Once complete, production orders are shipped within one week.

❑ Human Resource Management

This was the only company from the sample that agreed to the fact that the strategy for human resource management was to use the 'carrot and stick principle'. This is equivalent to the strategy of taking advantage of cheap labour. The justification was mainly in terms of the absence of motivation programmes for the employees with the exception of the provision for production and attendance related bonus. However, the company promotes the concept of teamwork among its employees for each production line.

Operator performance is monitored through the use of job tickets, which are filled in by the operators. The job tickets are approved by the supervisor before it is compiled by the finance department for the computation of wages and production related bonus. Employee productivity is assessed manually.

The daily absenteeism rate is between 5 and 10% and the annual direct and indirect labour turnover ratio was about 8%. In order to cope with scarcity of skilled labour the company has recourse to foreign labour mainly from China and India. The percentage of foreign labour employed was 38%. Moreover, it was argued that the productivity of foreign labour was higher than the Mauritian counterpart.

❑ Finance

The strategy in terms of finance is to promote new investment with a view to attain better quality, enhanced manufacturing flexibility and the ability to introduce new product lines. The percentage of sales earnings invested in plant and equipment is about 12%. In contrast to the majority of companies in the sector, which used the piece rate system for computation of wages, the payment system in this company was the hourly wage system. It was argued that this system enables the company to achieve its quality targets by relieving the pressure on operators for volume production. The finance department has a computerised accounting system for computation of wages and for conducting other financial transactions.

The company uses a combination of sea and airfreight for the delivery of the orders as per the agreement with the customers. On average about 70% of orders are shipped by sea and the remainder are delivered by airfreight. The cost of airfreight is about three times that of surface shipment. The costing structure for a typical order is given in table 6.3. On average, the company achieves 80% of on time shipment.

Factor	% Cost per order (Average)
Shipping	10
Air freight (applicable in certain cases to about 30% of order)	22
Direct labour	30
Indirect labour	15
Fabrics and trims	15
Miscellaneous (Rents, electricity, logistics etc...)	8

Table 6.3 Costing structure for typical production orders

6.3.3 Case Study 3: Exemplar of Quick Response Strategy

The third case study was conducted at Job Textiles Ltd, a company located at Goodlands, with 250 employees involved in the manufacture of shirts and blouses. The company is one of the three companies claiming to have in place the quick response strategy for meeting the changing requirements of its customers. The company was established in 1987 by the director, a French expatriate, and presently has a production capacity of 2 000 garments per day. The garments are mainly exported towards England, France, Belgium and Reunion Island and the annual turnover of the company is about £3.6 million.

❑ Marketing

The market category serviced by the company involves designer wears, that is, retailers in the high price, high quality, stylish design, high variety and low volume segment. The products are marketed by the director, who equally assumes the responsibility of the marketing manager, through personal contacts with wholesalers and sales agents in the importing countries. About 2% of the annual company turnover is spent on the marketing function for the organisation and participation in international fashion trade shows and for visiting customers. The merchandising officer who is responsible for the preparation of collection plans assists the director in the marketing activities. As far as possible the company aims to limit the product range that is marketed to shirts and blouses, in order to take advantage of the higher labour productivity achieved while manufacturing these products. Moreover, the trend for the demand of similar products has been increasing over the past five years.

Most of the market information in terms of trends in product demand and end user preferences for fabrics and garment design is obtained from the customers as feedback information for reviewing subsequent orders. The company uses the conventional telephone, fax and email systems for communicating with customers. The lead-time for marketing of products (start of process till order is secured) with existing customers is between three and twelve weeks. This includes the lead-time for designing the product until accepted by the customer, which takes about two weeks. The lead-time for marketing the products with new customers however is about twelve weeks or more. The company mostly accepts orders for batch production (orders of less than ten thousand of pieces) with possibilities for replenishment with or without changes in the design. Over the past two years the company has experienced considerable pressures from the market for improvement in quality and the reduction in lead-time, order size and price of garments. The company has since then invested in a number of automated systems for design and manufacturing in order to maintain its competitive advantage in terms of cost, quality and delivery reliability.

❑ Product Design and Development

The strategy for product design and development is to add differentiation features on existing designs in line with the requirements of the market. The company employs one fashion designer for the purpose. Usually the proposal for changes in fabric and garment design is obtained from the customers (wholesalers and sales agents) who are extensively involved in conducting market research. The customers use product sales rate data for evaluating the acceptance of specific designs and for placing replenishment or new orders.

Moreover, the customers lead the design process by providing information in terms of fabrics and trims and styles for manufacturing. Fabric designs are equally obtained from local fabric suppliers. The in-house design office is mainly involved in verifying the manufacturability of the design in collaboration with the planning, purchasing and the manufacturing departments and propose modifications if any, to the customers. Design information is shared between the departments through the local area network. Once the design idea is agreed upon, sample garments are produced and forwarded to the customers together with cost estimates for approval. Cost estimates are worked out manually based on past experience, customer expectations and competitor prices. The lead-time for the design process (agreeing upon fabric design, samples and costing) is approximately two weeks. Graded patterns for the garments are usually produced in-house using the Lectra system, which is equally used to produce the marker plan for cutting. In certain cases, the customers provide the graded patterns together with the garment specifications.

❑ Planning and Control

The company usually has production plans for one to three months ahead and is often involved in the manufacture of repeat orders with or without modifications to the initial design depending on the sales rate of the product. Production schedules are produced manually by the planning department in collaboration with the manufacturing department and the sales department. The planning process however makes extensive use of the in-house management information system (MIS) software (TCO) for organising a large number of activities including issue of bill of materials, process planning, and storage and monitoring of production capacity data. The master production schedule covers a period of 3 weeks and purchasing is organised such that fabrics, trims and accessories are received in the factory one week before production starts. On average the lead-time between confirmed order and delivery is eight weeks. It is however common for the company to deliver partial orders, upon request from the customers, in order to achieve shorter order to delivery lead times. It takes about four weeks to deliver the order by ship to most of the European countries.

In addition to scheduling of activities, the planning department is involved in the setting up of work standards and ensuring quality control. Work-study officers are employed to ensure that the correct methods are in place and time standards for the operations are reasonable and respected. Method and time studies are in fact regularly carried out during production for reviewing time standards and work methods. The quality control system mainly involves sample inspection of the products by quality controllers on the production line and 100% inspection before the finished garments are packed for delivery. On average the scrap rate is less than 2% of the order as any defective item is referred back to the production line for repair.

❑ Purchasing and Inventory

The company obtains its fabrics from the customers, from companies that are recommended by the customers or from local suppliers. About 40% of fabrics are purchased from weaving mills (e.g. from Socota and Consolidated Fabrics) locally. The remaining fabrics are imported from countries like the UK, France, Portugal and Italy in line with the recommendation of the customers. The company has a partnership relationship with most of its fabric suppliers such that, the suppliers advise the company in terms of new fabrics and market trends. Fabrics are usually purchased in bulk for the complete order. While purchased locally the lead-time for obtaining the fabrics is three weeks and if imported it takes up to six weeks to acquire the fabrics. An EDI system is used for conducting transactions with the suppliers in order to allow faster decision-making and to cut down on lead-times. The EDI allows transfer of required specifications data to and from the suppliers and payment for transactions to be effected in real time.

Trims and accessories on the other hand are purchased in bulk for the complete order from local suppliers and the lead-time for the purchase is about two weeks. The procedure involves comparing quotations from potential suppliers and selecting those, which have a good track record in terms of quality and delivery reliability. The fabrics and trims are usually acquired one week before the scheduled date for manufacturing in order to conduct sample tests on the fabric and inspect the trims and accessories for conformance to quality requirements. Statistical quality control procedures are used for storing and analysing all data associated with inspection and testing.

A computerised MRP system is used to carry out the purchasing function (generation of purchase requisition and order forms) and for managing in-house inventory such that real time data is available on all items in stock. The MRP system is shared by the planning department for generating the purchase requisition as and when materials are required, bearing in mind the lead time for acquisition and the production schedules.

❑ Manufacturing

The manufacturing strategy of the company is to have short run production in order to achieve quick response in meeting the requirements of the customers. There are six production lines in the company arranged in a product type of layout with a manual overhead rail system for the transfer of materials between the workstations. Planning and work-study personnel are involved in setting up the layout and arranging operations for each manufacturing order, to ensure optimum utilisation of the resources and minimal work in progress. Line balancing is conducted manually based on past data and experience. Three supervisors, six foremen and a team of five quality controllers work on the shop floor to ensure that the assembly process is in line with schedule and quality requirements.

The company is equipped with the Lectra system for producing marker plans using graded patterns that are either supplied by the customers or produced by the design department. Given that the design and the cutting department use the same information system, design data are shared between the departments. Digitisers are used to load design data (hard copy patterns) into the software. Once the marker plan is ready, the fabric is spread on the cutting table using an automated spreading machine for cutting. The cutting operation is performed manually through the use of band knives. For linings however die cutting is used. Fusion wherever applicable, is carried out on linings with continuous pressing machines. Following cutting, the cut pieces and the accessories are sorted out and placed on hangers, which are loaded into the assembly line. The supervisors and foremen ensure that each employee is provided with the work instruction for the operation to be conducted. These are fixed on the worktable of the employees. Most of the machines on the assembly line are manual requiring skilful operators. The pressing operation, following assembly, is conducted by using of die presses.

The machine operators are made responsible for the quality of the assembly operations such that each operator ensures that there is no defect associated to the assembly process. Any identified defective item is reshuffled into the production line for corrective action or is rejected from the line by the Quality controller. Bar codes are used to monitor employee performance and the productivity of the each production line. On average, the percentage of defects/scrap per order is less than 2%.

❑ Human Resource Management

The policy of the company in terms of human resource management is to maintain and develop an effective workforce with a sense of belonging to the company. At the management level there is a production manager, planning manager and a fashion designer with tertiary level qualifications. The remaining personnel responsible for merchandising, work-study, purchasing, maintenance, personnel management and supervision of operations have qualifications up to secondary level (A' Level) with working experience in the garment industry.

On average the daily absenteeism rate is 8%. The annual turnover of direct labour is about 12% while that of indirect labour is about 3%. About 8% of the workforce (machine operators) consists of foreign labour mainly from China. In addition to training its employees, the company has policies for providing attendance and production related bonus and organising indoor and outdoor activities to keep the employees motivated towards their work. Also, the company promotes teamwork for which both financial and non-financial rewards are provided when achievements (team productivity) are above average. The operator and line productivity are assessed through the management information system software. A piece rate wage system is used for computing the wages of employees.

❑ Finance

The finance strategy of the company is to promote investment in facilities for enhancing manufacturing flexibility and permit achieving reduced lead times. So far the company exports about 50% of the orders by airfreight as per the request of customers and the remaining are exported by sea freight (as replenishment orders). An order to delivery lead-time of four weeks is thus achieved. However, the cost of exporting by air is about three times of that paid while using surface shipment. On average, the company achieves 85-90% of on time shipment.

The percentage of annual turnover spent on training of machine operators and personnel at management level is 1% and 2% respectively. The percentage of annual turnover spent on new equipment is less than 5%. The costing structure for a typical order for the company is given in table 6.4.

Factor	% Cost per order (Average)
Shipping	10
Direct labour	10
Indirect labour	10
Fabrics and trims	50
Miscellaneous (Rents, electricity, logistics etc...)	20

Table 6.4 Costing structure for typical production orders

6.4 Analysis, Discussions and Recommendations

In addition to the functional strategies, the performance indicators for the three case study companies were worked out in each case with the collaboration of the company personnel and that of the chief executive. The results of the assessment are shown in table 6.5. The last column in the table illustrates the benchmarks achieved by the 'best of the best' companies in the US. These data are mainly for companies that have shifted from the traditional mass production systems to batch production systems with quick response ability and without foregoing their achievements in quality standards. The data was published in 1993 by the American Apparel Manufacturers Association (AAMA, 1993) and were confirmed as being achieved in a number of garment manufacturing companies by Heinje (1997). The work of Hienje was based on a survey of 20 companies, which claimed to have embarked upon quick response manufacturing strategy in order to take advantage of time compression within the supply chain to compete against suppliers from the low labour cost countries. Given that QR strategy is a means of achieving mass customisation (the right product for right customer at the right time within a volume market), Hunter (2002) argues that this will be the most competitive strategy for the future.

Performance Indicator	Definition	Results for Case Study Companies			Bench-mark*
		LC	HVA	QR	
Average product development cycle time	Number of days from concept of new product until the new style is released for production (minimum)	90	90	90	25
Sell through (%)	The percentage of products sold at regular price	N/A	90	50	100
Design acceptance (%)	The number of garment styles manufactured divided by the total number of designs produced	50	45	80	90
Average Order fulfilment cycle, (days)	Minimum number of days between receiving confirmed order and shipping the goods	90	45	90	8
% Of on time shipment	The percentage of orders shipped on time (average)	85	80	85	98
Cost conformance	Ratio of actual cost to planned cost to produce an order	1.2	1.2	1	0.8
Engineered Styles (%)	Ratio of number of styles accepted to number of styles developed	N/A	15	70	75
Cycle time (days)	The time required to produce a unit of product (days)	7	2.5	1.5	3
Work in progress (number of weeks of production)	The total amount of product that is stored (including raw material) or that is on the production line (weeks of production)	10	8	2	2
Conformance to Quality	The percentage of garments meeting quality standards (specifications)	98	96	98	100
% Conformance to plan	The number of units produced to the number of units expected to be produced per day	86	84	75	100
Shipping cycle time (days)	The number of days from an order is released to ship until it is released to the carrier to be delivered to the customer (minimum)	30	35	5	3
% Of replenishment shipments	The number of units shipped as replenishment as a percentage of total units shipped	Nil	12	50	30
% Of shipment direct to store	% Of shipment that go directly to the retail store location bypassing distribution centres	Nil	15	25	100
Productivity Measures					
Labour productivity (£/employee)	Added Value/Number of employees Total Output/Number of employees	N/A	N/A	N/A	N/A
Capital productivity (ratio)	Value added/Fixed assets or Total Output/Fixed assets	N/A	N/A	7:1	N/A
% Of products that are UPC (Universal Product Code) bar coded		Nil	78	90	100
% Of shipping cartons bar coded according to UCC (Universal Container Code) shipping container marking guidelines		Nil	60	90	100
Depth of implementation of EDI for the following activities (%)					
o Issue purchase orders		Nil	Nil	100	100
o Issue invoices		Nil	Nil	100	100
o Issue advance shipment notices		Nil	Nil	100	100
o Share product activity data		Nil	Nil	100	100
o Confirm purchase order		Nil	Nil	100	100
o Share planning schedules		Nil	Nil	100	100
o Issue remittance advices		Nil	Nil	100	100
% Of incoming raw materials and manufacturing supplies bar coded		Nil	7	50	100

Table 6.5 Performance measures for case study companies

The following sections provide an analysis of the results generated by the audit tool and that of the collected information through the in-company working sessions, in an attempt to illustrate the strengths and weaknesses of the case study companies. The recommendations that followed the analysis were presented to the companies during the last working session and the possibilities for implementing alternative strategies for achieving enhanced product competitiveness in the world market were also discussed.

6.4.1 Case Study 1 (Exemplar of Low Cost Strategy)

The main strength of the company is its ability to achieve and maintain a low cost manufacturing strategy with minimum investment in both human and capital resources. Most of the decisions within the company are centred on the managing director and the production manager, which allows swift decision-making. The company achieves high labour productivity by laying heavy emphasis on the piece rate wage system and optimises the use of equipment by overtime work. There is little production automation and currently there is no shift system but the company is contemplating its introduction for the near future. A summary of the other strengths of the company whereby the score was perceived to be a 'best score' in the audit is as follows:

1. The company largely satisfies the customer requirements in terms of quantity, quality and delivery reliability.
2. The labour is cheap and specialised. Most of the machine operators have at least 10 years of working experience on the same/similar operations and achieve high productivity. On average labour productivity was 88%.
3. The reject rate is less that 5% (usually reworked) and scrap is less than 2% of the order.
4. Orders are secured at least three months in advance, which allows the company to smoothly plan and schedule its operations and achieve its production targets. The master production schedule for instance covers at least 4 weeks of production.
5. The company purchases its fabrics and trims from a limited number of suppliers, which provide quality assurance data for the goods supplied.

6. The performance and productivity of employees is closely monitored through the use of the bar code system. Any productivity problem identified within a production line is sorted out as soon as possible by the production manager with the support of the supervisors, to ensure that targets are met.
7. The attendance and production bonus is a useful means to keep the pressure on employees for achieving enhanced performance.
8. Production orders are shipped as soon as they are completed (packed).
9. The profit margin of the company is 30% to 40% and is viewed as satisfactory by the director.
10. The company has no difficulty in securing orders and as at January 2001, the company already had confirmed orders until June 2001.
11. The company has plans to expand its facilities by investing on state of the art equipment to improve productivity further.

The wide availability of production orders has been the main reason why the company has not reviewed its current manufacturing strategy. However, following the auditing exercise, while the weaknesses were being discussed, it was evident that even while maintaining the present strategy, the company had considerable room from improvement and could achieve better results in the medium to long run by taking appropriate decisions to overcome the shortcomings. These opportunities were based on statements with a score less or more (deviation from best) than the 'best score' in the audit. A summary of the main shortcomings identified in this way is as follows:

1. By selling the products to sales agents the company loses at least 5% of the selling price per product. For instance, for a product selling at £2, free on board wholesale price, the loss is about £600 per day. On average, a marketing executive would cost the company £500 per month.
2. Given that the managing director is directly involved in marketing the products and is also responsible for the day-to-day operations (e.g. finance decisions), there are only a limited number of international trade shows in which he can participate. This limits the effectiveness of the marketing exercise. Also, marketing when undertaken can take up to six months (from start) before a confirmed order is received. There is no marketing research undertaken and

there is little feedback from the customers on the sales rate or on customer preferences. Equally data was not available for the amount of products sold at mark down prices such that the company is not fully aware of the performance of its products on the market.

3. None of the products were being sold directly to retailers or delivered to the retail stores. The supply chain involves sales agents, wholesalers and distribution centres, which largely decrease the profit margin of the company.
4. The company is not equipped with the latest information and communication technologies like Internet (only two personal computers are connected to the Internet), local area networks and Electronic Data Interchange (EDI). This prevents the company from embarking upon quick response strategies.
5. The design activities are limited to adding differentiation features to existing designs and working on those proposed by customers. The collection plan is more of a collection of items that have been produced by the company in the past. Also, the design office is not equipped with the appropriate human resources (fashion designer, qualified design engineer) and there is no research conducted on fabrics or on novel designs. In spite of the limited design activities, it can take up to four weeks to agree upon a design with the customer. The minimum product development cycle time on the other hand is 90 days (includes time for marketing of the product until it is released for production).
6. Over the last two years, the company has been experiencing pressures from the market in terms of quality, lead-time and price reduction. This clearly demonstrates the trend in the market for higher value added products and smaller batch sizes. Failure to meet these requirements in the future may imply losing considerable market shares.
7. Most of the activities within the company are conducted manually. These include production planning and scheduling, line balancing, setting time and methods standards, materials requirement planning, inventory management, maintenance planning and scheduling, and design and costing. All of these can be supported by a wide range of IT packages currently available on the market. The computerisation of these functions can considerably reduce the effort and time devoted to these activities and bring in step improvements in productivity.

8. The company can hardly accommodate repeat orders or changes in order size because of lack of flexibility in the planning and scheduling of activities.
9. The company has large amount of inventory and hence capital tied up in inventory for large periods of time. On average there was about 10 weeks of inventory at any one point in time in the factory.
10. Quality requirements are achieved through inspection of the products on the production line and through the use of 100% inspection of the garments following manufacture before packing is carried out. There is no statistical quality control system in place and it is very difficult to track common problems for taking corrective measures.
11. The company employs a minimum of overheads to keep costs down. This places considerable pressures on the supervisors and the production manager to meet targets.
12. Housekeeping is generally poor in the company in spite of the existence of the overhead rail material handling system. This is mainly attributed to the existence of large amount of work in progress and inventory. Also, the dyeing and the finishing departments are largely short of space to accommodate the finished products from the shop floor. It is quite common to have a bottleneck at these departments before the products are shipped.
13. Most of the hardware in the cutting room (e.g. pattern making, fabric spreading and cutting, fusing, imparting transfer marks, sorting) involve manual operations and hence require skilful operators. Automation of these systems can considerably improve productivity.
14. In spite of the fact that the company sources its fabrics and trims from a limited number of suppliers there is no strategic partnership relationship between the company and the suppliers. The company thus maintains the procedure for comparing quotations before purchasing though the decision is most of the time in favour of past suppliers with a proven tract record.
15. It is common for the factory to hold large amounts of stock and at times to be out of stock as there is no scientific means (e.g. Re-order point, Kanban or Just in time systems) for deciding upon inventories.
16. There are no training programmes for employees and personnel at management level.

17. The daily absenteeism rate is about 8% and the annual direct labour turnover is about 12%. These are mainly attributed to the absence of motivation programmes for retaining labour.
18. On average less than 5% of the annual turnover is invested on plant and equipment and on new technology.

The above clearly demonstrates the company's current strategy for maintaining the cost competitiveness of the products by emphasising labour productivity and minimal investment to maximise output. The company is far from achieving the performance indicators of the benchmarks in the sector (see table 6.3). However, the present strategy has largely been successful, as the company has no difficulty in securing orders in the market place and net profit has been stable over the past two years. Based on the outcome of the auditing exercise and bearing in mind that the company wished to maintain the low cost manufacturing strategy, a series of recommendations were made with a view to bring in step improvements in the activities undertaken in the factory and to create the environment for allowing the company to shift from the low cost strategy to other strategies, if it chose to do so. The company agreed to conduct feasibility studies to determine the cost and other implications before any decision for implementing the recommendations is taken. The recommendations were as follows:

- **To Improve Productivity, Quality and Manufacturing Flexibility**
    1. To implement a total productive maintenance system and as far as possible replace obsolete equipment with new ones.
    2. To work out an annual training plan for the personnel at management level (including foremen, supervisors and managers) and for machine operators.
    3. To work out a motivation programme for all employees. It is not necessary for the programme to be financially remunerative (e.g. promoting team work, increasing the scope for promotion, competition for good housekeeping, organisation of outdoor sport activities and competitions, prize giving ceremonies, coverage for medical insurance, etc...).
    4. To invest on software packages for the following activities: materials requirement planning, inventory management, product design and costing.

5. To invest on a CAD/CAM system to automate the cutting activities.
6. To implement an overhead material handling system in replacement to the PBU.
7. To implement a total quality management system.

- **To Embark on Quick Response Strategy**
  1. To set up a marketing department with appropriate personnel for conducting market research and identifying new customers and their requirements.
  2. To set up a product design department equipped with the appropriate hardware and software for developing new product lines in line with the customer requirements. To recruit qualified personnel for the department.
  3. To invest on Universal Product Code (UPC) and Universal Container Code (UCC) bar coding systems.
  4. To embark on a partnership relationship with the suppliers of fabrics and trims with a good track record.
  5. To embark on a partnership relationship with the customers with possibilities for access to Point of Sale data.
  6. To invest on an EDI system to enable sharing of data with customers and suppliers and conducting transactions on line, in real time.

6.4.2 Case Study 2 (High Value Added Strategy)

The main reason for this company to claim having in place the high value added strategy is that it has heavily invested in the state of the art technology for its design and manufacturing activities. It is involved in both batch and high volume production and serves the lower end of the market and hence is best classified as a company with low cost manufacturing strategy. The investments in automated and computerised systems enable the company to achieve high productivity, manufacturing flexibility and production of above average quality garments for specialised stores. The company has the technological capability, expertise and the required resources both to move up market and to embark on quick response strategies. A summary of the strengths of the company with statements associated to 'best score' from the audit tool, were as follows:

1. The company conducts aggressive marketing for its products and is involved in marketing research for identifying the requirements of the changing market.
2. The company has the flexibility to work both on high and low volumes.
3. Design of fabrics and garments are produced in-house in collaboration with the customers. Given that fabrics are manufactured in-house, there is limited pressure on the lead-time for acquiring fabrics.
4. The company is equipped with the required hardware and software for undertaking design activities.
5. Planning and scheduling of activities is undertaken through the use of an MRP system with shared data with the Purchasing department.
6. The GSD software is used for setting method and time standards.
7. An EDI system is used to conduct transactions with some of the suppliers of trims and accessories.
8. The company has fully automated systems for lay setting, marker planning, cutting and material handling. Also, programmable sewing systems were being used in some of the assembly lines.
9. The total amount of defects/scrap was less than 2% of the production order.
10. The company laid much emphasis on teamwork for achieving production targets. Also, the company had in-house training programmes to enable employees develop multiple skills.
11. A large proportion of the products delivered by the company are bar coded as per the Universal Product Code (UPC) and the Universal Carton Code (UCC).
12. The hourly wage system and the piece rate system are used together with production and attendance related bonus as payment system.
13. The company believes in the use of the state of the art technology for achieving enhanced product competitiveness and a large percentage of the annual turnover is spent on investment on tools and equipment in the quest to serve the upper segment of the market.

Tee Sun was found to be one of the few companies to have acquired the latest technology for the design and manufacture of quality garments. The present manufacturing system is efficient and flexible enough to enable the company embark upon the quick response strategy and serve the higher segment of the market with relatively more profits (e.g. designer wear). The present strategy of the company was more of a low cost strategy than high value added strategy. The concept of high value added being related to the sales value of the final product and mostly associated to fashion garments (high price, high variety, low volume).

Following the auditing exercise, a number of weaknesses with 'average score' were identified. These were discussed with the company personnel during the working session before the recommendations for the company was worked out. The following are a summary of the main shortcomings:

1. The company has recourse to wholesalers for the distribution of its products and has little feedback in terms of the performance of the garments (design) on the market (e.g. access to sales rate data and percentage of garments sold at mark down prices).
2. In spite of having a fully equipped marketing department, the investment on the marketing function for identifying new customers was limited as the company was enjoying pressures from existing customers in terms of orders covering long periods of time.
3. The company was equally found to experience pressures from the existing customers for improved quality. The company has resort to 100% inspection for meeting quality standards. There are few procedures for eliminating quality related problems at source.
4. The planning schedules are rigid and there are few possibilities for customers to place replenishment orders over a same selling season.
5. The company holds large amount of inventory over long periods of time as materials are received well in advance prior to release on the production lines. Even finished garments in certain case were stored for up to two weeks before delivery.
6. The processes of acquiring trims and accessories are usually long as the company uses the multiple sourcing strategy and does not have a partnership relationship with specific suppliers.
7. With the exception of production and attendance related bonus there are limited motivation programmes for employees, including for personnel at management

level. This, to some extent explains the high daily absenteeism rate and the high annual direct and indirect labour turnover ratio.

The auditing exercise confirmed the potential of this company to design and manufacture quality garments at competitive prices. However, the facilities were not being fully exploited to develop a competitive advantage to enable the company compete against suppliers from the low cost countries. The following recommendations were made for the purpose, based on the output of the audit exercise and discussions the author had with the company executives during the working sessions.

- **To Further Improve Productivity and Quality**
  1. To implement a total quality management system as a replacement for the inspection for quality. Such a system will allow the company to design quality into the products and processes thus eliminating the need for intensive inspections. Also, the use of statistical quality control systems will enable the company keep track of the source of quality related problems.
  2. To provide in-house and outdoor training for the personnel at management level and for machine operators in areas such as productivity improvement tools and techniques, total quality management, procurement, human resource management etc...
  3. To work out a motivation programme for all employees in order to develop a sense of belonging to the company and fight against absenteeism and labour turnover.

- **To Embark on Quick Response Strategy**
  1. The marketing department to investigate the possibilities for selling the products directly to retailers at the upper end of the market.
  2. To use the EDI system for sharing real time sales data with the customers.
  3. The merchandising and design department to develop differentiated products with higher value added for the designer wear market.

4. To embark on a partnership relationship with the suppliers of trims and accessories in order to implement just in time systems and avoid keeping large inventories.

6.4.3 Case Study 3 (Exemplar of Quick Response Strategy)

This company is one of the few companies in Mauritius, that has invested on the appropriate systems for achieving quick response to customer demand. It is involved in batch manufacturing, with possibilities for replenishment and uses a combination of sea and airfreight for the shipment of the end products. The additional costs associated with airfreight delivery are equally shared by the company and the customers and is largely met by the higher value of the manufactured garments. The company mainly services the designer wear market category. While conducting the audit it was observed that this company shares a number of characteristics with the low cost and the high value added strategy companies but demarcates from them in terms of manufacturing flexibility and responsiveness to market requirements. A summary of the strengths of the company with statements associated to 'best score' from the audit tool, were as follows:

1. The company specialises in the manufacture of products for the upper end of the market and largely satisfies the customer requirements in terms of quality and delivery reliability.
2. The company shares product sales rate data with its customers such that replenishment orders if required, are produced and delivered to the customers within a period of three weeks. This also allows the company to closely monitor the trends in demand from the market.
3. The company has implemented a manual overhead rail system for material handling which allows it to easily keep track of production capacity, maintain good housekeeping and limit work in progress to a minimum. The total work in progress for the company was two weeks of production capacity in contrast to ten weeks of the low cost strategy exemplar.
4. The company has a CAD system for marker planning and an automated spreading machine with fabric control devices for preparation of the lay bed.
5. The total amount of defects was less than 2% of the production order.

6. The company has a MRP system for generation of bill of materials, purchasing and inventory control such that real time data is available on all stocks held by the company.
7. The company has an EDI system for conducting transactions with suppliers of fabrics, trims and accessories.
8. The company lays heavy emphasis on teamwork for meeting production targets and empowerment of employees with regards to dealing with quality problems.
9. Training for employees is provided using in-house facilities and employees have opportunities for promotion.
10. The bar code system is used to assess the performance of employees and production lines.
11. All products delivered by the company are bar coded as per the Universal Product Code (UPC) and the Universal Carton Code (UCC).

This company was among one of those which were found to have an annual turnover greater than that of the larger size companies having the low cost strategy, during the preliminary survey conducted at the beginning of research (see section 2.5.3). However, in spite of its success as a supplier to the upper segment of the market and the competitive advantage it has developed in terms of fast response to market requirements, it shared a number of weaknesses with the low cost strategy company exemplar. These weaknesses were statements with an average score, associated with the current manufacturing practice, generated by the audit tool.

1. The company has recourse to sales agents and wholesalers for the distribution of its products to retailers and hence loses about 5% on the price per garment.
2. The chief executive is the sole person responsible for the marketing of the products, which limits the scope of his actions and possibilities for aggressive marketing of the products and services the company excels in.
3. The company mainly relies on its customers for the design of the fabrics and garments and does not have the software and hardware for conducting research and development on design.
4. Quality requirements are met through 100% inspection of the products on the production line and before packing. Note that inspection is a non value added

activity and the use of a large number of quality controllers adds to the cost of the final product.

5. The cutting activity is manual and the efficiency of the process largely depends on the skills of the operators. Though errors are not common, they are costly whenever they occur.
6. The company does not have a partnership relationship with the suppliers of fabrics and trims and hence the process of acquiring materials (invite quotations, compare and select suppliers) is long and tedious.
7. There are limited motivation programmes for employees, including for personnel at management level.

Given the smaller size of this company and its strengths in terms of manufacturing flexibility and achieving quick delivery, the scope for this company to serve the high value added market is considerable. This requires the company to invest on appropriate systems to achieve enhanced quality and develop its design capability. The recommendations for this company were as follows.

- **To Improve Productivity**
  1. To invest on CAD/CAM systems for automating the operations in the cutting room.
  2. To work out a motivation programme for all employees.
  3. To investigate the possibility for replacing the current wage payment system from the piece rate system to an hourly wage system.

- **To Embark on High Value Added Strategy**
  1. To implement a total quality management system as replacement for the inspection for quality.
  2. To develop a design office with the appropriate resources for producing in-house designs.
  3. To develop a marketing department for marketing of the products and services to potential retailers.

4. To embark on a partnership relationship with the suppliers of trims and accessories in order to implement just in time systems and avoid large inventories.

Chapter 7
Apparel Sector Auditing

7.1 Introduction

The three case studies clearly demonstrate that in spite of the fact that the companies were involved in the manufacture of different products with different claimed strategies, there were more similarities than differences between their manufacturing practices. The survey method was used to verify if that was also the case for the sample of companies. An analysis of the survey results is presented in this chapter. Note that the initial survey was conducted prior to the case studies, following which, based on the experience gathered from the case study exercise, the companies were contacted again to confirm the accuracy of the statements that were selected from the audit tool. In many cases, changes were made to the responses in the light of discussions between the author and the executives responsible for each of the functional areas being considered. The individual company audit reports have not been included for reasons of confidentiality as most of the companies were reluctant to make these available in the public domain. The audit results, given in appendix G, provide a detailed view of manufacturing practice in the garment-making sector in Mauritius, an analysis of which allows understanding the implications for the industry in the wake of world trade liberalisation.

The sector wise analysis is mainly in terms of the factors that are within the scope for change in the manufacturing organisations in terms of the mechanisms and controls illustrated within the IDEF0 garment manufacturing system model. These include the technological capabilities, the human resources and the work systems that were in place at the time of the survey. The presentation of the survey results follows the format of the feasibility study conducted by Bob Lowson (1998) on the implementation of the quick response (QR) strategy by small and medium scale enterprises (SMEs) in the United Kingdom.

7.2 Technological Capability

The technological capability of a company includes the tools and equipment that were being used for design, production planning and control, purchasing and inventory control, manufacturing, and associated information and communication systems. These mostly depended on the exigencies that the marketing function placed on the manufacturing function and are considered under the headings of marketing, design, manufacturing, planning and control and, information and communication systems.

❑ Marketing

So far, most of the companies were marketing their products either to wholesalers (47%)[1] or sales agents (18%) with typically high volumes and order to delivery lead-times of up to twelve weeks (77%). Only two companies (12%) were marketing their products directly to retailers with lead times of less than six weeks. The lead-time for marketing itself was up to 12 weeks for the majority of companies (88%) and the market categories served by the companies were department stores, retail chains, and independent and specialised stores, all of which involve the sale of low variety and high volume products (non seasonal basic garments e.g. shirts, T-shirts and trousers). Only 18% of companies were servicing the designer wear market category whereby emphasis on the design of a high variety of products with different styles was more considerable. These mainly constituted some of the larger companies working to the high value added strategy.

The main pressures on companies from the market were in terms of quality (71%) and price (47%) and to a lesser extent on lead-time reduction (35%), design (24%) and order size reduction (12%). Most of the companies (59%) had confirmed orders for three months ahead. The remainder had production plans covering longer periods and in one case the period was up to 12 months ahead. Given the wide availability of production orders covering long periods of time, most of the companies were fully involved in meeting the requirements of the orders and had little interest in revisiting current strategies, which were believed to be competitive.

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[1] The figures in brackets illustrate the percentage of companies

❑ Design

The main weakness of the industry was found to be its limited involvement in the design of fabrics and garments. The majority of the companies depended on customers (65%) or fabric suppliers (29%) for design of fabrics. Moreover the companies which were equipped with appropriate software for fabric design (30%), mainly used the software to propose and agree upon changes with the customers or fabric suppliers. There was little in-house design conducted from scratch.

With regards to garment design, these were in most cases worked out in collaboration with the customers (65%) and mainly involved adding differentiation features to past designs. In a few cases (35%), companies were working on completely different garment styles. Surprisingly, in spite of the availability of a wide range of technologies in the form of Computer Aided Design (CAD) at affordable prices for automating the design process, only few companies (24%) were using specialised CAD systems for garment design. Similar CAD systems were however, being extensively used (82%) for the generation of garment patterns and for lay planning prior to cutting. A few of the larger companies (18%) had fully integrated CAD/CAM systems (Lectra or Gerber systems) for pattern generation and computer-controlled cutting. These provide enormous benefits in terms of fabric utilisation, speed, flexibility and quality. However, there was little evidence of shared design information through the CAD systems with the customers.

❑ Manufacturing

In addition to automated systems for lay planning, the cutting room involved the use of automated spreading machines with fabric control devices (71%) for producing the lay bed. Cutting in these companies was carried out manually using portable or band knives.

With respect to operations on the shop floor, the scope for automation in the garment industry is mainly in terms of material handling and data collection systems. It was observed that about a third of the companies (29%) had partial investments on the Unit Production System (UPS) which enables computerised automated material handling between workstations (Gerber and Eton systems). The UPS being a relatively expensive system, costing about £5000 per workstation, was mainly found in the larger companies. The installation of these systems was being carried out in stages (one production line at a time) such that the Progressive Bundle Unit (PBU) system was being used in parallel. A number of companies claimed to have achieved up to 50% improvement in productivity following the implementation of the UPS system as a replacement to the PBU system. The remaining companies had either the PBU system (47%) or a manual overhead rail system (35%) for material handling. The assembly (sewing) and finishing (trimming, pressing, packing) operations on the other hand were mainly manual through the use of general-purpose machinery requiring skilful operators. A few companies (25%) however had partial investments on programmable sewing systems.

In spite of all the companies laying heavy emphasis on employee productivity for maintaining the cost competitiveness of the products, only 47% of the companies had an automated data collection system (use of bar codes or real time data collection available with automated systems, e.g. ETON system) for monitoring employee performance. The remaining companies (53%) resorted to job tickets for the compilation of the relevant data, which was both tedious and time consuming. These were used for compiling employee wages and production related bonus and for taking decisions with regards to redeployment of employees in the event of poor performance. It was observed that only 36% of companies were generating productivity reports (employee, line, factory) on a regular basis for analysis and decision making purposes.

❑ Planning and Control

Moreover, limited applications of information technology were seen for production planning and control activities. About 56% of companies were in fact using manual systems for planning and scheduling activities and for inventory control and management. These included some of the larger companies having in place the low cost manufacturing strategy. The remaining companies either had a PC based materials requirement planning (MRP) system (13%) or a network-based MRP system as part of the management information system (31%). In both cases, data was shared with the purchasing department for inventory control and management.

With regards to implementation of EDI, it was observed that a reasonable number of companies (35%) had such a system in place. However, the transactions through EDI were mainly effected with suppliers rather than customers (12%). The remaining companies were using traditional methods (telephone, fax) for communicating with suppliers and customers across the supply chain. Only one company was found to have acquired an Enterprise Resource Planning (ERP) system, which was networked between the sales/merchandising, planning and purchasing departments.

There was heavy emphasis placed by all the companies on 100% inspection of the products on the production line and at the finishing stage prior to packing and delivery. A few companies (29%) were using a computerised system for storing quality related data and for monitoring quality standards by conducting quality audits. Only one company, with HVA strategy, was found to be following the procedures as per International Standards Organisation 9002 (ISO) certification. Production time standards for the assembly operations were most of the time set up either using method and time studies or data from past experience. A few companies (12%) were found to be using General Sewing Data (GSD) software for the purpose.

❑ Information & Communication Systems

The computerisation of administrative systems was found to be more evident in the companies (94%) with the use of office automation packages for applications like personnel records, wages computations, generation of payroll, financial accounting, order records and processing, sales and customer databases, supplier databases, procurement and inventory records and operator performance records. Note that all the information pertaining to the day-to-day running of the factories were input into the computer systems in the administrative office even if the activities involved manual operations. For instance, all job tickets were collected from the shop floor and returned to the administrative office for further processing using the appropriate application software.

The internal information system was centralised at the administrative office in most of the companies such that up to date records were available to management at any one point in time with regards to most of the activities in the company, for analysis and decision making purposes. None of the companies were involved in a shared information system (Wide Area Network) with customers for tracking real time point of sale (PoS) data. Wherever available EDI was being used for sharing design and costing information and for confirming transactions online with the customers. The companies involved in QR strategies only had access to sales rate data after specific periods of time (usually quarterly) supporting replenishment orders, rather than access to real time point of sale data.

7.3 Human Resources

Garment manufacturing is a labour intensive sector with low levels of automation by the very nature of the fabrics and sewing tasks, for the assembly processes. The sector relies on the skills of its operators, especially machinists, to maintain the quality of the garment manufactured. It was observed that the majority of the companies (93%) had a hierarchical structure with up to five levels (Directors, managers, supervisors, foremen and operators) requiring rigorous monitoring of the performance of its employees to achieve cost competitiveness. The wage system in most of the companies (77%) was based on the piece rate system together with allowances in terms of production bonus for above average performance (82%), which constantly maintain pressure on the employees for an increased volume of work. Commonly, an attendance bonus was provided for employees (94%) in order to fight against absenteeism, which on average was above 5% daily (65%). Other motivation programmes to employees included on the job training, organised indoor/outdoor activities and award competitions (41%).

In spite of these efforts by employers in the sector, the labour turnover rate is relatively high as compared to other manufacturing sectors in Mauritius. Most employees view this sector as non-secure and unstable. On average the annual direct and indirect labour turnover is more than 5% in 75% of the companies. The figure is however less than 5% in the larger companies where the employees felt more secure in their jobs. In order to cope with the increasing local labour cost (25%), unavailability of skilled labour locally (38%), unwillingness of people to join the sector, and lower productivity of local labour (50%), many of the companies (81%)

have resorted to importing foreign labour mainly from mainland China and India. In about two thirds of the companies, foreign labour accounted for more than 20% of the labour force.

7.4 Work Systems

The work systems in the majority of the companies were set up for mass production (94%) with long lead times and little variation in the type of product. There was little difference between the layouts of the factories in spite of differences in the claimed manufacturing strategies. The majority of the companies had a combination of process and line layout, which is typical of garment making companies. The various departments were arranged for smooth flow of work in progress from the store through the cutting, sorting, assembly, finishing, and packing sections. The assembly operation typically follows a line layout with workstations arranged in the same order as the operations, which are to be carried out on the semi-finished garment. The use of PBU (47%) whereby the cut pieces are sorted out in bundles and loaded into the assembly line involves large amounts of work in progress as buffers between the sections and workstations. Manual (35%) or computerised (29%) overhead material handling systems on the other hand involves loading the cut pieces on hangers (accessories and cut pieces for one garment on one hanger) and involves much less work in progress on the shop floor. Line balancing, in most cases (88%) was conducted manually by the planning department.

Though some of the large companies (18%) had implemented strategies for backward integration (setting up of spinning or weaving mills for manufacture of fabric), there was little indication of strategies for forward integration (database marketing, distribution, direct contact with retailers). Also, the use of design packages and EDI for shared data (design, point of sale data) between the companies and customers were limited with only two companies having such a system in place.

The various constituents of lead times and the minimum time scale involved for the majority of companies are shown in table 7.1. For a typical order of three weeks throughput time (manufacturing time), the minimum order to delivery lead-time was 9 weeks; three weeks for acquiring the fabric and accessories and three weeks for delivery by sea freight. The marketing activity on the other hand, which equally included activities associated with the design of the garment, took more than four weeks before an order was secured, for the majority of the companies (69%).

Activity	Lead time (minimum number of weeks)	% of companies
Marketing of garments (including design/merchandising)	Up to 4 4 to 12	31 56
Agreement on fabric design with customer	Less than 1 1 to 2	6 44
Sampling (preparing samples, quotations, agreement on specifications and delivery dates)	Less than 1 1 to 2	56 6
Purchasing of fabrics and trims following confirmed order	3 3 to 6	50 31
Manufacturing (Throughput time)	Less than 4 4 to 12	19 56
Delivery	Less than 1 3 or more	6 94

Table 7.1 Lead times associated with main activities in the garment sector

7.5 External and Internal Environment Analysis

The garment sector in Mauritius was established in the mid 1970s to solve the massive unemployment problem the country was facing at the time. However, it was only in the early 1980s, after the government offered a myriad of incentives to foreign investors (EPZ Act, 1976) that the activities in the sector were boosted significantly. Most of the investors came from Hong Kong, Taiwan and Europe to take advantage of the pool of cheap labour available for the labour intensive operations associated with garment assembly. The country provided the required infrastructure to create a conducive environment for conducting business. Exports from the garment sector increased from $305 million in 1991 to $850 million in 2001 and the sector is now one of the main pillars of the economy. However, in spite of a massive increase in exports over the last ten years from the sector, attributed to favourable market conditions, there has been little change in the manufacturing strategy adopted by most of these companies since their establishment in the mid 1980s.

In the meantime, there have been drastic changes in the external environment, which imposes a series of challenges to the companies. The Socio-cultural, Technical, Economical and Political (STEP) factor analysis and the Porter Five Forces Model (Porter, 1980) were used to analyse the changing nature of the external environment. The analysis is based on information collected during the literature review, the survey of companies and the numerous discussions the author has had with experts in the sector. A summary of the information is presented here.

In the light of the findings, A SWOT analysis, based on the survey results through the use of the audit tool, was conducted to verify the extent to which the companies were equipped to meet the requirements of the changing environment. These are discussed in the following sections before an attempt is made to explore the avenues for improvement.

7.5.1 STEP Factor Analysis

The STEP factor analysis allows a clear view of the macro factors that influence the business. These include the socio-cultural, technical, economic and political factors. It is vital that companies revisit their operations on a regular basis in the light of the changes in these factors in order to create competitive advantages for the garments that are manufactured. The relevant factors for a garment making business are shown in figure 7.1.

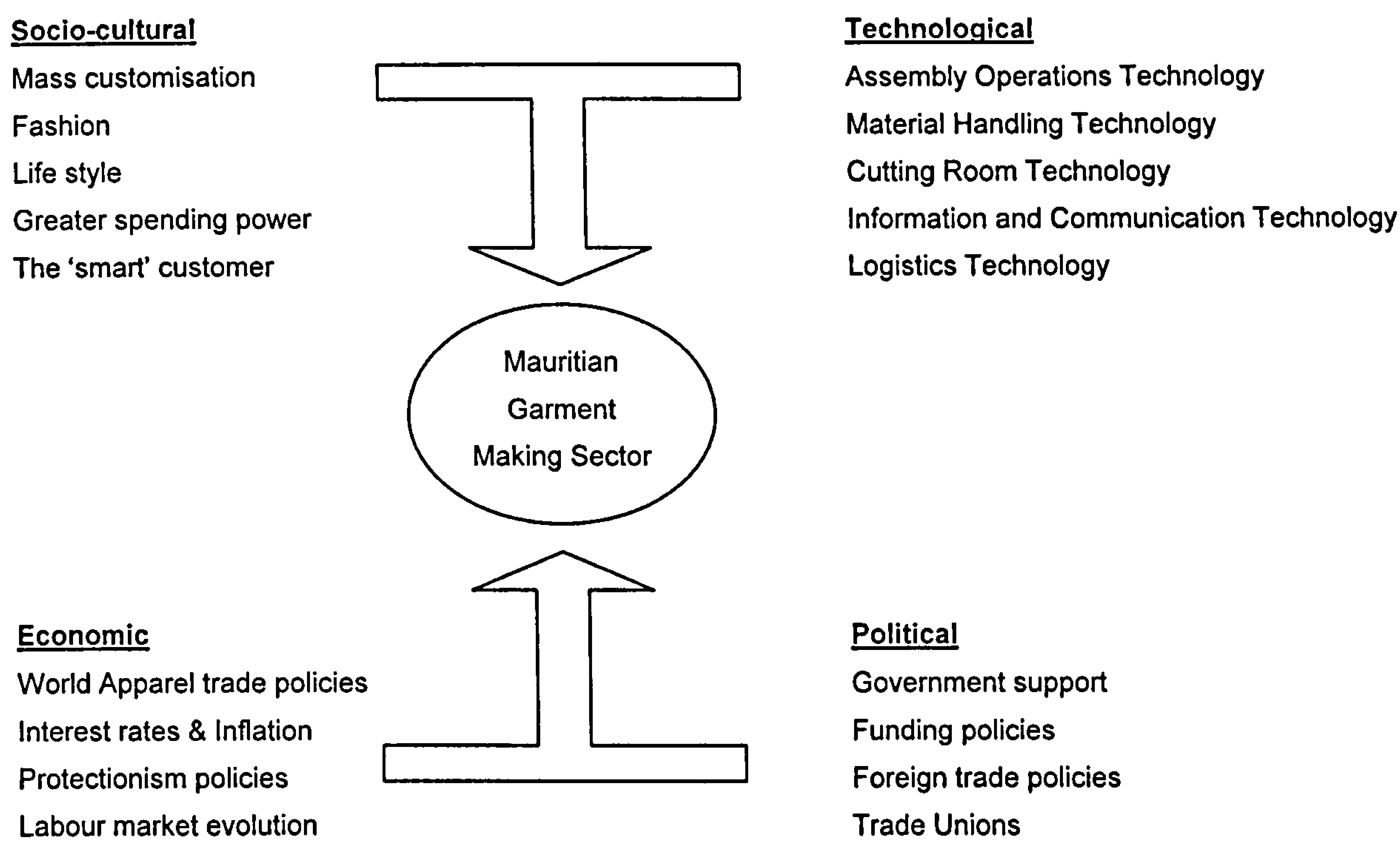

Figure 7.1 STEP factor influences on the garment-making sector

❑ Socio-cultural factors

Most of the company executives agreed that demand patterns from the customers were constantly changing because of changes in the buying habits of the end users. These include greater emphasis on quality, customised garments, fashion and styling and uniqueness of design, which were in contrast to the recent past when the emphasis was mostly on the cost of the garments. The end users (Europe and the US) equally have greater spending power and are more conscious in terms of the fabric and garment style. This places considerable pressure on the retailers for achievement of enhanced customer satisfaction. In return, the retailers (including wholesalers and sales agents) expect the garment manufacturers to provide for more choice in terms of fabric and garment design without sacrificing the quality aspect and ensure faster response to demand changes from the market. Retailers were actually more interested in suppliers that could deliver a confirmed order within the same season (order to delivery lead time of 8 weeks or less) with possibilities for replenishment of orders to limit mark down sales and avoid excessive inventory at the retailer end.

It should be noted that very few of the Mauritian garment making companies were extensively involved in market research to identify the trends in demand from end users of the products. Most companies relied on the information provided by the customers (wholesalers, sales agents and retailers) with regards to changing requirements of the market place. The other source of information for gauging the changing needs of the end users was through trade magazines and participation in international trade fairs and exhibitions.

❑ Technological Factors

The garment making industry has experienced considerable changes in manufacturing technology worldwide. These changes are mainly in terms of the use of computer aided design (CAD) packages for fabric and garment design, grading and marker making and lay planning. Automated handling systems are used for lay tables and computer aided manufacturing (CAM) systems are used in conjunction with CAD for lay cutting. Use of these technologies enables greater fabric utilisation and speed of operation, flexibility in terms of production runs and style changes, and enhanced quality. Moreover, unit production systems (UPS) have been developed for automated material handling between workstations in the assembly line with possibilities for real time data collection and monitoring of production and employee performance through computerised control systems. Programmable sewing systems and a range of sewing control devices are equally available for achieving enhanced productivity.

Perhaps the most innovative technology in the garment making industry has been the use of information systems technology and electronic data interchange (EDI) systems for achieving greater coordination between all players in the apparel supply chain with a view to achieve quick response vis-à-vis changes in market demand. Information systems allow sharing of CAD data with customers such that fabric and garment designs are worked in close collaboration with the customers. The sharing of electronic point of sale (EPoS) data from retailers enables immediate reaction in the supply channel to demand and decisions made thereupon thus reducing considerably forecasting errors and associated inventories. EDI on the other hand enables electronic transmission of transactional information such as forecasts of requirements, purchase orders, shipping notices and information accompanying the actual goods in the form of barcodes that help to tract the movement of the garment from the manufacturer up to the end user.

The adoption of these state of the art technologies in the apparel sector largely varied between the companies. There was a reasonable level of automation in specific parts of the garment making process. However, this led to 'islands of automation' without an integrated approach to automation for design, cutting and material handling. With regards to information and communication technology for sharing real time sales data (EPoS data) with customers, none of the companies had such a system in place and this is a major constraint for the adoption of the QR strategy.

❑ Economical Factors

So far the economic factors have been conducive for the growth of apparel manufacture in Mauritius. The country has a modern infrastructure in terms of road, airport, seaport, telecommunications and energy generation networks. In spite of the fact that the wage level has increased considerably over the last five years, the country is still considered as a low labour cost country (World Bank, 2001). The average monthly salary for a machine operator is £100. The annual inflation rates have been less than 8% over the last five years. The country enjoys quota and duty free access to both the EU and the US markets. There are a range of financial institutions (private banks, Development Bank of Mauritius, Small and Medium Industries Development Organisation, Technology Diffusion Scheme, Joint Venture Capital) that have schemes to support investments in the sector at preferential rates.

What garment making companies do not appear to realise is the impact of the imminent changes likely to accompany the phasing out of the MFA. On the other hand, the garment sector has a poor image and is viewed by most people as being insecure in terms of employment. The labour turnover rate is high and most companies find it difficult to recruit skilled labour. A large number of companies already have had resort to foreign labour because of the lack of interest of local labour to join the sector.

❑ Political Factors

The government provides all necessary support to the sector, which is one of the pillars of the economy with a direct labour force of about 80000 people and foreign exchange earnings representing 60% of the total export earnings of the country (CSO, 2001). The sector benefits from the support of various organisations like the Export Processing Zone Development Authority (EPZDA) for technology transfer, Mauritius Exports Development Authority (MEDA) for identifying new markets, and the Industrial Vocational and Training Board and Clothing Services Centre (CSC) for provision of training. There is no legislation in terms of minimum wage and there are a wide range of incentives provided to foreign investors in the sector including tax holidays on first five years of business, waving of levy and duty on imported equipment and raw materials. Moreover, the government actively participates in trade forums with the EU, the US and the WTO in order to safeguard the interests of the country for preferential access to the markets. The companies seem to have taken full advantage of the provisions from the government with the exception of training, which, because it requires release of employees is preferred to be conducted in-house.

7.5.2 Porter Five Forces Model

While the STEP factor analysis provides a macro view of the external environment with the challenges it poses and opportunities it offers to the garment-making sector, the Five Forces Model proposed by Porter (1980) is useful to make an assessment of the competitive factors pertaining to the immediate environment in which the sector operates. The list of competitive factors, which has a major influence on the activities of the garment-making sector in Mauritius, is illustrated in figure 7.2.

The relative strength of the forces determines the profitability of the sector. If all the forces are strong, profitability in the business is expected to be on the low side. On the other hand if the forces become weaker, companies in the sector can claim higher prices for the products and have improved profitability. Porter argues that the companies must attempt to influence the forces through distinct strategies in order to decrease the strength of the forces and hence create competitive advantages for the products that are manufactured.

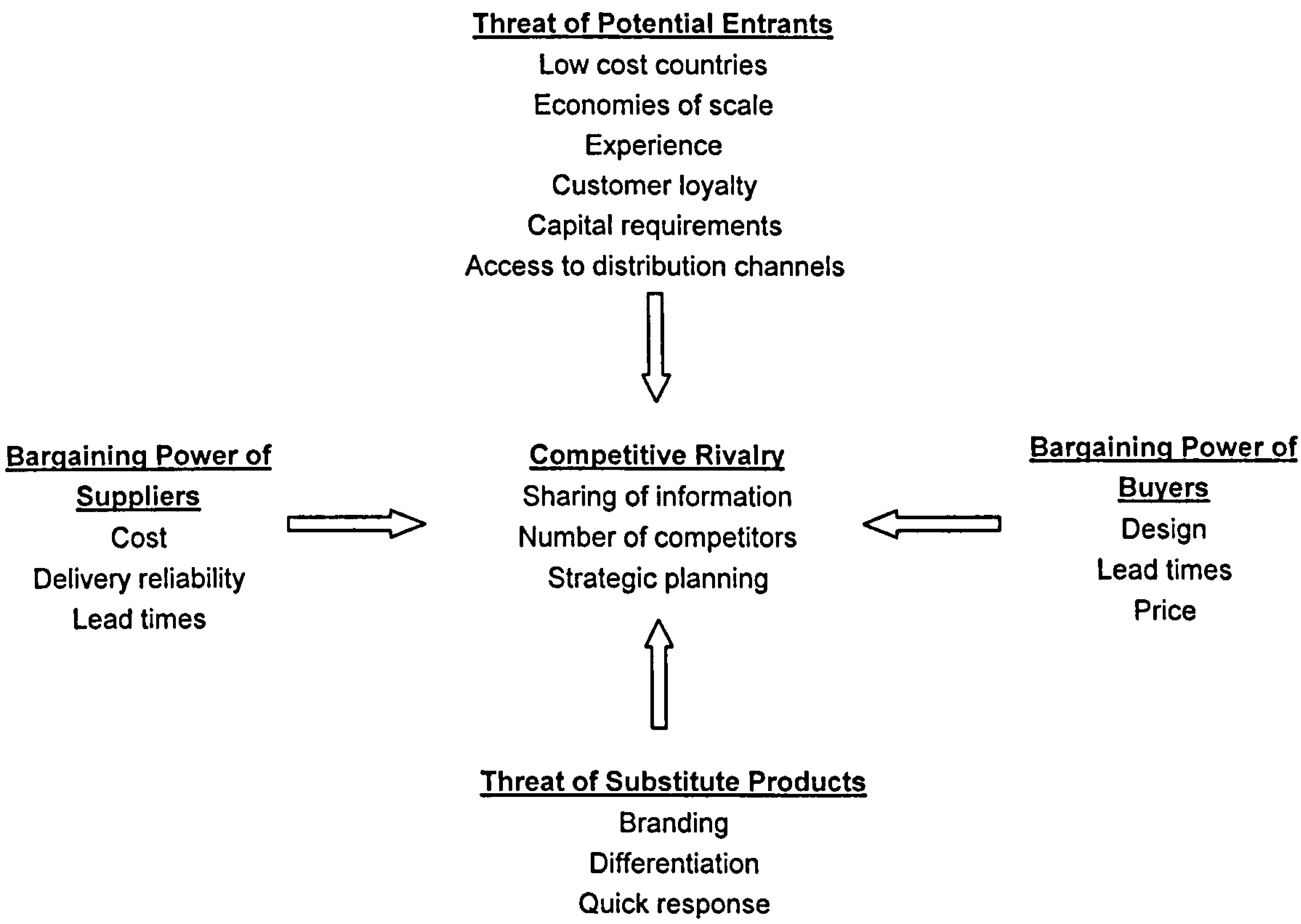

Figure 7.2 Competitive factors within the immediate environment

❑ Threats of Potential Entrants

The threat of potential entrants into the sector is relatively low from local manufacturers as the companies are already having major difficulties in recruiting skilled labour locally. However, given the labour intensive nature of the operations in garment manufacturing, the limited investment required for setting up a factory and size not being a prerequisite for economic manufacture, the threat is quite intensive from overseas manufacturers in low labour cost countries like Madagascar, Mozambique, India, China, Bangladesh, Pakistan, Indonesia, the Philippines and Vietnam among others. The companies in all these lower labour cost countries serve the same markets (the EU and the US) as Mauritius and hence the competition for a share of the market is severe. The only advantage Mauritius has had so far is duty free and quota free access to the markets which is scheduled to lapse in 2005 after the phasing out of the MFA.

Other conditions that further increase the threats from potential entrants especially from the low labour cost countries into the market, include:

1. There is no need for prior experience in the sector to set up a business. Such experience can be attained through the employment of skilled labour or through training. Also, the operations being labour intensive, setting up of the business requires relatively little investment in capital equipment. With the provisions of AGOA, the threats from potential entrants from the African region where labour is cheaper and widely available, is expected to increase considerably.
2. Customers can switch from one supplier to another at little or no cost especially in the absence of partnership relationships between them. The waving of quota restrictions on suppliers from the Asian continent will provide more sourcing opportunities for customers, which is considered as a major threat to the local manufacturing companies.
3. Companies providing the right product at the right price with the right response can easily build market share. The use of information and communication technology is vital for achieving such advantage. Though the local garment sector is known for producing the right product at the right price, it is largely disadvantaged in terms of supplying the market with the right response because of long lead times in acquiring fabrics and trims (imported) and delivery by sea which takes a minimum of three weeks to the major destinations in Europe.
4. There is wide scope for companies providing differentiated products in terms of fabric and garment design in order to satisfy the requirement of QR and HVA strategies. Again, the local sector does not seem to have invested in the required technological capability for undertaking fabric and design activities.

❑ Threats of substitute products

The threat of substitute products is intense as most of the companies are involved in the manufacture of basic garments (T-shirts, shirts, trousers, nightwear, kids wear, jogging suits etc...), which can be produced by any other company especially in the lower labour cost countries with a possible cost advantage. Unless companies in the sector provide branded, differentiated products or services for instance to achieve better response to demand changes, the future will be more difficult as the quantitative restrictions for market access are eliminated.

❑ Bargaining power of buyers

The customers for the products manufactured mainly include wholesalers, sales agents and to a lesser extent retailers. About 70% of the products are exported to countries in the EU and the remaining 30% to the US. Overall the power of the buyers is strong as they can source their requirements from a range of countries, as the garments made locally are relatively standardised items. The possibilities for sourcing from other countries will be further enhanced, at the same time increasing the bargaining power of the buyers, as quota restrictions are removed for all member countries of the WTO by the year 2005. In general the Mauritian apparel sector is vulnerable through its lack of direct links to end customers and to retailers.

❑ Bargaining power of suppliers

Suppliers to the sector include those providing raw material, fabrics and trims, energy, tools and equipment etc… The bargaining power of the suppliers are fairly high but not on the same scale as buyers. A relatively large number of companies in fact compare quotations from both local and overseas suppliers before selecting the most competitive supplier in terms of cost, quality and delivery reliability. With regards to fabrics, given that there are only a limited number of local weaving and knitting companies, the bargaining power is relatively high from these suppliers especially for quick orders.

❑ Competitive Rivalry within the Industry

There is limited competition between the companies within the sector as they aim at different customers and channels of distribution. Most of the companies have been serving the same customers for more than two years and hence have developed a good working relationship with them. The rivalry is however fairly intense in terms of recruitment of local skilled labour. This mainly explains the reason for the relatively high annual labour turnover ratio in the sector whereby skilled labour move from one company to another in the search of a better pay packet and working conditions.

7.5.3 SWOT analysis

The STEP factor analysis shows that the garment sector currently enjoys favourable economic and political conditions for conducting business. The main shortcomings are in terms of the technological capability and the ability of the companies for conducting market research and achieving better response to changing market conditions. This is confirmed in the five forces model whereby two of the forces namely, bargaining power of buyers and threat of substitute products are relatively strong as the sector does not have any special attribute that demarcates it from other suppliers around the world. Strong forces have a negative influence on the competitiveness of the manufacturing companies and unless appropriate actions are taken to decrease the effect of the forces, companies can run out of business.

By way of summary, figure 7.3 illustrates the strengths, weaknesses, opportunities and threats (SWOT) for the sector based upon the results of the survey, the STEP factor analysis and the Porter Five Forces Model.

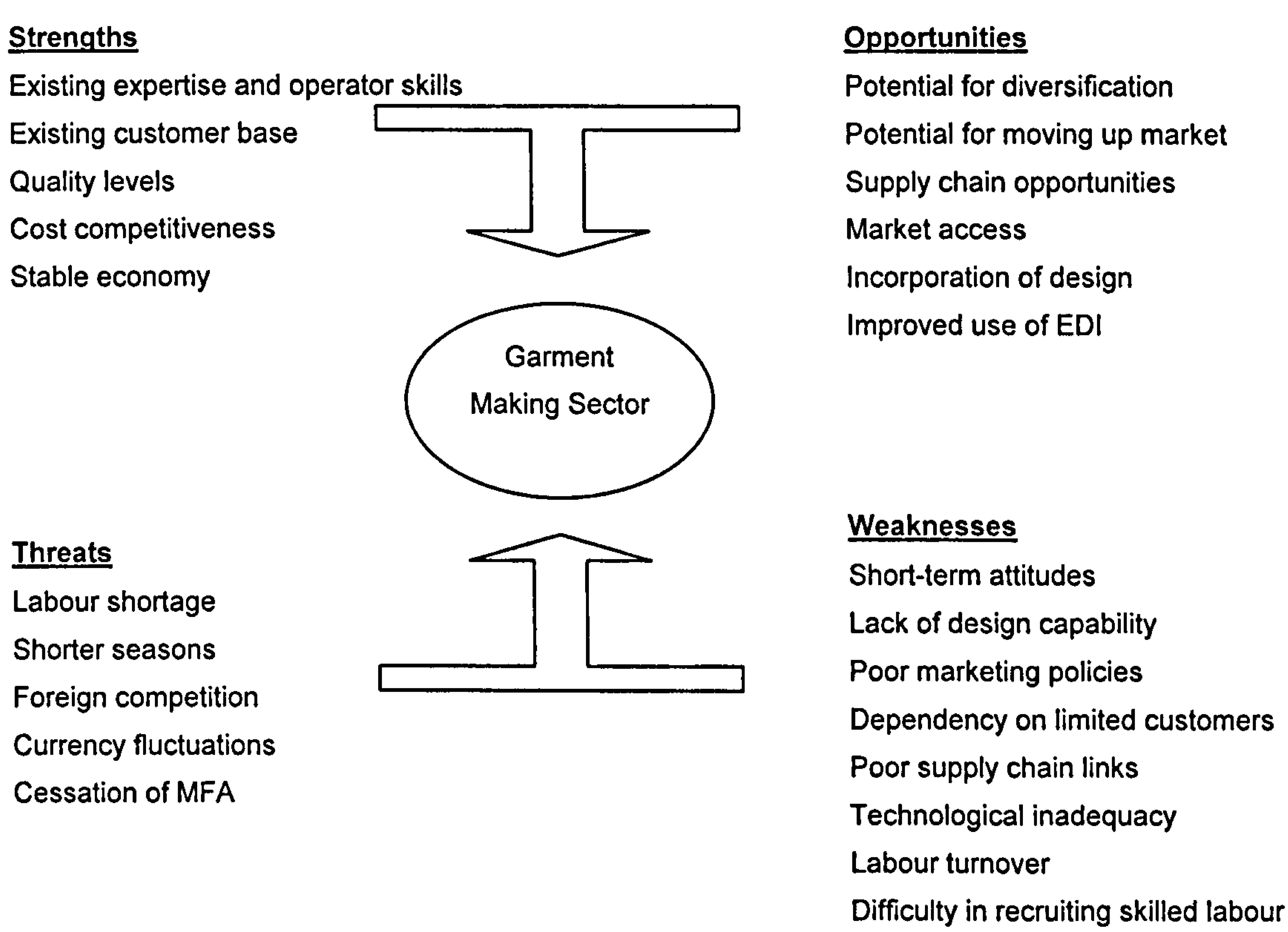

Figure 7.3 SWOT analysis for Mauritian garment making sector

❑ Strengths and Opportunities

The Mauritian garment-making sector has the reputation as a reliable supplier of quality products to customers in countries of the EU and the US (Tait, 2002). It has a strong customer base and most of the companies have developed a good working relationship with their customers, having served them for at least two years in most cases. The success of the sector is mainly attributed to its capability to maintain the cost competitiveness of the products without neglecting the quality aspect. The companies within the sector have the experience, expertise and skilful labour to fully meet the requirements of the changing markets in terms of quick response or manufacturing of high value added products. These strategies have so far not been exploited mainly because of the wide availability of production orders from existing customers and the current capacity of companies is taken up satisfying current orders (crisis management). The present resources in fact can provide the foundation for embarking upon the QR and HVA strategies thus avoiding head on competition with manufacturers from the low cost countries. The companies claiming to have in place QR and HVA strategies started their operations as low cost manufacturers and invested on the appropriate technologies and systems for achieving quick response and moving up market.

Moreover, the sector has the potential for diversification through vertical integration especially upstream that is, on the supplier side. A number of the larger companies were seen to have already invested on knitting or weaving facilities to cut down the lead-time and the costs associated with the importation of fabrics from overseas. This equally provides the companies with enhanced scope for the design of fabrics and garments and helps to create a corporate identity, which is at present largely missing in the sector.

Opportunities equally exist for the companies to invest upon and make effective use of information and communication technologies (ICT) to form partnership relationships with the suppliers and customers by sharing data across the supply chain. Such relationships through ICT create differentiation in terms of services, which is vital for achieving enhanced customer satisfaction and largely help to reduce the time taken for making decisions.

❑ Weaknesses and Threats

The wide availability of production orders from wholesalers and sales agents has prompted most of the companies to limit investments on marketing and product design. The industry mainly operates as a CMT centre for the customers who provide the design to be manufactured. An abrupt change in the purchasing policy of the customers however, is usually fatal to the company. Over the past two years, the industry has seen 25 medium to large size companies closing down with 15580 people losing their jobs (CSO, 2002). On average there are two companies closing down every quarter. This is mainly attributed to the dependency of the companies on a limited number of customers. Moreover, as the sector is involved in the manufacture of basic garments, competition from other low cost countries is fierce.

The major weakness of the sector seemed to be the lack of long-term commitment from the manufacturers. There is constant fear for losing orders, which was the main reason put forward by the companies for limited investment in automation systems like the ETON which requires heavy investment (about £5000 per workstation). As most of the companies were involved in mass production with long lead times, there was little interest for technologies like EDI and information systems for sharing data with customers. Actually, the companies tend to react to the pressures from the customers in terms of investment in information and communication systems and so far EDI has not been a prerequisite for smoothly conducting the transactions. The EDI system in one of the companies was acquired at the request of the customer.

Even in terms of quality systems, the companies were satisfied with the 100% inspection system as it enabled achievement of customer requirements in terms of specifications and standards. The implementation of systems like Total Quality Management or ISO certification was not viewed as a priority.

The limited availability of skilled labour locally, relatively high labour turnover ratio, difficulties in competing with other low cost suppliers, regular fluctuations in the

Mauritian Rupee* have reinforced the short-term attitude adopted by the manufacturers which is the major threat to a large number of the companies.

7.5.4 Findings and Recommendations

The analysis of the sector is based on information collected from the seventeen companies that constituted the sample for the research. A comparison chart for the companies with regards to implementation of state of the art practices available within the industry (characteristics of best practice companies) is shown in table 7.2.

In spite of the limitations of the individual companies, it was found that with the exception of use of electronic point of sale data (EPoS), which was not used by any of the companies, the other characteristics were shared by different companies within the sector. This constitutes a major asset for the sector, which if shared between the companies, can serve to bring in major improvements in companies which do not have some of the best practice systems in place. For instance, two companies had EDI systems for conducting transactions with the customers (surprisingly, one of them was a low cost strategy company). These companies can share their experience on the use and advantages of using EDI with the other companies.

Moreover, a few of the low cost strategy companies had developed their own brands and one of them was serving the designer wear segment of the market. This demonstrates the potential of some of the companies for moving up market. However design of fabrics and garments remained one of the main shortcomings of the sector.

* Imports are paid in US Dollars and export earnings are mainly in EURO. Appreciation in value of the US Dollar and depreciation of the EURO vis-à-vis the Mauritian Rupee is quite common and leads to losses in earnings.

Characteristic	Company																
	HVA			Low Cost											QR		
	1	2*	3	4	5*	6	7	8	9	10	11	12	13	14	15*	16	17
Market research	✔			✔												✔	
Selling to retailers	✔										✔						
EDI with customers				✔											✔		
EPoS data access																	
Own label (brand)				✔			✔	✔		✔							
Designer wear market		✔	✔	✔											✔	✔	✔
Fabric design (CAD)		✔					✔									✔	
Garment design (CAD)		✔					✔									✔	
Local Area Network		✔		✔			✔									✔	
EDI with suppliers		✔		✔			✔								✔	✔	✔
Single sourcing	✔	✔			✔		✔										
MRP System (IT)	✔	✔	✔	✔		✔	✔								✔	✔	
Vertical integration	✔	✔								✔							
TQM/ISO procedures			✔	✔		✔									✔	✔	✔
Use of GSD	✔	✔	✔			✔											
Real time Performance monitoring		✔	✔	✔	✔	✔	✔	✔							✔	✔	
Cellular manufacturing										✔							
Training	✔	✔	✔												✔	✔	
Automated material handling		✔		✔				✔								✔	
Automated cutting (CAD/CAM)	✔	✔	✔			✔											
Delivery by air															✔		

Table 7.2 Similarities and differences between companies

* Case study companies

There are numerous possibilities for the companies to implement systems with relatively little investment yet a high associated outcome in terms of productivity and customer satisfaction. Such systems, which were already being used by some of the companies, include:

- CAD for fabric and garment design in order to explore possibilities for the companies to create their own in-house design and hence create an identity for their products.
- Automated lay planning and cutting for improving the output, quality and accuracy of the cutting operations.
- Use of GSD for setting time and methods standards to reinforce the current practice and compare it with standard data from the industry.
- Implementation of a bar code system for real time data collection from the shop floor. Such systems are useful for closely monitoring the productivity of the production line and that of the factory and for earmarking capacity management problems.
- Use of MRP system for inventory control and supplier management.
- Implementation of a total quality management system for proper recording and monitoring of quality control data and cutting down on the non-value added extensive inspection activities.

Companies willing to embark on the QR strategy necessarily need to have a partnership relationship with their suppliers and customers for fast decision making across the supply chain to achieve the reduced lead-time required. The use of technologies such as EDI largely helps in the process. EDI equally enables the manufacturing companies to have access to point of sale data in real time in order to monitor the performance of the products on the market and work out strategies together with the customer for replenishment or for changes to be effected in design. The longer delivery lead-time by sea freight can be overcome by airfreight at an additional cost of about 10%. The QR case study company met this additional cost by sharing the cost with the customer and by exporting about half of the order by sea and the remainder as replenishment by air. QR strategy equally requires that the companies manufacture differentiated products for which the additional price is justified.

The implementation of any new system requires trained personnel for its effective utilisation. The importance of training for all the above systems cannot be overemphasised. It is vital that the companies seeking to embark upon alternative strategies by investing upon the required system or technology and make provision for appropriate training for their personnel. So far very few of the companies were seen to take advantage of the training programmes offered by the various institutions supporting the garment-making sector in Mauritius.

❑ Recommendations

The following are proposals for the garment sector in the light of the findings of the research:

1. There is a need to create awareness within the companies with regards to the implications of apparel trade liberalisation and the challenges the companies will face while competing with other low cost countries like China, India, Indonesia, Philippines, Sri Lanka, and Bangladesh, among others.
2. The supporting institutions like the EPZDA, the CSC, the IVTB, the Mauritius Employers Federation and the University of Mauritius should meet together to design and run short training programmes to develop expertise in design and marketing which are the main shortcomings of the sector.
3. The companies are recommended to review their marketing strategies in order to explore opportunities other than those offered by the usual customers. A coordinated marketing initiative from the government and the Mauritius Employers Federations might be useful.
4. The companies must be encouraged to share their expertise in terms of implementation of systems such as on line data recording using bar codes, MRP, TQM and EDI systems. Companies involved in the marketing of such packages could act as facilitators for the purpose and the CSC to act as the coordinator for organising demonstration and working sessions.
5. The EPZDA should conduct a training needs assessment for the sector and develop training programmes in the light of the findings for the sector. Such programmes can be offered by the CSC and the IVTB to overcome the shortage in skilled labour.

6. Companies to investigate the possibility of replacing the current wage payment system, which is based on piecework rate. Lowson (1998) argues that such a system acts as a barrier to cultural improvement, restricts quality levels, hinders flexibility and, in many ways prevents the setting up of working teams.
7. Companies in the sector to conduct feasibility analysis with regards to investments to be made in various areas such as design, cutting, material handling, information and communication systems, quality management among others.
8. The EPZDA to create a network of companies for the sharing of available expertise through the organisation of site visits, demonstration sessions and seminars.

7.6 Use of the Audit Tool within the Garment Sector

The audit tool was initially designed to enable manufacturing companies make a self assessment of their current manufacturing strategy and benchmark it against better practice from within the industry. It was successfully used for the purpose in the case study companies. Moreover, following the survey of the sample of companies, all the data input into the software was stored in the database, which was used to generate statistical reports associated with each of the functional areas for the sector. The analysis for the sector was undertaken based on these reports.

The advantages of the audit tool include:

1. It keeps a record of all the companies in which an audit has been carried out. The results of the audit are available in terms of audit reports, which can be used for benchmarking current practice with better practice from within the industry. The better practices are representative of the practices in an ideal company and can be accessed separately for reference purposes. For instance, currently the ideal company has all the characteristics listed in table 7.2 among others. The better practices can be updated by the user whenever applicable, as and when better systems than those covered in this thesis are available. The benchmarking is always carried out in relation with the updated ideal company.
2. The auditing exercise, especially while conducted using the case study method, allows company executives to brainstorm on the weaknesses of the company and

explore possibilities for implementing alternative strategies in the various functional areas.

3. Given that the assessment is in terms of the functional areas, change can be implemented more smoothly (for instance, by treating one function at a time) without bringing major disruptions to the current practice thus limiting resistance against change, in the way operations are conducted within the company.
4. The results of each audit are added into the database, which is used for the generation of statistics for the group of companies being considered. The statistical reports include results associated with each of the statements in the audit tool, which can be analysed individually. For the purpose of the current research a sample of seventeen companies have been considered which have generated sensible results. The addition of more companies in the database will provide a better picture of the sector.
5. Once a manufacturing practice has been reviewed or changed, this can be easily updated in the database by filling in the relevant audit forms. The database management system however also stores the results of previous audits conducted for reference purposes (historic of the company since initial audit is stored)
6. The tool incorporates the IDEF0 system model for a typical garment making company such that details associated to activities within each of the functional areas and their interactions can be viewed for reference purposes.
7. The audit tool is comprehensive, user friendly and contains all possibilities in terms of manufacturing practice in the garment-making sector around the world and hence can be used by any garment making company or sector world wide for manufacturing strategy auditing.

The sole limitation of the tool is that is requires experts from the sector, for the interpretation and analysis of the results that are generated and for making appropriate decisions in the light of the analysis. The development of an artificial intelligence system for the purpose constitutes one of the recommendations for further work.

Chapter 8
Conclusion

8.1 Introduction

The current research was undertaken in an attempt to contribute to the existing knowledge available on the process of manufacturing strategy development. During the literature review it was observed that though the importance of the manufacturing function for achieving enhanced product competitiveness was widely documented, there was limited documentation available which illustrates a practical approach for the formulation of manufacturing strategy. The development of a simple methodology for manufacturing strategy assessment and analysis for the purpose of deciding upon appropriate alternative strategies was vital especially for garment making companies in Mauritius, which were facing fierce competition for a share of the market from other low labour cost countries. This defined the scope of the current research, which was conducted in close collaboration with seventeen garment making companies.

The project enabled the development of a manufacturing system reference model integrated with a manufacturing strategy audit tool in the form of a software tool designed specifically for apparel making companies. The use of the tool in three case study companies enabled them to brainstorm on the weakness of their current manufacturing practice and embark on a programme for change with a view to building increased competitive advantage for their products.

This chapter presents the achievements vis-à-vis the objectives that were set at the start of the project. The contribution of the research to current knowledge in the area associated to the process of manufacturing strategy is then discussed. Two future research projects are also proposed at the end.

8.2 Research Discussions

The research work started with an intensive literature review of the changing environment in which apparel-making companies will be operating following the complete elimination of quotas and reductions in tariffs in the wake of international apparel trade liberalisation. From the literature review it was observed that manufacturing companies that so far have had preferential access to the markets in terms of liberal quota and duty remissions would henceforth face numerous challenges from suppliers in lower labour cost countries, to maintain their share of the market. This could result in a severe blow to the economies of countries with heavy reliance on apparel exports such as Mauritius.

In an attempt to investigate the possible effects of world trade liberalisation on the Mauritian garment-making sector, a preliminary survey was conducted to take note of the current manufacturing practices in the companies. The results showed that in spite of increasing local labour costs and pressures from customers in terms of improved quality and reduced lead-time, the majority of the companies were maintaining strategies of low cost with minimum investment in capital equipment, high volume production with heavy reliance on the customers for product design. Though the companies realised that there was need for a change in manufacturing strategy to be able to compete against suppliers from other low cost countries, the procedure for adopting such change was not evident to the company executives.

An intensive review of the literature on manufacturing strategy was undertaken to identify possibilities in terms of the process of manufacturing strategy, which could be useful for the garment-making companies. It was found that though the importance of the manufacturing function for achieving competitive advantage was widely documented with valid justifications, only a handful of publications were available in terms of the process of developing manufacturing strategy. The most relevant one was that proposed by Platts and Gregory (1990), which illustrated the concept of manufacturing system auditing in the process of strategy formulation. However, the process was found to be a medium to long-term exercise and was too tedious for in-house implementation in the garment making companies. This led to the present research for the design and development of a simple audit tool to enable garment-making companies assess their current strategies, the benchmarking of it against better practices and the selection of appropriate strategies for implementation in the light of the auditing exercise.

A simple audit tool based on the manufacturing strategy framework proposed by Skinner (1969) and the concept of auditing proposed by Platt and Gregory was developed following extensive data collection from a sample of ten garment making companies. The tool developed in the form of a software package, incorporates an apparel manufacturing system reference model which illustrates in detail all the activities that form part of a typical garment making company and a functional auditing programme that enables companies to assess their current strategy, conduct benchmarking against better practices and decide upon alternate feasible strategies for implementation.

The audit tool was validated by its successful use in three case study companies for the purpose of manufacturing strategy auditing. A methodology was developed and followed to ensure that the process is efficient and effective. The results clearly illustrate the strengths and weaknesses of the companies, vis-à-vis the strategy that they claimed to have in place.

Case study #1, an exemplar of companies having a low cost manufacturing strategy, was involved in the manufacture of denim wear and claimed to rely on this strategy for maintaining the competitiveness of its products. The main strength of this company was in terms of the effective use of cheap labour for undertaking CMT operations with minimal investment on marketing, design and automated systems. This however limits the scope of the company for provision of differentiated products or services to its customers. Competition from other low cost suppliers can be a major threat to the existence of this company in the near future, unless alternative strategies are adopted for developing a competitive advantage on factors other than low cost. The current manufacturing practices were compared against industry benchmarks and recommendations were made to allow the company to achieve improved productivity, quality and manufacturing flexibility. These recommendations if implemented will enable the company to embark on the quick response strategy in the longer run. The company has since undertaken a feasibility study to assess the implications of the proposals for change.

Case study #2 on the other hand was involved in the manufacture of T-shirts and claimed be involved in the manufacture of high value added products. Following the audit exercise, it was confirmed that the strategy was more that of low cost, in spite of the fact that the company had the state of the art technology for its design and manufacturing operations. The size of the company does not allow it to embark on high value added strategy, which implies high variety and low volume manufacturing. However, the scope for moving up market (designer wear) and implementing a quick response strategy was promising. In addition to proposals for setting up the required systems to achieve QR, the recommendations equally dealt with issues related to productivity and quality improvement.

Case study #3 was a smaller company in size rightly claiming to have in place the quick response strategy. The company was one of the few companies in Mauritius to use a combination of sea and airfreight for the delivery of its products in order to ensure quick response to customer requirements. However, there were clear shortcomings in terms of functions like design, marketing and manufacturing automation. The recommendations were in line with the quest of the company to improve productivity, manufacturing flexibility and quality standards.

Following the case studies, the survey method was used to make a detailed assessment of the manufacturing strategy of the sample of garment making companies, representative of the population of companies in Mauritius. An analysis of the external environmental conditions in which the companies operate, using STEP factor analysis, SWOT analysis and the Porter Five Forces Model showed that there was an urgent need for the companies to adopt differentiation strategies to develop a competitive advantage to be able to compete against suppliers from other low cost countries. The use of the audit tool showed that a relatively large number of companies had limitations in terms of design, marketing, manufacturing automation, use of information and communication technology and partnership relationships with suppliers and customers among others. The recommendations for the sector were in terms of the setting up of the appropriate infrastructures to further support the garment-making sector in the acquisition of knowledge and technologies to enable the companies develop the much desired competitive advantage.

8.3 Research Objectives and Achievements

The research methodology adopted during the course of the project addressed the aims and objectives that were set out in chapter 1. Each objective is reviewed below to illustrate the achievements with regards to the set objectives.

Objective 1: To make an assessment of the challenges facing apparel industries in developing countries such as Mauritius following the liberalisation of world trade in the year 2005.

A literature review was conducted for the purpose, which showed that suppliers from low cost countries that presently have restricted access to the EU and the US markets are a major threat to those that presently enjoy preferential access to the markets. The complete liberalisation of world apparel trade is expected to create both winners and losers. The clothing economies such as Romania, Mauritius, Turkey, Bangladesh, Tunisia, Morocco and Madagascar with heavy reliance on apparel exports and with little comparative advantage are forecasted to be on the loser's side against the major suppliers which include China, India, Pakistan and Sri Lanka. The challenge to the manufacturing companies in the clothing economies is to adopt appropriate differentiation strategies to provide add on features in terms of products and services that demarcate them from the competitors. The failure to do so can be a severe blow to several of the clothing economies.

Objective 2: To review the status of current technology and manufacturing practices in the apparel industry in Mauritius.

A preliminary survey of garment making companies in Mauritius was conducted. The following is a summary of the findings that clearly illustrate the need for a complete review of strategies for developing comparative advantages vis-à-vis suppliers from other low cost countries.

- Marketing is mainly carried out through personal contacts with wholesalers and sales agents. Only a limited number of companies were involved in selling the garments directly to retailers. The current practice is that of customers getting in touch with the manufacturing companies for production orders rather than the reverse. Also, the companies were seen to have little involvement in marketing research and research related to design of new products. The companies did not view design as a problem as these were most of the time provided by the customers. However, the companies were increasingly facing pressures from the market in terms of frequent changes in design, decreasing order to delivery lead times, improved quality, and reduced price.

- The production cost was considered to be much higher in Mauritius while productivity was much lower vis-à-vis the immediate competitors from the low cost countries (the major supplier countries). However, very few of the companies were investing on systems that can boost productivity. For instance only a handful of companies had integrated computerised systems for functions like marketing and distribution, manufacturing and management information systems.
- The companies still look for large manufacturing orders with long lead times. Little attempt is made to move from the mass production system to smaller batch production with wider variations in product specifications. The quality/cost combination is used as panacea for winning orders. Other strategic issues such as design of new fabrics and garment styles, manufacturing flexibility for quick change in operations, fast and responsive delivery, systems automation for improved productivity and flexibility, use of information and communication technologies for sharing data across and within the supply chain were not considered as priorities.
- The only acute problems identified by the companies were the shortage of skilled labour, its increasing cost, high rates of absenteeism and the increasing cost of raw materials.

From the survey, the short term and 'management by crisis' attitude of the companies was evident. The current practice if maintained will be detrimental to the sector, as the majority of the companies seemed to rely mainly on the cost competitiveness of their garments for market share. This strategy though successful so far, will be not be useful to achieving competitive advantage while competing on level grounds with the suppliers from the low cost countries.

Objective 3: To develop an apparel manufacturing system reference model which can serve as a basis for analysing manufacturing practices in companies.

After reviewing the tools and techniques available for modelling of manufacturing systems, the IDEF0 modelling tool was selected as it was found to be most appropriate for illustrating details with regards to each activity, and interactions between them, that takes place within a typical garment making company. The relevant data to construct the model was collected from a sample of ten companies. A series of databases and documents were developed as a supportive information system within the model to illustrate details about the activities and the associated input, output, controls and mechanisms (ICOMs). The model was validated in the companies and by key experts from within industry and was confirmed to be a comprehensive representation of activities taking place in garment making companies.

Objective 4: To develop a tool for apparel manufacturing strategy assessment and benchmarking.

The activities within IDEF0 manufacturing system model were critically analysed to investigate all possibilities in terms of manufacturing practice in the garment making industry. The relevant data was collected from trade magazines, literature review, and through discussion sessions the author had with experts from the Clothing Services Centre, company executives, and representatives from the key functional areas from the sample of companies. The audit tool was developed as a software tool integrated to the IDEF0 manufacturing system model. It was designed for used in-house by companies for viewing best practices, making audit of current practice, benchmarking current practice with better practices or for making decision with regards to implementation of alternative strategies for achieving enhanced product competitiveness.

Objective 5: To use the tool to make an assessment of the strategy used by garment making companies in Mauritius.

The tool was successfully used in three case study companies with promising results in terms of manufacturing strategy assessment and for deciding on the plan of action for future investments in systems and technologies in order to make effective use of manufacturing capabilities to develop a competitive advantage. The results have been discussed in chapter 6 and is summarised in the previous section. In addition the tool was used through the survey method in a sample of seventeen companies with a view to test its effectiveness for conducting sector wise analysis. The results of the survey, presented in chapter 7, confirmed the findings of the preliminary survey conducted, which was conducted four years ago. This shows that there has not been any change in the strategy of the companies in spite of the pressures from the customers and from suppliers competing for the same market. The future of the sector looks gloomy unless alternate strategies different from that of the immediate competitors are adopted.

Objective 6: To develop and test a novel methodology for manufacturing strategy assessment and selection.

The methodology for manufacturing strategy assessment and selection, through the use of the audit tool was tested in the case study companies and was largely appreciated by the participants. It was equated as being a tool, which provides 'simple answers to difficult questions'. However, the methodology is useless if no action is initiated in the light of the auditing exercise. Fortunately, this was not the case in the case study companies. The presence of the chief executive or his representative during the auditing exercise proved to be vital for ensuring implementation of the plan of action. A follow up of the progress made by the companies is part of the recommendations for future work.

8.4 Research Contributions to Knowledge

The research contributions to knowledge are:

- A practical approach towards manufacturing strategy formulation and analysis has been developed for garment making companies, which largely demystifies the process of manufacturing strategy, to the benefit of these companies. A similar approach can be adopted in other manufacturing sectors for deciding upon alternate strategies for achieving enhanced product competitiveness.
- The manufacturing system model provides a complete picture of all the activities that takes place in a typical garment making company. The model can be used as a reference document for the development of information system architectures.
- A novel manufacturing strategy tool has been developed that can be used by any garment making company world wide, for manufacturing strategy assessment, selection and benchmarking.
- The tool has been validated by its successful application within three case study companies in Mauritius.

- A detailed analysis of the current manufacturing practice in the garment-making sector in Mauritius has been conducted.

8.5 Research Evaluation

The process of manufacturing strategy assessment and selection is mainly based on the use of the audit software, which contains an extensive amount of data compiled from the sample of companies following a critical analysis of the IDEF0 apparel manufacturing system model. Every effort was made to ensure that the data covers the range of possibilities in terms of manufacturing practice in the garment making business.

The following is a critical assessment of the process and the manufacturing strategy audit tool:

1. The IDEF0 approach was adopted as the most appropriate for the present needs, though it is acknowledged other models exist. The model was developed up to the third level of detail and hence only provides a macro view of the typical activities involved in garment making.
2. The scores that are associated to each of the statements in the audit tool are indicative of average and better practices. Despite the fact that these were validated by experts from the apparel sector, the scores remain somewhat subjective and should not be treated as industry average or best practices.
3. The methodology for manufacturing strategy auditing and selection through the case study method was successfully tested in only three companies. Whilst these companies were selected specifically to represent exemplars of the use of different manufacturing strategies, the usefulness of this approach can only be confirmed if it is supported by more case studies. The results of any changes implemented following the auditing exercise also need to be evaluated.

8.6 Further Work

Two future programmes were identified towards the end of this research to further strengthen the findings from the current research.

Research Project #1

The objective of this research is to follow up the actions that were initiated in the case study companies following the initial auditing exercise and to monitor the outcomes following any implementation of change.

Research Project #2

The objective of this programme is to extend the auditing exercise as per the case study method in a greater number of companies. The advantages of this research project are threefold:

1. It will create an awareness within more companies of the possibilities of alternative practices for achieving enhanced competitiveness
2. It will provide an opportunity for decision makers within companies to brainstorm in the presence of the chief executive, on the strengths and weakness of the current manufacturing system.
3. It will allow the creation of a database in terms of manufacturing practice within the sector, an analysis of which can lead policy makers supporting the industry (e.g. the government) to decide on the best course of action for helping the companies within the sector to achieve competitive advantage.

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Appendix A

Apparel Manufacturing Sector Survey Questionnaire

Thank you for sparing some of your time to fill in this confidential questionnaire.

Part A Company Profile

Name of Respondent (Optional) ______________________

Job Title ______________________

Name of Firm ______________________

Address ______________________

____

Tel. No. ______________________

Fax No. ______________________

Email Address ______________________

Year of Establishment ______________________

Kindly tick the appropriate answer or answers to the following questions

Q1 Ownership Structure

1. Mauritian owned
2. Foreign Owned
3. Joint Venture

Q2 Number of Employees

Please specify number (optional) ______________________

1. less than 50
2. 50-250
3. 251-500
4. 501-1000
5. above 1000, please specify approximate number ____________

Q3 Approximate Annual Turnover

Please specify average annual turnover (Optional) ____________

1. less than Rs 5M
2. Rs 5M - Rs 50M
3. Rs 50M - Rs 500M
4. over Rs500M, please specify approximate value ____________

Q4 Year of establishment ______________________

Q5 Production facilities location

1. Single site
2. Multiple sites, please specify number of sites

____

PART B Market Profile and Marketing Strategy

Q6 Which market segment does your company service?

1. Local market 2. Export market 3. Subcontracting from local firms
4. Subcontracting from foreign firms
5. Other, please specify ______________________________

Q7 If you are involved in exports, which country or countries does your company export to? ______________________________

Q8 How would you categorise the market you are serving?

1. Low quality 2. High quality 3. Medium quality

Q9 Is your company under pressure from the market?

1. Yes 2. No

If yes, what kind of pressure is experienced?

1. Increased quantity 2. Improved quality 3. Improved efficiency
4. Reduced price 5. ISO Certification
6. Others, please specify ______________________________
____

Q10 What are the distribution channels of your company?

1. Sales agents in Mauritius
2. Sales agents in foreign countries
3. Contact with overseas wholesalers
4. Contact with overseas retailers
5. Others, please specify ______________________________
____

Q11 What promotion strategy does your company use?

1. TV 2. Road Shows 3. Magazines 4. Exhibitions
5. Personal contacts 6. Contacts through Governmental Organisations
7. Others, please specify ______________________________

Q12 Are you aware of the implications of the Multi-Fibre Agreement?

1. Yes 2. No

Q13 Do you feel that the Multi-Fibre Agreement is a threat to your market?

1. Yes 2. No

Q14 Which countries do you think would be your immediate competitors after the phasing out of the Multi-Fibre Agreement?

1. India 2. Pakistan 3. Vietnam 4. Hong Kong 5. Taiwan
6. Thailand 7. US 8. UK9. France 10. Madagascar
11. Malaysia 12. Bangladesh 13. China
14. Others, please specify ______________________________

____

Q15 What position do you perceive yourself amongst your competitors? Please circle.

Top 10% 20% 30% 40% 50%

Bottom 10% 20% 30% 40% 50%

Q16 Please tick the appropriate boxes in the table below to indicate how you would rate your company vis-à-vis your competitors in terms of the factors listed in the table.

Factors	Rating		
	Higher	Lower	Similar
Production Cost			
Labour Cost			
Quality			
Productivity			

Q17 What percentage of your annual turnover is spent on marketing?

1. 5% 2. 6-10% 3. 11-15% 4. 16-20%
5. Other, please specify approximate amount ____________________

Q18 What are your main concern with regards to marketing of your products?

1. Lack of data on different markets
2. Decreasing lead time

3. Inadequate information on potential customers
4. High Air freight costs
5. Ability to meet increasing demand
6. Ability to meet higher quality standards
7. Others, please specify ______________________________

____

PART C Manufacturing Strategy

Q19 What is the approximate lead-time available between order and delivery?

1. one week or less 2. 2 to 3 weeks 3. 4 to 5 weeks
4. 6 to 7 weeks 5. More than 8 weeks, please specify approximate lead time ______________________________

Q20 How often does your company meet the lead time?

1. Always 2. Rarely 3. Most of the time

Q21 Did your company find the lead time decreasing over the past years?

1. Yes 2. No

If yes, what is envisaged to meet decreasing lead times?

1. Expand present facilities 2. Subcontract 3. Increase productivity
4. Provide overtime 5. Other, please specify ______________

____

____

Q22 Do you think the lead time would be a major constraint in the future?

1. Yes 2. No

Q23 What has been the trend over the past 5 years in demand of products manufactured by your company?

1. Increasing demand of similar products
2. Decreasing demand
3. Demand of changing designs
4. Demand of completely different products

5. Other, please specify ________________________________

____

Q24 Please enter the main product groups (e.g Shirts, T-Shirts, Shorts, Trousers, Blouses, Jackets etc...) manufactured by your company and indicate the pattern of demand by ticking the appropriate boxes in the matrix below.

Main Product Group ———	1.	2.	3.	4.	5.
Approximate % of Total Production (in terms of units)					
Demand Pattern					
Steady demand					
Variable demand					
Seasonal demand					
Falling demand					
Growing demand					
Produced for Stock					

Q25 From where does your company obtain the design of the products manufactured?

1. In-house design 2. From customers 3. From fashion shows
4. From magazines 5. Other, please specify ________________________________

____

____

Q26 From where does your company obtain the design of its fabrics?

1. In-house design 2. From customers 3. From fashion shows
4. From magazines 5. Other, please specify ________________________________

____

____

Q27 Where does your company obtain the fabrics from

1. Manufactured in-house

2. Local firms/market
3. Imports, please specify country or countries from ______________

____

4. Customers
5. Other sources, please specify ___________________________

   ____

Q28 What is the approximate product introduction lead-time?

1. One week or less   2. 2-3 weeks   3. 4-5 weeks   4. 6-7 weeks
5. Other, please specify _________________________________

Q29 Please indicate the approximate amount of scrap/rejects/defective products produced by your company as a percentage net production, in recent years.

1. less than 5%   2. 5-10%   3. 10-15%   4. More than 15%

Q30 For each of the following sub-systems, please indicate by ticking appropriate boxes in the table, which is in use in your company and if a manual or computerised system is used. If computerised, please indicate if the system is standalone or integrated to the total manufacturing control system. Also, wherever applicable, indicate the type of system being used.

System and sub-system	In Use				Not in Use
	Manual Control System	Computerised Control System			
		Stand-alone	Integrated	Type of System (where applicable)*	
Marketing and Distribution					
Sales and Distribution					
Sales Promotion					
Advertising					
Sales Forecasting					
Design and Style Creation					
Product Costing					
Manufacturing					
Order Processing					
Pattern Creation/Control and modification					
Material Requirement Planning					
Bill of Materials					
Rough Cut Capacity Planning					
Purchasing					
Process Planning					
Ply Making					
Cutting					
Panel Labelling					
Production Planning and Scheduling					
Shop Floor Data Collection					
Inspection/QC/QA					
Maintenance Planning					
Work Study/Method Study					
Auxiliary					
Management Information System					
Transport Management					

Sub-System	In Use				Not in Use
	Manual Control System	Computerised Control System			
		Stand-alone	Integrated	Type of System (where applicable)*	
Research and Development					
Design and Style Creation					
Human Resource Management					
Material Handling					
Factory Layout					
Stock/Inventory Control					
Employee Performance					
Enterprise Resource Planning					
Lot traceability/On line inquiry					

* Please indicate use of Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Automated Manufacturing Systems (AS), Automated Material Handling Systems (AMHS), Robotics ®, Computer Aided Process Planning (CAPP), Bar Coding (BC), Electronic Data Interchange (EDI), Computer Numerical Control Machines (CNC), Direct Numerical Control Equipment (DNC), Computerised Maintenance Management Systems (CMMS), Total Quality Management Systems (TQM), Statistical Quality Control Systems (SQC) etc...

Part D Manufacturing Audit

Q31 Please tick the appropriate boxes in the table below basing on which you believe is the best answer to the manufacturing function in your company.

Manufacturing Functions	A	B	C
Product			
Production Line (standardised, mixed, customised for A, B and C respectively)			
Allowable variability in product specification (little, some, much)			
Co-ordination among production, marketing and engineering functions (little, some, much)			
Design from scratch (usually, sometimes, rarely)			
Concern for productivity (little, some, much)			
Use of specialised start-up procedures (little, some, much)			
Technology			
Degree of mechanisation (little, some, much)			
Degree of mechanisation of material handling (little, some, much)			
Use of state of the art technology (little, some, much)			
Extent of production related Research and Development (little, some, much)			
Extent of subcontracting (little, some, much)			
Investment in Production and Inventory Control Systems (low, medium, high)			
Emphasis on Quality (little, some, much)			
Amount of inspection throughout manufacturing process (little, some, much)			
Workforce			
Number of supervisory levels (few, several, many)			
Range of worker skills (narrow, medium, broad)			
Extent of worker control over workplace (little, some, much)			
Extent of worker discretion in work planning (little, some, much)			
Wage payment system (salary, salary+output, output)			

Q32 Please rate the following problems as faced by your company (1 being acutely faced and 5 being not important).

Problems	Rating				
	1	2	3	4	5
Shortage of labour					
Low productivity					
Availability of spare parts					
Availability of fabrics					
Design of fabrics					
Design of products					
Marketing of products					
Availability of machines/equipment					
Cost of raw materials (fabrics)					
Cost of labour					
Cost of equipment					
Pace of IT change					
Training opportunities for labour					
Material Handling					
Line Balancing					
Quality Control					
Rejects					
Inventory Control					
Research and Development					
Availability of technical staff (for repairs and maintenance)					
Maintenance of equipment					
Other, please specify					

Thank you very much for your comprehension and collaboration in filling in the questionnaire.

Hurreeram D K

Faculty of Engineering

University of Mauritius

Reduit, Mauritius

Tel (230) 454 1041

Fax (230) 465 7144

Email hureeram@uom.ac.mu

Appendix B
Survey of Garment Retailers in the UK

The objective of the survey was to identify order winners and order qualifiers to the following market segments: Haute Couture, Designer shops, Independent and Specialised stores, Department stores, Retail Chains and Discount Stores. The survey results were eventually used to work out a rating to compare the price charged, the quality characteristics of the products, the variety of products offered and the volume of products available for specific styles in the various market segments. The survey was conducted by visiting retail shops in Huddersfield and London. In most cases the questionnaire was filled in by the stores manager.

The retails shops visited include
Haute Couture: Christian Dior, Il Piacere Donna
Designer Shop: Yves St. Laurent, Levi's
Independent Store: Next, Gap
Department Store: Marks and Spencer, British Home Store
Retail Chain: Littlewoods, George (Asda)
Discount Store: Matalan, Woolworths

Survey Questionnaire

Grateful if you could spare some of your time to fill in the questionnaire.

Name of Company ....

Address ....

....

Contact person ....

Tel........................... Fax ....   Email ....

Qu1. Which market segment do you perceive your company to be part of? Please tick.

1. Haute Couture
2. Designer shop
3. Independent store
4. Department store
5. Retail chain
6. Discount store

Qu2. Please indicate the characteristics associated to the specified market segment in Qu1 above. Please tick.

1. Sale of branded garments
2. Sale of own branded garments
3. Unique design
4. Personalised customer service
5. Low price
6. Moderate price
7. Expensive garment
8. Limited volume
9. High volume
10. Low variety
11. High variety
12. Large number of outlets
13. Limited outlets
14. Other please specify ....

    ....

Qu3. What are the features that qualify a supplier to serve the specified market segment? Please tick.

1. Fabric design
2. Garment design
3. Fabric and garment design
4. Aesthetics
5. Fabric quality
6. Garment quality
7. Garment price
8. Rapid response to market requirement
9. Delivery reliability
10. Brand
11. Other, please specify ....
....

Qu4. What are the features that allow suppliers to win orders in the particular market segment?

1. Fabric design
2. Garment design
3. Fabric and garment design
4. Aesthetics
5. Fabric quality
6. Garment quality
7. Garment price
8. Rapid response to market requirement
9. Delivery reliability
10. Brand
11. Other, please specify ....
....

Qu5. On a scale of 1 to 10, please rate the following features for your market segment as appropriate and per the details given below:

Typical Product	Please insert average rating on a scale from 1 to 10			
	Price rating 1 is £5 10 is £100	Quality rating 1 is low quality 10 is exclusive quality	Variety offered 1 is low variety 10 is high variety	Volume of specific styles 1 is very low volume 10 is high volume
Shirt				
Trousers				
T-Shirt				

Thank you for your collaboration and the time devoted in the filling of the questionnaire.

Hurreeram Dinesh Kumar
Manufacturing System Research Group
University of Huddersfield
Queensgate
Huddersfield, HD1 3DH
UK
Email: d.k.hurreeram@hud.ac.uk

Appendix C

Details of Garment Manufacturing Companies in Mauritius

No.	Company	Year of Est.	No. of Employees	Type of Product	Products Manufactured
1	Cie Mauricienne de Textile	1986	3000	Knitted	t-shirts, polo shirts, sweatshirts, jogging suits, fancy dresses, cardigans
2	Tropic Knits	1987	2500	Knitted	t-shirts, polo shirts, sweatshirts
3	Sonia Wear	1984	1600	Knitted	t-shirts, polo shirts, sweatshirts
4	Star Knitwear	1987	1300	Knitted	Dresses, lingerie, brass, hosiery, Other knitted garments, jersey wear: skirts, dresses, shorts. .t-shirts, polo shirts, sweatshirts
5	Tee Sun	1987	1200	Knitted	t-shirts, polo shirts, sweatshirts, Other knitted garments, jersey wear: skirts, dresses, shorts..
6	Corotex	1983	1200	Knitted	Sportswear : jogging / track suits, gym wear, t-shirts, polo shirts, sweatshirts
7	Prosimex	1988	1000	Knitted	t-shirts, polo shirts, sweatshirts
8	United Apparel	1989	960	Knitted	Jackets, polo shirts, t-shirts, pants
9	Sentosa	1988	800	Knitted	Dresses, Other knitted garments, jersey wear: skirts, dresses, shorts..
10	Kentex Garments	1987	760	Knitted	t-shirts, polo shirts
11	World Knits	1993	700	Knitted	t-shirts, polo shirts, sweatshirts
12	Olympic Knitting	1986	650	Knitted	T-shirts, polo shirts, fancy garments, ladies & children wear
13	Tangara	1986	500	Knitted	t-shirts, polo shirts, sweatshirts
14	Victory Garments	1986	450	Knitted	t-shirts, polo shirts, sweatshirts
15	Hong Kong Shanghai Knitting Factory	1985	400	Knitted	t-shirts, polo shirts, sweatshirts
16	Victory Garments	1982	400	Knitted	Children's, Kids wear
17	Richfield Textiles	1994	390	Knitted	t-shirts, polo shirts, sweatshirts, Other knitted garments, jersey wear: skirts, dresses, shorts. Underwear, socks, stocking
18	Avant	1987	350	Knitted	Children's, Kids wear, Sportswear : jogging / track suits, gym wear, t-shirts, polo shirts, sweatshirts
19	Hong Kong Garments./ Maydon Fashion	1986	270	Knitted	Blouses, Dresses, Other knitted garments, jersey wear: skirts, dresses, shorts, t-shirts, polo shirts, sweatshirts
20	Napson's	1987	250	Knitted	Shirts, t-shirts, polo shirts, sweatshirts

No.	Company	Year of Est.	No. of Employees	Type of Product	Products manufactured
21	Nigma Gloves	1984	250	Knitted	t-shirts, polo shirts, sweatshirts, Other knitted garments, jersey wear :skirts, dresses, shorts..
22	Tan Union	1984	208	Knitted	t-shirts, polo shirts, sweatshirts
23	Maurihai	1988	170	Knitted	t-shirts, polo shirts, sweatshirts
24	Tweed	1990	150	Knitted	t-shirts, polo shirts, sweatshirts
25	Birkill Clothing	1988	150	Knitted	Shirts, t-shirts, polo shirts, sweatshirts
26	Hyper Confection	1988	150	Knitted	Other knitted garments, jersey wear: skirts, dresses, shorts. Shirts, Sleep / night wear, Sportswear: jogging / track suits, gym wear
27	Fabulous Garments	1981	150	Knitted	Children's, Kids wear, Sportswear: jogging / track suits, gym wear, t-shirts, polo shirts, sweatshirts, Shirts, Suits, jackets, ensemble..
28	L'Inattendu	1990	130	Knitted	Blouses, Children's, Kids wear, Dresses, Other knitted garments, jersey wear: skirts, dresses, shorts..
29	Goldenwear	1988	110	Knitted	Dresses, lingerie, brass, hosiery, Shirts, t-shirts, polo shirts, sweatshirts
	Total Knitted		20148		

No.	Company	Year of Est.	No. of Employees	Type of Product	Products manufactured
30	Textile Industries	1972	3800	Woven	Shirts
31	Leisure Garments	1983	1950	Woven	Shirts, Jeans wear, denim wear, Skirts
32	Novel Group	1987	1400	Woven	Jeans wear, denim wear, Blouses, Children's, Kids wear, Dresses, Other knitted garments, jersey wear: skirts, dresses, shorts. Suits, jackets, ensemble..
33	Sinotex	1984	1340	Woven	Jeans wear, denim wear, Shirts, Skirts, Suits, jackets, ensemble, dresses
34	Grove Industries	1986	1300	Woven	Shirts
35	Aquarelle Clothing	1987	1200	Woven	Shirts
36	News Island Clothing	1985	1058	Woven	Blouses, Shirts
37	Ely	1989	850	Woven	Blouses, Shirts, Dresses
38	Corona Clothing	1972	600	Woven	Suits, jackets, ensemble. Trousers, Shorts
39	Bentley Apparel	1988	500	Woven	Blouses, Shirts
40	Firemount	1990	500	Woven	Jeans wear, denim wear, Shirts, Skirts, Suits,

No.	Company	Year of Est.	No. of Employees	Type of Product	Products manufactured
41	Mahadeo	1990	500	Woven	Shirts, Skirts, Work clothes, uniforms, coats
42	BH Industries	1984	450	Woven	Blouses, Shirts
43	Overseas Garment	1988	400	Woven	Blouses, Dresses, Skirts, Shirts
44	Texamon	1988	350	Woven	Shirts, Underwear, socks, stocking
45	Job Textiles	1986	250	Woven	Dresses, Shirts, Skirts
46	Palmar / Clemence	1980	250	Woven	Jeans wear, denim wear, Shirts, Skirts, Suits, jackets, ensemble
47	Safco Mode	1992	250	Woven	Jeans wear, denim wear, Shirts, Skirts, Suits, jackets, ensemble
48	Noblesse	1986	225	Woven	Blouses, Shirts, sleep/ nightwear, Underwear, Socks, Stockings
49	Phoenix Wear	1988	225	Woven	Blouses, Shirts, Dresses
50	Tropiko	1981	225	Woven	Blouses, Shirts, Childrens, Kids wear, dresses, shirts, skirts
51	MFM Confection/Caustat&Sons	1983	220	Woven	Blouses, Shirts, Dresses, Headwear, Caps, Headband, Skirts
52	Manupan	1973	200	Woven	Shirts, Skirts, Suits, jackets, ensemble...
53	Jack Tellor / Paul de Vence	1975	185	Woven	Shirts
54	R.S. Fashions	1984	175	Woven	Jeans wear, denim wear, Shirts, Skirts, Suits, jackets, ensemble
55	Contessa Fashion	1987	160	Woven	Blouses, Shirts
56	Blue Azur	1987	150	Woven	Childrens, Kids wear
57	Fimtex	1988	150	Woven	Sleep / night wear
58	Life Garments	1986	150	Woven	Blouses, Shirts, Skirts
59	M.G. Garments	1985	150	Woven	Dresses, Shirts, Skirts
60	Shams Fabrics	1989	150	Woven	Baby / infant wear, diapers, Blouses, Children, Kids wear
61	SVU Ltd	1985	150	Woven	Baby / infant wear, diapers, shirts
62	Jeanswear	1990	140	Woven	Jeans wear, denim wear
63	Palmira	1993	135	Woven	Shirts
64	Autentic Wear Ltd	1995	125	Woven	Childrens, Kids wear, Dresses, Jeans wear, denim wear
65	Uniforms	1974	122	Woven	Shirts, Skirts, Work clothes, uniforms, coats

No.	Company	Year of Est.	No. of Employees	Type of Product	Products manufactured
66	HM Garments	1984	120	Woven	Blouses, Shirts
67	Carnaval	1980	119	Woven	Carnival, party dresses
68	First Garments	1986	110	Woven	Shirts
	Total Woven		20334		

Appendix D

Open Ended Questionnaire for Construction of Apparel Manufacturing System Model

Company Name ______________________________

No. of Employees ______________________________

Product range ______________________________

Market segment ______________________________

Main Activity	Sub-activities	Decision Node and Decision Maker	Time Span/Documents and Records/Data and material Flow/Performance measures
Sales and Marketing			
Product Design and Development			
Cut, Make and Trim			
Planning and Control			
Purchasing and Inventory			
Human Resource			
Finance and Accounting			

Activity	Sub activities	Input	Output	Control	Mechanism

Other Remarks (Miscellaneous)

Quality Assurance System

Maintenance Management System

Appendix E

Audit Tool Questionnaires

PRODUCT DESIGN AND DEVELOPMENT					
CODE	STATEMENT	Tick	Strategy	Score	Best Score
	The strategy for product design and development is		*WHO*		5
1	*to obtain the design from the customer*		*D1*	*3*	
2	*to produce the designs using in-house expertise only (including experts from mother company, if applicable)*		*D2*	*3*	
3	*to work out the design as a joint effort between the customer and the PD&D department*		*D3*	*5*	
4	*to subcontract the design activity to a design agent*		*D4*	*3*	
	The extent of involvement of the customer in the product design process is:		WHO		5
5	the customer does not involve in the design process		D2	3	
6	the customer has little participation in the design process		D2/D3	3	
7	*the customer actively participates in the design process*		*D1/D3*	*5*	
8	the customer leads the design process		D1	3	
	In addition to PD&D department, the other departments *actively* involved in the design process include		WHO		30
9	*Sales and Marketing*		*D2/D3*	*5*	
10	*Planning and Control*		*D2/D3*	*5*	
11	*Purchasing and Inventory*		*D2/D3*	*5*	
12	*Manufacturing (CMT)*		*D2/D3*	*5*	
13	*Finance and Accounting*		*D2/D3*	*5*	
14	*Human Resource Management (Personnel)*		*D2/D3*	*5*	
15	XXX (not applicable/non of the above)		D1/D4	3	
	Data transfer between the PD&D department and the departments actively involved in the design process is through		HOW		14
16	*Informal meeting*		*D2/D3*	*3*	
17	*Formal meeting*		*D2/D3*	*3*	
18	*E-mail*		*D2/D3*	*3*	
19	*Local area network (company information system)*		*D2/D3*	*5*	
	The fabric design is obtained from		WHO		5
20	*In-house designers*		*D2/D3*	*5*	
21	The customer		D1	3	
22	Fabric suppliers		D4	3	
23	The design agent		D4	3	

	Garment specifications are		WHO		5
24	obtained from customer		D1	3	
25	determined in-house (including from mother company)		D2	3	
26	*worked between customer and PD&D department*		*D3*	*5*	
27	obtained from the design agent		D4	3	
	Garment patterns (graded) are		WHO		5
28	supplied by the customer		D1	3	
29	in house manually		D1/D2/D3	3	
30	produced in house using a CAD system		D1/D2/D3	3	
31	*produced in house using a CAD/CAM system*		D1/D2/D3	*5*	
32	supplied by the design agent		D4	3	
	Fabric design is carried out using		HOW		5
33	a manual system (hand sketch)		D2/D3	3	
34	a CAD system		D2/D3	3	
35	*specialised fabric design software*		*D2/D3*	*5*	
36	XXX (None of the above, Not applicable, Don't know)		D1/D4	3	
	The garment design process involves the extensive use of		HOW		26
37	*Forecasting data*		*D2/D3*	*5*	
38	*Point of sale data*		*D2/D3*	*5*	
39	*End of season sales data*		*D2/D3*	*3*	
40	*Specialised apparel design systems (CAD, Electronic sketching systems, template programmes)*		*D2/D3*	*5*	
41	*Simulation systems*		*D2/D3*	*5*	
42	*past design*		*D2/D3*	*3*	
43	XXX (None of the above)		D2/D3	3	
	Aspects of garment serviceability which are most emphasized upon during the design process include		HOW		31
44	*Comfort*		*D2/D3*	*5*	
45	Durability		D2/D3	3	
46	Functional use		D2/D3	3	
47	*Creativity/Innovation*		*D2/D3*	*5*	
48	*Uniqueness*		*D2/D3*	*5*	
49	*Twist*		*D2/D3*	*5*	
50	*Shrinkage*		*D2/D3*	*5*	
51	XXX (Don't know)		D2/D3	2	
	In making garment choices manufactured by the company, end users mostly focus on		HOW		49
52	*Styling*		*D1/D3*	*5*	
53	Fit		D1/D3	3	
54	Fabrics		D1/D3	5	
55	Price		D1/D3	3	

56	Brand name		D1/D3	5	
57	*Product presentation*		*D1/D3*	*5*	
58	*Creativity in design*		*D1/D3*	*5*	
59	*Uniqueness of design*		*D1/D3*	*5*	
60	Durability		D1/D3	3	
61	Stability		D1/D3	5	
62	Aesthetics		D1/D3	5	
63	XXX (Don't know)		D2/D3	2	
	Cost estimates for the garment are worked out		HOW		16
64	*based on past experience*		*D1/D2/D3*	*3*	
65	*using specialised software*		*D1/D2/D3*	*5*	
66	*based on customer expectations*		*D1/D2/D3*	*5*	
67	*based on competitor prices*		*D1/D2/D3*	*3*	
	The lead time for agreeing upon a fabric design with the customer is		WHEN		5
68	*less than one week*		*D2/D3*	*5*	
69	between one to two weeks		D2/D3	3	
70	between two to three weeks		D2/D3	3	
71	more than four weeks		D2/D3	3	
	The average lead time for the design of a new product is (from sample request to confirmed customer order)		WHEN		5
72	*less than five days*		*D2/D3*	*5*	
73	between five and ten days		D2/D3	3	
74	between ten and fifteen days		D2/D3	3	
75	between fifteen and twenty days		D2/D3	3	
76	more than twenty days		D2/D3	3	
	Design of a product line involves		WHAT		19
77	*adding differentiation features to past designs*		*D2/D3*	*5*	
78	*designing completely different products*		*D2/D3*	*5*	
79	*preparing cost estimates (quotations) for manufacturing the product*		*D2/D3*	*3*	
80	*generating the product specifications*		*D2/D3*	*3*	
81	*producing the graded patterns*		*D2/D3*	*3*	
	Product design is evaluated against market place requirements through the use of		WHAT		16
82	*Market Surveys*		*D2/D3*	*5*	
83	*Product sales rate data*		*D2/D3*	*3*	
84	*POS data/EPOS data*		*D2/D3*	*5*	
85	*Fashion/trade shows*		*D2/D3*	*3*	
86	XXX (None of the above, Don't know)		D2/D3	3	

	The differentiation features of the product vis-à-vis those proposed by competitors are in terms of (please tick any four)		WHAT		26
87	the brand		D2/D3	3	
88	the price		D2/D3	3	
89	*the quality*		*D2/D3*	*5*	
90	*product fit*		*D2/D3*	*5*	
91	*the styling*		*D2/D3*	*5*	
92	*the service quality*		*D2/D3*	*5*	
93	XXX (Don't know)		D2/D3	3	
	The present strategy for PD&D is adopted because		WHY		5
94	it has paid off over the past		D1/D2/D3	3	
95	of cost constraints for investment in more appropriate technology		D1/D2/D3	3	
96	of unavailability of skilled designers		D1/D2/D3	3	
97	of unavailability of skilled labour for running CAD/CAM systems		D1/D2/D3	3	
98	of the policies of the mother company		D1/D2/D3	3	
99	*it is most competitive*		*D1/D2/D3*	*5*	
100	Don't know		D1/D4	3	

MARKETING/MERCHANDISING					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The marketing strategy is		WHO		5
1	*to use the marketing department (including that in the company's home country)*		*M1*	5	
2	*to use a local/overseas agent*		M2	3	
3	*to use the customer for marketing the product*		M3	3	
	The product is marketed		HOW		5
4	*Directly to the retailers*		*M1*	*5*	
5	To wholesalers		M1/M3	3	
6	To sales agents		M2	3	
7	through a manufacturing network		M1	3	
8	through the customer		M3	3	
	Data transfer between the company and the customer is effected via		HOW		19
9	*Telephone*		*M1*	*3*	
10	*Fax*		*M1*	*3*	
11	*Electronic Data Interchange (EDI)*		*M1*	*5*	
12	*Internet EDI*		*M1*	*5*	
13	Email		M1	3	
	The main areas of activity for the marketing department include		HOW		37

14	*Organisation of promotion and advertising campaigns*		*M1*	*5*	
15	*Organisation of fashion/trade shows*		*M1*	*5*	
16	*Participation in fashion/trade shows*		*M1*	*3*	
17	*Participation in promotion and advertising campaigns*		*M1*	*3*	
18	*Marketing research for identifying new customers and customer needs*		*M1*	*5*	
19	*Marketing research for identifying new channels of distribution*		*M1*	*5*	
20	*Working on short term marketing plans*		*M1*	*3*	
21	*Working on long term marketing plans*		*M1*	*3*	
22	*Research to identify the strength and weakness of competitors*		*M1*	*5*	
	Marketing is done		HOW		24
23	using previous designs		M1	3	
24	*using new designs (proposed samples)*		*M1*	*5*	
25	*using the company reputation*		*M1*	*5*	
26	using personal contacts		M1	3	
27	through government/para-statal/non government organisations		M1	3	
28	*using the brand name*		*M1*	*5*	
	The percentage of annual turnover spent on marketing is		HOW		5
29	Negligible		M2/M3	3	
30	Between 1% and 5%		M2	3	
31	Between 6% and 10%		M1/M2	5	
32	*Between 11% and 15%*		*M1*	*5*	
33	More than 15%		M1	5	
34	XXX (don't know)		M1/M2/M3	3	
	The average lead time for marketing (start of process to confirmed order from customer) is usually		WHEN		5
35	*within one month*		*M1/M2*	*5*	
36	between one to three months		M1/M2	3	
37	between three to six months		M1/M2	3	
38	between six months to one year		M1/M2	3	
39	more than one year		M1/M2	3	
	The product/customer/country combination aimed at by the marketing function for the coming two years is		WHAT		25
40	similar products, same customers, same country		M1	3	
41	similar products, different customers, same country		M1	5	
42	similar products, different customers, different country		M1	5	
43	different products, same customers, same country		M1	5	
44	*different products, different customers, same country*		*M1*	*5*	
45	different products, different customers, different country		M1	5	
	The product/customer/country combination served by the company over the past two years is		WHAT		25
46	similar products, same customers, same country		M1	3	

47	similar products, different customers, same country		M1	5	
48	similar products, different customers, different country		M1	5	
49	different products, same customers, same country		M1	5	
50	*different products, different customers, same country*		*M1*	*5*	
51	different products, different customers, different country		M1	5	
	Over the past two years		WHAT		10
52	*the company has won customers in favour of its competitors*		*M1*	*5*	
53	*there has been increasing demand of similar products*		*M1*	*5*	
54	the demand for similar products has been stable		M1	3	
55	the demand for similar products has been decreasing		M1	3	
56	there has been increasing pressure on quality of products		M1	3	
57	there has been increasing pressure on design features		M1	3	
58	there has been increasing pressure on lead time reduction		M1	3	
59	there has been increasing pressure on order size reduction		M1	3	
60	there has been increasing pressures on price reduction		M1	3	
	The market category serviced by the company is		WHAT		5
61	*Haute Couture (very high price, excellent quality, unique design, large variety, very low volume)*		*M1*	*5*	
62	Designer Wears (high price, high quality, stylish design, high variety, low volume)		M1	5	
63	Independent and Specialised Stores (moderate price, high quality, low variety, high volume)		M1	3	
64	Department Store and Retail Chains (moderate price, good quality, low variety, high volume)		M1	3	
65	Bargain and Discount Stores (low price, moderate quality, low variety, high volume)		M1	3	
	The product marketed can be classified as being		WHAT		5
66	on-going garments (non seasonal, stable demand throughout the year)		M1	3	
67	basic garments (non seasonal, limited change in style over a year)		M1	3	
68	seasonal garments (demand is spread only over a particular season)		M1	3	
69	*fashion garments (usually seasonal garments, however, requiring frequent change in styling)*		*M1*	*5*	
	Marketing is conducted for		WHAT		5
70	CMT operations only		M1	3	
71	*design and CMT operations*		*M1*	*5*	
72	make to order only		M1	3	
73	make to order and make to stock		M1	3	
74	make to stock		M1	3	
	The company accepts		WHAT		5
75	Orders for specific products without possibilities for change once manufacturing starts		M1	3	
76	Orders for specific products with possibilities for minor design changes linked with CMT operations		M1	3	

77	*Orders for specific products with small order sizes renewed on a regular basis with or without design changes during the course of manufacture (repeat order policy)*		*M1*	*5*	
	The order size (number of pieces per order) marketed is		WHAT		5
78	*of the order of a few thousands*		*M1*	*5*	
79	of the order of tens of thousands		M1	5	
80	of the order of hundreds of thousands		M1	3	
81	of the order of millions		M1	3	
82	XXX (there is no specific limitation on order size)		M1	3	
	The competitive advantage of the company vis-à-vis its immediate competitors is the		WHAT		40
83	*Price offered*		*M1*	*5*	
84	*Product quality*		*M1*	*5*	
85	*Product design*		*M1*	*5*	
86	*Delivery reliability*		*M1*	*5*	
87	*Manufacturing flexibility*		*M1*	*5*	
88	*Productivity level*		*M1*	*5*	
89	*Industrial infrastructure*		*M1*	*5*	
90	*lead time*		*M1*	*5*	
91	XXX (don't know)		M1	3	
	On average, the percentage amount of products sold at mark down prices is		WHAT		5
92	*Less than 5%*		*M1*	*5*	
93	less than 10%		M1	3	
94	between 10% and 25%		M1	3	
95	between 25% and 50%		M1	3	
96	more than 50%		M1	3	
97	XXX (don't know)		M1	3	
	The current marketing strategy is adopted because		WHY		10
98	*it has paid off over the past*		*M1*	*5*	
99	of cost constraints		M1	3	
100	it is most competitive		M1	5	
101	of time constraints		M1	3	
102	of lack of opportunities		M1	3	
103	XXX (don't know)		M1	3	

CMT					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The CMT strategy is		WHAT		5
1	*to have long run production*		A1	3	
2	*to have batch production*		A2	5	

3	*to have short run production*		*A3*	*5*	
	Method study and work measurement is conducted by		WHO		5
1	experienced workers		A1/A2/A3	3	
2	trained personnel		A1/A2/A3	3	
3	*industrial engineers*		*A1/A2/A3*	*5*	
	The actual layout of the factory is		HOW		5
4	*line or product-oriented layout*		*A1*	*3*	
5	functional or process-oriented layout		A2	5	
6	cellular layout		A3	5	
	The material handling system used is the		HOW		5
7	progressive bundle system (PBU)		A1	3	
8	*unit production system(UPS)*		*A2*	*5*	
9	cellular production system		A2/A3	5	
10	manual rail system		A1/A2	3	
11	automatic computerised rail		A1/A2	5	
	Marker making is performed		HOW		5
12	manually on the fabric		A1/A2/A3	3	
13	manually using a marker paper and carbon copies		A1/A2/A3	3	
14	using a CAD system		A1/A2/A3	5	
15	*using a CAD/CAM system (Digitised system)*		*A1/A2/A3*	*5*	
	The percentage of defective order due to poor marking is		HOW		5
16	*less than 5%*		*A1/A2/A3*	*5*	
17	between 5 and 10%		A1/A2/A3	3	
18	between 10 and 15%		A1/A2/A3	3	
19	more than 15%		A1/A2/A3	3	
	Spreading is done		HOW		
20	manually		A1/A2/A3	3	5
21	using automated spreading machine with fabric control devices(tension, position, end treatment)		A1/A2/A3	5	
22	using automated spreading machine without fabric control devices		A1/A2/A3	3	
	The cutting room involves		HOW		5
23	operator controlled cutting (use of portable cutting knives)		A1/A2/A3	3	
24	the use of band knives		A1/A2/A3	3	
25	the use of die cutting		A1/A2/A3	5	
26	servo assisted cutting		A1/A2/A3	5	
27	*computer controlled cutting (CAD/CAM system)*		*A1/A2/A3*	*5*	
	Transfer marks on cut fabrics are obtained by using		HOW		5

28	*vertical straight knives*		*A1/A2/A3*	*5*	
29	hot notches		A1/A2/A3	3	
30	drills		A1/A2/A3	3	
31	thread marking machines		A1/A2/A3	5	
32	templates and wax pen		A1/A2/A3	3	
33	manual systems		A1/A2/A3	3	
	Fusing is carried out using		HOW		5
34	*rollers presses*		*A1/A2/A3*	*5*	
35	flat-bed presses		A1/A2/A3	5	
36	continuous pressing machines		A1/A2/A3	5	
37	irons		A1/A2/A3	3	
	Machines used for the assembly of apparels are		HOW		5
38	manual requiring skilful operators		A1/A2/A3	3	
39	semi automatic with control devices		A1/A2/A3	5	
40	*fully automatic*		*A1/A2/A3*	*5*	
	Pressing is done using		HOW		5
41	*buck press*		*A1/A2/A3*	*5*	
42	iron press		A1/A2/A3	3	
43	block or die pressing		A1/A2/A3	5	
44	form pressing (topper press)		A1/A2/A3	5	
45	steamers		A1/A2/A3	3	
46	manual steam iron with suction table		A1/A2/A3	3	
	Line balancing is performed		HOW		10
47	manually		A1/A2/A3	3	
48	*using a computerised system*		*A1/A2/A3*	*5*	
49	on an overtime basis		A1/A2/A3	3	
50	using multi-skill operators		A1/A2/A3	5	
	The production line layout is		WHEN		5
51	*reviewed and reset for each manufacturing order*		*A1/A2/A3*	*5*	
52	the same all the time		A1/A2/A3	3	
53	is reviewed and reset in the event of line balancing problems		A1/A2/A3	3	
	To establish production standards work study (Method Study & Work Measurement) is normally conducted		WHEN		5
54	on and off to solve problems on the line		A1/A2/A3	3	
55	*on a regular basis during production*		*A1/A2/A3*	*5*	
56	only at the start of manufacture of each order		A1/A2/A3	3	
	The product(s) most often manufactured by the company include		WHAT		5

57	Shirts		A1/A2/A3	5	
58	Trousers		A1/A2/A3	5	
59	Skirts		A1/A2/A3	5	
60	Blouses		A1/A2/A3	5	
61	T-shirts		A1/A2/A3	5	
62	Kids wear		A1/A2/A3	5	
63	Dresses		A1/A2/A3	5	
64	Jackets		A1/A2/A3	5	
65	Lingerie		A1/A2/A3	5	
66	Denim Wear		A1/A2/A3	5	
	The percentage of fabric defect is		WHAT		5
67	*less than 2%*		*A1/A2/A3*	5	
68	between 2% to 4%		A1/A2/A3	3	
69	between 5% to 7%		A1/A2/A3	3	
70	between 8% and 10%		A1/A2/A3	3	
	The percentage of defects arising from wrong transfer marks is		WHAT		5
71	*less than 2%*		*A1/A2/A3*	5	
72	between 2% and 4%		A1/A2/A3	3	
73	between 5% and 7 %		A1/A2/A3	3	
74	between 8% and 10%		A1/A2/A3	3	
	The amount of waste produced during cutting operation is		WHAT		5
75	*less than 2%*		*A1/A2/A3*	5	
76	between 2% and 4%		A1/A2/A3	3	
77	between 5% and 7%		A1/A2/A3	3	
78	between 8% to 10%		A1/A2/A3	3	
	The percentage of defects attributed to the fusing operation is		WHAT		5
79	*less than 2%*		*A1/A2/A3*	5	
80	between 2% and 4%		A1/A2/A3	3	
81	between 5% and 7%		A1/A2/A3	3	
82	between 8% and 10%		A1/A2/A3	3	
83	more than 10%		A1/A2/A3	3	
	The percentage of defects due to incorrectly formed stitches		WHAT		5
84	*less than 2%*		*A1/A2/A3*	5	
85	between 2% and 4%		A1/A2/A3	3	
86	between 5% and 7%		A1/A2/A3	3	
87	between 8% and 10%		A1/A2/A3	3	
88	more than 10%		A1/A2/A3	3	

PURCHASING AND INVENTORY					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The purchasing strategy is		WHAT		5
1	*to use single sourcing without strategic partnership relationship*		P1	3	
2	*to use multiple sourcing*		P2	3	
3	*to allow for supplier/customer integration*		*P3*	*5*	
	The sourcing strategy for fabrics is		WHO		5
4	to obtain the fabric from the customer		P1	3	
5	to obtain the fabric from a supplier recommended by the customer		P1	3	
6	to compare quotations from local suppliers and select best		P2	3	
7	to compare quotations from local and overseas suppliers and select best		P2	3	
8	to use a network of suppliers		P2	3	
9	*through a partnership relationship with specific supplier(s)*		*P3*	*5*	
	The sourcing strategy for trims and accessories (T&A) is		WHO		5
10	to obtain the T&A from the customer		P1	3	
11	to obtain the T&A from suppliers recommended by the customer		P2	3	
12	to compare quotations from local suppliers and select best		P2	3	
13	to compare quotations from local and overseas suppliers and select best		P2	3	
14	to use a multiple suppliers		P2	3	
15	*through a partnership relationship with specific suppliers*		*P3*	*5*	
	Selection of the fabric supplier is mainly based on		WHY		30
16	*the price quoted*		*P2*	*5*	
17	*the quality of the fabric*		*P2*	*5*	
18	*the order to delivery lead time*		*P2*	*5*	
19	*delivery reliability*		*P2*	*5*	
20	*the involvement of the supplier as a partner for enhancing product competitiveness*		*P3*	*5*	
21	*the track record for the supplier*		*P2*	*5*	
	Selection of trim and accessories supplier is mainly based on		WHY		30
22	*the price quoted*		*P2*	*5*	
23	*the quality of supplies*		*P2*	*5*	
24	*the order to delivery lead time*		*P2*	*5*	
25	*delivery reliability*		*P2*	*5*	
26	*the involvement of the supplier as a partner for enhancing product competitiveness*		*P3*	*5*	
27	*the track record of the supplier*		*P2*	*5*	
28	XXX (Not applicable)		P3	3	
	Fabric from the supplier is mostly obtained		HOW		10

29	in batches as and when requested by the company		P1/P2/P3	5	
30	in bulk for the complete order		P1/P2	3	
31	*on a just-in-time principle*		*P3*	*5*	
32					
33	**Trims and accessories are purchased**		HOW		10
34	in batches as and when requested by the company		P1/P2/P3	5	
35	in bulk for the complete order		P1/P2	3	
36	*on a just-in-time principle*		*P3*	*5*	
37	*XXX (Not applicable)*		*P3*	3	
	Data transfer between the company and the fabric supplier is via		HOW		16
38	*Telephone*		*P1/P2/P3*	*3*	
39	*Fax*		*P1/P2/P3*	*3*	
40	*Electronic Data Interchange*		*P1/P2/P3*	*5*	
41	*Internet EDI*		*P1/P2/P3*	*5*	
	Data transfer between the company and the T&A supplier is via		HOW		16
42	*Telephone*		*P1/P2/P3*	*3*	
43	*Fax*		*P1/P2/P3*	*3*	
44	*Electronic Data Interchange*		*P1/P2/P3*	*5*	
45	*Internet EDI*		*P1/P2/P3*	*5*	
	Purchasing is carried out		HOW		10
46	manually (use of purchase order forms)		P1/P2/P3	3	
47	through the use of a PC based purchasing software		P1/P2/P3	3	
48	*through the use of a company based computerised inventory control system*		*P1/P2/P3*	*5*	
49	*through the use of EDI*		*P1/P2/P3*	*5*	
	The inventory control system is		HOW		10
50	manual		P1/P2/P3	3	
51	PC based-computerised MRP		P1/P2/P3	3	
52	Company computerised system on a local area network		P1/P2/P3	5	
	Inventory control is determined		HOW		10
53	using an Economic Order Quantity (EOQ)		P1/P2/P3	3	
54	*using the just-in-time principle*		*P1/P2/P3*	*5*	
55	on a Kanban System		P1/P2/P3	5	
56	when stock falls to re-order level		P1/P2/P3	3	
57	as and when materials are needed		P1/P2/P3	3	
	On average, the lead time for obtaining the fabric is		WHEN		5
58	*less than three weeks*		*P1/P2/P3*	*5*	
59	between three and six weeks		P1/P2/P3	3	

60	between six and nine weeks		P1/P2/P3	3	
61	more than nine weeks		P1/P2/P3	3	
	On average the lead time to obtain the trim and accessories is		WHEN		5
62	*less than three weeks*		*P1/P2/P3*	*5*	
63	between three and six weeks		P1/P2/P3	3	
64	Between six and nine weeks		P1/P2/P3	3	
65	more than nine weeks		P1/P2/P3	3	
	On average, prior to production, the fabric is stored over a period of		WHEN		5
66	*less than one week*		*P1/P2/P3*	*5*	
67	one week		P1/P2/P3	3	
68	one to two weeks		P1/P2/P3	3	
69	two to three weeks		P1/P2/P3	3	
70	three to four weeks		P1/P2/P3	3	
71	more than four weeks		P1/P2/P3	3	
	On average, the trims and accessories are stored over a period of		WHEN		5
72	*less than one week*		*P1/P2/P3*	*5*	
73	one week		P1/P2/P3	3	
74	one to two weeks		P1/P2/P3	3	
75	two to three weeks		P1/P2/P3	3	
76	three to four weeks		P1/P2/P3	3	
77	more than four weeks		P1/P2/P3	3	
	On average, following manufacture, the finished garment is shipped within		WHEN		5
78	*one week*		*P1/P2/P3*	*5*	
79	one to two weeks		P1/P2/P3	3	
80	two to three weeks		P1/P2/P3	3	
81	three to four weeks		P1/P2/P3	3	
82	four to six weeks		P1/P2/P3	3	
	The quality of the incoming fabric is ensured by		WHAT		5
83	the reputation of the supplier		P1/P2/P3	3	
84	the test results from the supplier		P1/P2/P3	3	
85	100% inspection of the fabric		P1/P2/P3	2	
86	sample testing of the fabric		P1/P2/P3	3	
87	*statistical quality control procedures for the fabric*		*P1/P2/P3*	*5*	
	The quality of the incoming trims and accessories is ensured by		WHAT		5
88	the reputation of the supplier		P1/P2/P3	3	
89	the test results from the supplier		P1/P2/P3	3	
90	100% inspection of the trims and accessories		P1/P2/P3	3	

91	*statistical quality control procedures for the trims and accessories*		*P1/P2/P3*	*5*	

PLANNING & CONTROL					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The strategy for planning and control is		WHEN		5
1	*for short term (less than 3 months ahead)*		C1	5	
2	*for medium term (3 to six months ahead)*		C2	3	
3	*for long term (6 months or more ahead)*		C3	3	
	Production planning is carried out		WHO		5
4	*by the planning department in collaboration with other departments*		*C1/C2/C3*	*5*	
5	by the planning department alone		C1/C2/C3	3	
6	by the mother company		C1/C2/C3	3	
7	by the marketing/merchandising department		C1/C2/C3	3	
8	by the director		C1/C2/C3	3	
	Long term production plans (covering 6 months or more ahead) are based on		HOW		10
9	sales forecasts		C3	5	
10	non confirmed orders		C3	3	
11	confirmed orders		C3	5	
12	budgetary expectations		C3	3	
13	XXX (not applicable)		C1/C2	3	
	Production planning and scheduling is carried out		HOW		5
14	manually		C1/C2/C3	3	
15	using a PC based production planning and control (MRP) system		C1/C2/C3	3	
16	*using a company based computerised production planning control system*		*C1/C2/C3*	*5*	
	Once manufacturing order is confirmed, material requirement is planned		HOW		10
17	manually		C1/C2/C3	3	
18	using a computerised MRP system		C1/C2/C3	5	
19	*using just-in-time principle*		*C1/C2/C3*	*5*	
	The probability for changes in order size following order confirmation and prior to start of production is		HOW		5
20	*nil*		*C1/C2/C3*	*5*	
21	less than 25%		C1/C2/C3	5	
22	between 25% to 50%		C1/C2/C3	3	
23	between 50% to 75%		C1/C2/C3	3	
24	more than 75%		C1/C2/C3	3	

	The probability for changes in order size while the order is being manufactured is		HOW		5
25	*nil*		*C1/C2/C3*	*5*	
26	less than 25%		C1/C2/C3	5	
27	between 25% to 50%		C1/C2/C3	3	
28	between 50% to 75%		C1/C2/C3	3	
29	more than 75%		C1/C2/C3	3	
	In the event of changes in order size during production, the production plans are		HOW		5
30	*modified easily*		*C1/C2/C3*	*5*	
31	reviewed with much difficulty		C1/C2/C3	3	
32	are not changed		C1/C2/C3	3	
33	XXX (not applicable)		C1/C2/C3	3	
	Fabrics, trims and accessories are received in the factory		HOW		10
34	well in advance, for stock		C1/C2/C3	3	
35	*on a just-in-time principle*		*C1/C2/C3*	*5*	
36	according to daily work orders		C1/C2/C3	5	
37	based on weekly work orders		C1/C2/C3	5	
38	based on monthly work orders		C1/C2/C3	3	
	Cut order plan is prepared		HOW		5
39	manually		C1/C2/C3	3	
40	*using a pc based software*		*C1/C2/C3*	*5*	
41	using chart spreading		C1/C2/C3	3	
	Production time standards for sewing operations are set up using		HOW		5
42	sample product data		C1/C2/C3	3	
43	company standards data based on past experience		C1/C2/C3	3	
44	method and time studies		C1/C2/C3	3	
45	predetermined motion/time systems (PMTS) data		C1/C2/C3	3	
46	PMTS software		C1/C2/C3	5	
47	*General sewing data software (GSD)*		*C1/C2/C3*	*5*	
	Quality specifications for the finished garments are achieved through the use of		HOW		10
48	100% inspection of finished products		C1/C2/C3	3	
49	*Statistical quality control procedures w.r.t all CMT activities*		*C1/C2/C3*	*5*	
50	acceptance sampling procedures		C1/C2/C3	5	
51	Quality audits for finished garments		C1/C2/C3	3	
52	ISO procedures		C1/C2/C3	5	
	The company usually has production plans for		WHEN		5
53	*one to three months ahead*		*C1*	*5*	
54	three to six months ahead		C2	3	
55	six to nine months ahead		C3	3	

56	nine to twelve months ahead		C3	3	
57	more than twelve months ahead		C3	3	
	The average lead time between customer confirmed order and delivery is usually		WHEN		5
58	*within one month*		*C1*	*5*	
59	between one to three months		C1	3	
60	between three to six months		C1/C2	3	
61	between six to nine months		C2/C3	3	
62	between nine to twelve months		C3	3	
63	more than twelve months		C3	3	
	The average time to deliver the order to the customer by ship is		WHEN		5
64	*less than two weeks*		*C1*	*5*	
65	between two to three weeks		C1	5	
66	between three to four weeks		C1/C2	3	
67	between four to five weeks		C1/C2	3	
68	between five to six weeks		C2/C3	3	
69	more than six weeks		C3	3	
	The average time to deliver the order to the customer by air freight is		WHEN		5
70	*less than two days*		*C1*	*5*	
71	between two to three days		C1	5	
72	between three to four days		C1	5	
73	between four to five days		C1	3	
74	between five to six days		C1	3	
75	more than six days		C1	3	
	The Master Production Schedule (MPS) covers a period of		WHAT		5
76	one week		C1	3	
77	*one to two weeks*		*C1*	*5*	
78	two to three weeks		C1	5	
79	three to four weeks		C1/C2	3	
80	four to five weeks		C1/C2	3	
81	five to six weeks		C1/C2	3	
82	six to seven weeks		C2/C3	3	
83	eight weeks or more		C3	3	
84					
	On average the amount of scrap per order is		WHAT		5
	less than two percent		*C1/C2/C3*	*5*	
85	two to five percent		C1/C2/C3	3	
86	five to eight percent		C1/C2/C3	3	
87	eight to ten percent		C1/C2/C3	3	
88	more than ten percent		C1/C2/C3	3	
	On average the amount of rework per order is		WHAT		5

89	*less than two percent*		*C1/C2/C3*	*5*	
90	two to five percent		C1/C2/C3	3	
91	five to eight percent		C1/C2/C3	3	
92	eight to ten percent		C1/C2/C3	3	
93	more than ten percent		C1/C2/C3	3	
	On average the amount of outgoing defects per order is		WHAT		5
94	*less than two percent*		*C1/C2/C3*	*5*	
95	two to five percent		C1/C2/C3	3	
96	five to eight percent		C1/C2/C3	3	
97	eight to ten percent		C1/C2/C3	3	
98	more than ten percent		C1/C2/C3	3	
	On average the amount of excess fabrics and trims per order is		WHAT		5
99	*less than two percent*		*C1/C2/C3*	*5*	
100	two to five percent		C1/C2/C3	3	
101	five to eight percent		C1/C2/C3	3	
102	eight to ten percent		C1/C2/C3	3	
103	more than ten percent		C1/C2/C3	3	

HUMAN RESOURCE MANAGEMENT					
CODE	**STATEMENT**	**Tick**	**Strategy**	**Score**	**Best Score**
	The strategy for human resource management is		WHAT		15
1	*to maintain and develop an effective workforce*		*H1*	*5*	
2	*to attack or take advantage of cheap labour*		H2	3	
3	*use the carrot and stick principle*		H3	3	
	The number of management levels (hierarchy) in the company is		WHO		5
4	*Two (Director, working teams)*		*H1*	*5*	
5	Three (Director, Managers, Working teams)		H1	5	
6	Four (Director, Managers, Supervisors, Working teams)		H1	3	
7	five (Director, Managers, Supervisors, Foremen, Operators)		H1	3	
	The percentage of indirect labour to direct labour is		WHO		5
8	less than 5%		H2/H3	3	
9	between 5 and 10%		H2/H3	3	
10	*between 10 and 15%*		*H2/H3*	*5*	
11	between 15 and 20%		H2/H3	3	
12	more than 20%		H2/H3	3	
	Operator performance data are collected using		HOW		5
13	bar codes		H1/H2/H3	5	
14	job tickets		H1/H2/H3	3	

15	*real time, on line data collection system*		*H1/H2/H3*	*5*	
	Operator productivity (output to input ratio) in the factory is		HOW		5
16	not assessed		H1/H2/H3	3	
17	assessed manually		H1/H2/H3	3	
18	assessed manually for a production line		H1/H2/H3	3	
19	assessed using a software (line and factory productivity)		H1/H2/H3	5	
20	*assessed using specialised software (individual, line, factory productivity)*		*H1/H2/H3*	*5*	
	To improve the efficiency of the operators, the company invests in		HOW		30
21	*continuously improving the working environment (lighting, cooling, wall painting, housekeeping etc...)*		*H1*	*5*	
22	*providing workers with on the job training*		*H1*	*5*	
23	*providing workers with bonuses and benefits for amount of works completed on a piece rate system*		*H1/H3*	*5*	
24	*providing workers with an ergonomic working environment (chairs, tables, machine orientation etc...based on method studies)*		*H1/H2*	*5*	
25	*the state of the art equipment*		*H1*	*5*	
26	*an effective equipment maintenance system*		*H1*	*5*	
	The company policy for preventing absenteeism is by		HOW		10
27	providing attendance bonus		H2/H3	3	
28	providing production bonus		H2/H3	3	
29	using warning systems		H2/H3	3	
30	*promoting team work (team spirit)*		*H1/H2*	*5*	
31	attending individual problems (communication)		H1/H2	5	
	On average the daily operator absenteeism rate is		WHAT		5
32	*less than 5%*		*H1/H2/H3*	*5*	
33	between 5 and 10%		H1/H2/H3	3	
34	between 10 and 15%		H1/H2/H3	3	
35	between 15 and 20%		H1/H2/H3	3	
36	more than 20%		H1/H2/H3	3	
	The annual direct labour turnover is		WHAT		5
37	*less than 5%*		*H1/H2/H3*	*5*	
38	between 5 and 10%		H1/H2/H3	3	
39	between 10 and 15%		H1/H2/H3	3	
40	between 15 and 20%		H1/H2/H3	3	
41	more than 20%		H1/H2/H3	3	
	The annual indirect labour turnover is		WHAT		5
42	*less than 5%*		*H1/H2/H3*	*5*	

43	between 5 and 10%		H1/H2/H3	3	
44	between 10 and 15%		H1/H2/H3	3	
45	between 15 and 20%		H1/H2/H3	3	
46	more than 20%		H1/H2/H3	3	
	Motivation programmes for the operators include		WHAT		35
47	*organised indoor and outdoor activities (games, sports, picnics etc...)*		*H1/H2*	*5*	
48	*production related bonus schemes*		*H1/H2*	*5*	
49	*award competitions (best operator, team, team leader etc...)*		*H1/H2*	*5*	
50	*regular on the job training programmes*		*H1*	*5*	
51	*regular out of the job training programmes*		*H1*	*5*	
52	*fair and wide scope promotion*		*H1*	*5*	
53	*opportunities for changing jobs and responsibilities*		*H1*	*5*	
	The percentage of foreign labour in the company is		WHAT		5
54	*nil*		*H1/H2/H3*	*5*	
55	up to 10%		H1/H2/H3	5	
56	between 10 and 20%		H1/H2/H3	3	
57	between 20 and 30%		H1/H2/H3	3	
58	between 30 and 40%		H1/H2/H3	3	
59	between 40 and 50%		H1/H2/H3	3	
60	more than 50%		H1/H2/H3	3	
	The purpose of recruiting foreign labour is		WHY		10
61	*to cope with unavailability of skilled local labour*		*H1/H2/H3*	*5*	
62	*to cope with increasing cost of local labour*		*H1/H2/H3*	*5*	
63	*to cope with lower productivity of local labour*		*H1/H2/H3*	*3*	

FINANCE AND ACCOUNTING					
CODE	**STATEMENT**	***Tick***	***Strategy***	***Score***	***Best Score***
	The finance strategy is to		WHAT		14
1	*promote new investment and expansion*		*F1*	*5*	
2	*promote company reputation*		*F2*	*5*	
3	*limit expenses*		F3	4	
	On average the percentage of order delivered by surface (by ship) is		HOW		5
4	*100%*		*F3*	*3*	
5	about 90%		F3	3	
6	about 80%		F3	3	
7	about 70%		F3	3	
8	about 60%		F3	3	
9	about 50%		F3	5	

10	less than 50%		F3	5	
	On average percentage of order delivered by air freight is		HOW		5
11	*less than 10%*		*F2*	*3*	
12	about 20%		F2	3	
13	about 30%		F2	3	
14	about 40%		F2	3	
15	about 50%		F2	5	
16	more than 50%		F2	5	
	The wage payment system for machine operators is		HOW		5
17	the hourly wage system		F3	5	
18	the piece rate wage system with single base rate		F3	3	
19	*the piece rate wage system with variable base rate*		*F1/F2*	*3*	
	Information is monitored by the Finance and Accounting department by using		HOW		5
20	a manual system		F3	3	
21	a pc based system		F3	3	
22	*a network based accounting software*		*F1/F2*	*5*	
	The average time to process and ship orders, after manufacturing is complete, is		WHEN		5
23	*less than one week*		*F2*	*5*	
24	between one and two weeks		F2	3	
25	between two and three weeks		F3	3	
26	more than three weeks		F3	3	
	The percentage of sales earnings invested in plant and equipment is		WHAT		5
27	less than 5%		F1	3	
28	between 5 and 10%		F1	5	
29	between 10 and 15%		F1	5	
30	between 15 and 20%		F1	5	
31	between 20 and 25%		F1	5	
32	*more than 25%*		*F1*	*5*	
	The shipping cost as a percentage of order cost is		WHAT		5
33	*less than 5%*		*F2*	*5*	
34	between 5 and 10%		F2	5	
35	between 10 and 15%		F2	3	
36	between 15 and 20%		F2	3	
37	between 20 and 25%		F2	3	
38	more than 25%		F2	3	
	The air freight cost as a percentage of order cost is		WHAT		

39	*less than 5%*		*F2*	*5*	
40	between 5 and 10%		F2	5	
41	between 10 and 15%		F2	3	
42	between 15 and 20%		F2	3	
43	between 20 and 25%		F2	3	
44	more than 25%		F2	3	
	The percentage of orders meeting on time shipments is		WHAT		5
45	*more than 95%*		*F2*	*5*	
46	between 90 and 95%		F2	3	
47	between 85 and 90%		F2	3	
48	between 80 and 85%		F2	3	
49	less than 80%		F2	3	
	Investment decisions on plant and equipment are based on		WHAT		33
50	*long term production plans*		*F1*	*5*	
51	*the quest to improve productivity by replacing worn out and obsolete equipment*		*F1*	*5*	
52	*the quest to expand production capacity*		*F1*	*5*	
53	*the quest to improve quality*		*F1*	*5*	
54	*the quest to produce new product lines*		*F1*	*5*	
55	*the quest to improve safety and environmental factors*		*F1*	*5*	
56	*the availability of enough capital (sales revenue and/or through borrowing)*		*F1*	*3*	
	The percentage cost of direct labour per order is		WHAT		5
57	*less than 10%*		*F3*	*5*	
58	between 10 and 20%		F3	5	
59	between 20 and 30%		F3	3	
60	between 30 and 40%		F3	3	
61	more than 40%		F3	3	
	The percentage cost of indirect labour per order is		WHAT		5
62	*less than 10%*		*F3*	*5*	
63	between 10 and 20%		F3	3	
64	between 20 and 30%		F3	3	
65	between 30 and 40%		F3	3	
66	more than 40%		F3	3	
	The percentage of fabric and trims cost per order is		WHAT		4
67	*less than 20%*		*F3*	*3*	
68	between 20 and 30%		F3	3	
69	between 30 and 40%		F3	5	
70	between 40 and 50%		F3	5	
71	more than 50%		F3	3	

	The percentage of other costs (building, electricity, logistics, etc...) per order is		WHAT		5
72	*less than 20%*		*F3*	*5*	
73	between 20 and 30%		F3	3	
74	between 30 and 40%		F3	3	
75	between 40 and 50%		F3	3	
76	more than 50%		F3	3	
	The percentage of turnover spend on training of direct labour annually is		WHAT		5
77	less than 5%		F2/F3	3	
78	between 5 and 10%		F2/F3	5	
79	between 10 and 15%		F2/F3	5	
80	between 15 and 20%		F2/F3	3	
81	more than 20%		F2/F3	3	
	The percentage of turnover spent on training of indirect labour annually is		WHAT		5
82	less than 5%		F2/F3	3	
83	between 5 and 10%		F2/F3	5	
84	between 10 and 15%		F2/F3	5	
85	between 15 and 20%		F2/F3	3	
86	*more than 20%*		*F2/F3*	*3*	
	Over the last two years the company		WHAT		5
87	*has seen its profit margin increasing*		*F1*	*5*	
88	has seen its profit margin stable		F1	3	
89	has seen its profit margin decreasing		F1	3	

Appendix F

Audit Results for Case Study Companies

The detailed results for the Low Cost, High Value Added and Quick Response strategy companies are given in the following pages. The table below represents a summary of the functional strategies for each of the companies.

Functional Strategies	Low Cost Strategy Company	High Value Added Strategy Company	Quick Response Strategy Company
Marketing Strategy			
M1: to use the marketing department (including that in the company's home country)	✔	✔	✔
M2: to use a local/overseas agent	✔		
M3: to use the customer for marketing the product			
Product Design and Development Strategy			
D1: to obtain the design from the customer			
D2: to produce the designs using in-house expertise only (including experts from mother company, if applicable)			
D3: to work out the design as a joint effort between the customer and the PD&D department	✔	✔	✔
D4: to subcontract the design activity to a design agent			
Planning and Control Strategy			
C1: for short term (less than 3 months ahead)			
C2: for medium term (3 to six months ahead)	✔		
C3: for long term (6 months or more ahead)		✔	✔
Purchasing and Inventory			
P1: to use single sourcing without strategic partnership relationship			
P2: to use multiple sourcing			✔
P3: to allow for supplier/customer integration	✔	✔	
Cut, Make and Trim Strategy			
A1: to have long run production			
A2: to have batch production	✔		✔
A3: to have short run production		✔	
Human Resource Management			
H1: to maintain and develop an effective workforce	✔		✔
H2: to attack or take advantage of cheap labour			
H3: use the carrot and stick principle		✔	
Finance and Accounting			
F1: promote new investment and expansion			✔
F2: promote company reputation			
F3: limit expenses	✔	✔	

Marketing Strategy M1

"to use the marketing department (including that in the company's home country)"

	Statements	Score Total	Score Best
2	**The product is marketed**	3	5
	To wholesalers		
3	**Data transfer between the company and the customer is effected via**	11	18
	Telephone		
	Fax		
	Email		
4	**The main areas of activity for the marketing department include**	6	38
	Participation in fashion/trade shows		
	Participation in promotion and advertising campaigns		
5	**Marketing is done (please tick any four)**	18	15
	using previous designs		
	using new designs (proposed samples)		
	through government/parastatal/non government organisations		
	using the brand name		
6	**The percentage of annual turnover spent on marketing is**	3	5
	Between 6% and 10%		
7	**The average lead time for marketing (start of process to confirmed order from**	3	5
	between three to six months		
8	**The product/customer/country combination aimed at by the marketing function for**	9	5
	similar products, different customers, different country		
	different products, same customers, same country		
	different products, different customers, different country		
9	**The product/customer/country combination served by the company over the past**	6	5

	Statements	Score Total	Score Best
	similar products, different customers, different country		
	different products, different customers, different country		
10	**Over the past two years**	12	9
	there has been increasing pressure on design features		
	there has been increasing pressure on lead time reduction		
	there has been increasing pressure on order size reduction		
	there has been increasing pressures on price reduction		
11	**The market category serviced by the company is**	6	5
	Independent and Specialised Stores (moderate price, high quality, low variety, high volume)		
	Department Store and Retail Chains (moderate price, good quality, low variety, high volume)		
12	**The product marketed can be classified as being**	8	5
	basic garments (non seasonal, limited change in style over a year)		
	fashion garments (usually seasonal garments, however, requiring frequent change in styling)		
13	**Marketing is conducted for**	3	5
	make to stock		
14	**The company accepts**	3	5
	Orders for specific products without possibilities for change once manufacturing starts		
15	**The order size (number of pieces per order) marketed is**	5	5
	of the order of tens of thousands		
16	**The competitive advantage of the company vis-à-vis its immediate competitors is**	25	30
	Product quality		
	Delivery reliability		
	Manufacturing flexibility		
	Productivity level		
	Industrial infrastructure		
17	**On average, the percentage amount of products sold at mark down prices is**	5	5
	Less than 5%		
18	**The current marketing strategy is adopted because**	8	10

Statements	Score	
	Total	Best
it is most competitive		
of time constraints		

Marketing Strategy M2

"to use a local/overeseas agent"

	Statements	Score Total	Score Best
1	**The marketing strategy is**	3	5
	to use a local/overeseas agent		
2	**The product is marketed**	3	5
	To sales agents		
6	**The percentage of annual turnover spent on marketing is**	3	5
	Between 6% and 10%		
7	**The average lead time for marketing (start of process to confirmed order from**	3	5
	between three to six months		

Design And Development Strategy D3 "to work out the design as a joint effort between the customer and the PD&D department"			
	Statements	Score Total	Score Best
1	**The strategy for product design and development is**	5	5
	to work out the design as a joint effort between the customer and the PD&D department		
2	**The extent of involvement of the customer in the product design process is:**	5	5
	the customer actively participates in the design process		
3	**In addtion to PD&D department, the other departments actively involved in the**	25	30
	Sales and Marketing		
	Planning and Control		
	Manufacturing (CMT)		
	Finance and Accounting		
	Human Resource Management (Personnel)		
4	**Data tansfer between the PD&D department and the departments actively involved**	13	15
	Informal meeting		
	E-mail		
	Local area network (company information system)		
5	**The fabric design is obtained from**	5	5
	In-house designers		
7	**Garment patterns (graded) are**	3	5
	in house manually		
8	**Fabric design is carried out using**	8	5
	a manual system (hand sketch)		
	specialised fabric design software		
9	**The garment design process involves the extensive use of**	8	26
	Point of sale data		
	End of season sales data		

	Statements	Score Total	Score Best
10	**Aspects of garment serviceability which are most emphasized upon during the**	13	24
	Durabilty		
	Creativity/Innovation		
	Uniqueness		
11	**In making garment choices manufactured by the company, end users mostly focus**	20	30
	Brand name		
	Creativity in design		
	Uniqueness of design		
	Styling		
12	**Cost estimates for the garment are worked out**	11	18
	based on past experience		
	based on customer expectations		
	based on competitor prices		
13	**The lead time for agreeing upon a fabric design with the customer is**	3	5
	between two to three weeks		
14	**The average lead time for the design of a new product is (from sample request to**	3	5
	more than twenty days		
15	**Design of a product line involves**	8	19
	designing completely different products		
	preparing cost estimates (quotations) for manufacturing the product		
16	**Product design is evaluated against market place requirements through the use of**	13	14
	Market Surveys		
	Product sales rate data		
	Fashion/trade shows		
17	**The differentiation features of the product vis a vis those proposed by competitors**	13	20
	the price		
	the quality		
	the styling		

	Statements	Score Total	Score Best
18	**The present strategy for PD&D is adopted because**	5	5
	it is most competitive		

Planning And Controlling Strategy C2 "for medium term (3 to six months ahead)"			
		Score	
	Statements	Total	Best
1	The strategy for planning and control is	3	5
	for medium term (3 to six months ahead)		
2	Production planning is carried out	5	5
	by the planning department in collaboration with other departments		
4	Production planning and scheduling is carried out	3	5
	manually		
5	Once manufacturing order is confirmed, material requirement is planned	8	5
	manually		
	using just-in-time principle		
6	The probability for changes in order size following order confirmation and prior to	5	5
	nil		
7	The probability for changes in order size while the order is being manufactured is	5	5
	nil		
8	In the event of changes in order size during production, the production plans are	3	5
	XXX (not applicable)		
9	Fabrics, trims and accessories are received in the factory	5	5
	on a just-in-time principle		
10	Cut order plan is prepared	5	5
	using a pc based software		
11	Production time standards for sewing operations are set up using	3	5
	company standards data based on past experience		
12	Quality specifications for the finished garments are achieved through the use of	9	5
	100% inspection of finished products		
	acceptance sampling procedures		

Quality audits for finished garments

Statements		Score Total	Score Best
13	The company usually has production plans for	3	5
	three to six months ahead		
14	The average lead time between customer confirmed order and delivery is usually	3	5
	between three to six months		
15	The average time to deliver the order to the custormer by ship is	3	5
	between three to four weeks		
17	The Master Production Schedule (MPS) covers a period of	3	5
	three to four weeks		
18	On average the amount of scrap per order is	5	5
	less than two percent		
19	On average the amount of rework per order is	3	5
	five to eight percent		
20	On average the amount of outgoing defects per order is	5	5
	less than two percent		
21	On average the amount of excess fabrics and trims per order is	5	5
	less than two percent		

Purchasing And Inventory Strategy P3 "to allow for supplier/customer integration"			
	Statements	**Score**	
		Total	**Best**
1	**The purchasing strategy is**	5	5
	to allow for supplier/customer integration		
6	**Fabric from the supplier is mostly obtained**	3	5
	in batches as and when requested by the company		
7	**Trims and accessories are purchased**	3	5
	in batches as and when requested by the company		
8	**Data transfer between the company and the fabric supplier is via**	6	17
	Telephone		
	Fax		
9	**Data transfer between the company and the T&A supplier is via**	6	17
	Telephone		
	Fax		
10	**Purchasing is carried out**	8	10
	manually (use of purchase order forms)		
	through the use of a company based computerised inventory control system		
11	**The inventory control system is**	5	5
	Company computerised system on a local area network		
12	**Inventory control is determined**	3	5
	as and when materials are needed		
13	**On average, the lead time for obtaining the fabric is**	5	5
	less than three weeks		
14	**On average the lead time to obtain the trim and accessories is**	5	5
	less than three weeks		
15	**On average, prior to production, the fabric is stored over a period of**	3	5

	Statements	Score Total	Score Best
	more than four weeks		
16	**On average, the trims and accessories are stored over a period of**	3	5
	three to four weeks		
17	**On average, following manufacture, the finished garment is shipped within**	5	5
	one week		
18	**The quality of the incoming fabric is ensured by**	3	5
	the reputation of the supplier		
19	**The quality of the incoming trims and accessories is ensured by**	3	5
	the reputation of the supplier		

Cut And Make Strategy A2
"to have batch production"

	Statements	Score Total	Score Best
1	**The CMT strategy is**	3	5
	to have batch production		
2	**In the CMT department, the ratio of machine operators to**	5	30
	foremen is (30)		
3	**Method study and work measurement is conducted by**	3	5
	experienced workers		
4	**The actual layout of the factory is**	5	5
	functional or process-oriented layout		
5	**The material handling system used is the**	3	5
	manual rail system		
6	**Marker making is performed**	5	5
	using a CAD system		
7	**The percentage of defective order due to poor marking is**	5	5
	less than 5%		
8	**Spreading is done**	3	5
	manually		
9	**The cutting room involves**	3	5
	the use of band knives		
10	**Transfer marks on cut fabrics are obtained by using**	3	4
	manual systems		
11	**Fusing is carried out using**	5	5
	flat-bed presses		
12	**Machines used for the assembly of apparels are**	10	5
	semi automatic with control devices		

	Statements	Score Total	Score Best
	fully automatic		
13	**Pressing is done using**	8	5
	buck press		
	iron press		
14	**Line balancing is performed**	3	12
	manually		
15	**The production line layout is**	8	5
	reviewed and reset for each manufacturing order		
	is reviewed and reset in the event of line balancing problems		
16	**To establish production standards work study (Method Study & Work Measurement)**	3	5
	only at the start of manufacture of each order		
17	**The product(s) most often manufactured by the company include**	5	5
	Denim Wear		
18	**The percentage of fabric defect is**	3	5
	between 2% to 4%		
19	**The percentage of defects arising from wrong transfer marks is**	5	5
	less than 2%		
20	**The amount of waste produced duirng cutting operation is**	3	5
	between 2% and 4%		
21	**The percentage of defects attributed to the fusing operation is**	5	5
	less than 2%		
22	**The percentage of defects due to incorrectly formed stitches**	5	5
	less than 2%		

Human Resource Management Strategy H1
"to maintain and develop an effective workforce"

	Statements	Score Total	Score Best
1	**The strategy for human resource management is**	5	5
	to maintain and develop an effective workforce		
2	**The number of management levels (hierarchy) in the company is**	3	5
	five (Director, Managars, Supervisors, Foremen, Operators)		
4	**Operator performance data are collected using**	5	5
	bar codes		
5	**Operator productivity (output to input ratio) in the factory is**	5	5
	asseessed using a software (line and factory productivity)		
6	**To improve the efficiency of the operators, the company invests in**	20	30
	the state of the art equipment		
	an effective equipment maintenance system		
	continuously improving the working environment (lighting, cooling, wall painting, housekeeping etc...)		
	providing workers with bonuses and benefits for amount of works completed on a piece rate system		
8	**On average the daily operator absenteeism rate is**	3	5
	between 5 and 10%		
9	**The annual direct labour turnover is**	3	5
	between 10 and 15%		
10	**The annual indirect labour turnover is**	5	5
	less than 5%		
11	**Motivation programmes for the operators include**	5	35
	production related bonus schemes		
12	**The percentage of foreign labour in the company is**	3	5
	between 30 and 40%		

Statements		Score	
		Total	Best
13	**The purpose of recruiting foreign labour is**	10	10
	to cope with unavailability of skilled local labour		
	to cope with increasing cost of local labour		

Finance and Accounting Strategy F3
"limit expenses"

	Statements	Score Total	Score Best
1	**The finance strategy is to**	3	5
	limit expenses		
2	**On average the percentage of order delivered by surface (by ship) is**	3	4
	about 90%		
3	**On average the percentage of order delivered by air freight is**	3	5
	less than 50%		
4	**The wage payment system for machine operators is**	3	5
	the piece rate wage system with single base rate		
5	**Information is monitored by the Finance and Accounting department**	3	5
	a pc based system		
12	**The percentage cost of direct labour per order is**	3	5
	between 20 and 30%		
13	**The percentage cost of indirect labour per order is**	3	5
	between 10 and 20%		
14	**The percentage of fabric and trims cost per order is**	5	5
	less than 20%		
15	**The percentage of other costs (building, electricity, logistics, etc...)**	5	4
	less than 20%		
16	**The percentage of turnover spend on training of direct labour annually**	3	5
	less than 5%		
17	**The percentage of turnover spent on training of indirect labour**	3	5
	less than 5%		
18	**Over the last two years the company**	3	5
	has seen its profit margin stable		

Marketing Strategy M1

"to use the marketing department (including that in the company's home country)"

	Statements	Score Total	Score Best
1	**The marketing strategy is**	5	5
	to use the marketing department (including that in the company's home country)		
2	**The product is marketed**	3	5
	To wholesalers		
3	**Data transfer between the company and the customer is effected via**	3	18
	Email		
4	**The main areas of activity for the marketing department include**	10	38
	Marketing research for identifying new customers and customer needs		
	Marketing research for identifying new channels of distribution		
5	**Marketing is done (please tick any four)**	5	15
	using new designs (proposed samples)		
7	**The average lead time for marketing (start of process to confirmed order from**	3	5
	between one to three months		
8	**The product/customer/country combination aimed at by the marketing function for**	6	5
	similar products, different customers, different country		
	different products, same customers, same country		
9	**The product/customer/country combination served by the company over the past**	6	5
	similar products, same customers, same country		
	different products, same customers, same country		
10	**Over the past two years**	3	9
	there has been increasing pressure on quality of products		
11	**The market category serviced by the company is**	6	5
	Independent and Specialised Stores (moderate price, high quality, low variety, high volume)		

	Statements	Score Total	Score Best
	Department Store and Retail Chains (moderate price, good quality, low variety, high volume)		
12	**The product marketed can be classified as being**	3	5
	basic garments (non seasonal, limited change in style over a year)		
13	**Marketing is conducted for**	8	5
	design and CMT operations		
	make to order only		
14	**The company accepts**	3	5
	Orders for specific products with possibilities for minor design changes linked with CMT operations		
15	**The order size (number of pieces per order) marketed is**	5	5
	of the order of a few thousands		
16	**The competitive advantage of the company vis-à-vis its immediate competitors is**	25	30
	Product quality		
	Delivery reliability		
	Manufacturing flexibility		
	Industrial infrastructure		
	lead time		
17	**On average, the percentage amount of products sold at mark down prices is**	5	5
	Less than 5%		
18	**The current marketing strategy is adopted because**	5	10
	it is most competitive		

Design And Development Strategy D3

"to work out the design as a joint effort between the customer and the PD&D department"

	Statements	Score Total	Score Best
1	**The strategy for product design and development is**	5	5
	to work out the design as a joint effort between the customer and the PD&D department		
2	**The extent of involvement of the customer in the product design process is:**	5	5
	the customer actively participates in the design process		
3	**In addtion to PD&D department, the other departments actively involved in the**	5	30
	Sales and Marketing		
4	**Data tansfer between the PD&D department and the departments actively involved**	3	15
	Formal meeting		
5	**The fabric design is obtained from**	5	5
	In-house designers		
7	**Garment patterns (graded) are**	5	5
	produced in house using a CAD system		
8	**Fabric design is carried out using**	5	5
	specialised fabric design software		
9	**The garment design process involves the extensive use of**	5	26
	Specialised apparel design systems (CAD, Electronic sketching systems, template programmes)		
10	**Aspects of garment serviceability which are most emphasized upon during the**	3	24
	XXX (Don't know)		
11	**In making garment choices manufactured by the company, end users mostly focus**	3	30
	XXX (Don't know)		
12	**Cost estimates for the garment are worked out**	8	18
	based on past experience		
	based on customer expectations		

	Statements	Score	
		Total	**Best**
13	**The lead time for agreeing upon a fabric design with the customer is**	3	5
	between one to two weeks		
14	**The average lead time for the design of a new product is (from sample request to**	3	5
	between five and ten days		
15	**Design of a product line involves**	8	19
	designing completely different products		
	preparing cost estimates (quotations) for manufacturing the product		
16	**Product design is evaluated against market place requirements through the use of**	3	14
	XXX (None of the above, Don't know)		
17	**The differentiation features of the product vis a vis those proposed by competitors**	3	20
	XXX (Don't know)		

Planning And Controlling Strategy C3

"for long term (6 months or more ahead)"

	Statements	Score	
		Total	Best
1	The strategy for planning and control is	3	5
	for long term (6 months or more ahead)		
2	Production planning is carried out	3	5
	by the marketing/merchandising department		
3	Long term production plans (covering 6 months or more ahead) are based on	5	10
	confirmed orders		
4	Production planning and scheduling is carried out	3	5
	using a PC based production planning and control (MRP) system		
5	Once manufacturing order is confirmed, material requirement is planned	5	5
	using a computerised MRP system		
6	The probability for changes in order size following order confirmation and prior to	3	5
	less than 25%		
7	The probability for changes in order size while the order is being manufactured is	5	5
	nil		
8	In the event of changes in order size during production, the production plans are	3	5
	are not changed		
9	Fabrics, trims and accessories are received in the factory	3	5
	based on monthly work orders		
10	Cut order plan is prepared	5	5
	using a pc based software		
11	Production time standards for sewing operations are set up using	5	5
	General sewing data software (GSD)		
12	Quality specifications for the finished garments are achieved through the use of	3	5
	Quality audits for finished garments		
13	The company usually has production plans for	3	5

	Statements	Score Total	Score Best
	nine to twelve months ahead		
15	**The average time to deliver the order to the custormer by ship is**	3	5
	between five to six weeks		
18	**On average the amount of scrap per order is**	3	5
	two to five percent		
19	**On average the amount of rework per order is**	5	5
	less than two percent		
20	**On average the amount of outgoing defects per order is**	5	5
	less than two percent		
21	**On average the amount of excess fabrics and trims per order is**	5	5
	less than two percent		

Purchasing And Inventory Strategy P3
"to allow for supplier/customer integration"

	Statements	Score Total	Score Best
1	**The purchasing strategy is**	5	5
	to allow for supplier/customer integration		
2	**The sourcing strategy for fabrics is**	5	5
	through a partnership relationship with specific supplier(s)		
6	**Fabric from the supplier is mostly obtained**	5	5
	on a just-in-time principle		
9	**Data transfer between the company and the T&A supplier is via**	14	17
	Telephone		
	Fax		
	Electronic Data Interchange		
	E-mail		
10	**Purchasing is carried out**	5	10
	through the use of a company based computerised inventory control system		
11	**The inventory control system is**	5	5
	Company computerised system on a local area network		
12	**Inventory control is determined**	5	5
	using the just-in-time principle		
13	**On average, the lead time for obtaining the fabric is**	5	5
	less than three weeks		
14	**On average the lead time to obtain the trim and accessories is**	5	5
	less than three weeks		
15	**On average, prior to production, the fabric is stored over a period of**	5	5
	one week		
16	**On average, the trims and accessories are stored over a period of**	3	5

	Statements	Score Total	Score Best
	two to three weeks		
17	**On average, following manufacture, the finished garment is shipped within**	3	5
	one to two weeks		
18	**The quality of the incoming fabric is ensured by**	5	5
	sample testing of the fabric		
19	**The quality of the incoming trims and accessories is ensured by**	5	5
	the test results from the supplier		

Cut And Make Strategy A3 "to have short run production"			
	Statements	**Score**	
		Total	**Best**
1	**The CMT strategy is**	5	5
	to have short run production		
3	**Method study and work measurement is conducted by**	3	5
	trained personnel		
6	**Marker making is performed**	5	5
	using a CAD/CAM system (Digitised system)		
7	**The percentage of defective order due to poor marking is**	5	5
	less than 5%		
8	**Spreading is done**	5	5
	using automated spreading machine with fabric control devices(tension.position, end treatment)		
9	**The cutting room involves**	5	5
	computer controlled cutting (CAD/CAM system)		
12	**Machines used for the assembly of apparels are**	5	5
	fully automatic		
13	**Pressing is done using**	3	5
	steamers		
14	**Line balancing is performed**	3	5
	manually		
15	**The production line layout is**	5	5
	reviewed and reset for each manufacturing order		
16	**To establish production standards work study (Method Study & Work**	5	5
	on a regular basis during production		
17	**The product(s) most often manufactured by the company include**	5	5
	T-shirts		

Statements		Score	
		Total	Best
18	The percentage of fabric defect is	5	5
	less than 2%		
19	The percentage of defects arising from wrong transfer marks is	5	5
	less than 2%		
20	The amount of waste produced duirng cutting operation is	5	5
	less than 2%		
21	The percentage of defects attributed to the fusing operation is	5	5
	less than 2%		
22	The percentage of defects due to incorrectly formed stitches	5	5
	less than 2%		

Human Resource Management Strategy H3

"use the carrot and stick principle"

	Statements	Score Total	Score Best
1	**The strategy for human resource management is**	3	5
	use the carrot and stick principle		
3	**The percentage of indirect labour to direct labour is**	3	5
	less than 5%		
4	**Operator performance data are collected using**	3	5
	job tickets		
5	**Operator productivity (output to input ratio) in the factory is**	3	5
	assessed manually		
6	**To improve the efficiency of the operators, the company invests in**	5	30
	providing workers with bonuses and benefits for amount of works completed on a piece rate system		
7	**The company policy for preventing absenteeism is by**	3	5
	providing attendence bonus		
8	**On average the daily operator absenteeism rate is**	3	5
	between 5 and 10%		
9	**The annual direct labour turnover is**	3	5
	between 5 and 10%		
10	**The annual indirect labour turnover is**	3	5
	between 5 and 10%		
12	**The percentage of foreign labour in the company is**	3	5
	between 30 and 40%		
13	**The purpose of recruiting foreign labour is**	3	10
	to cope with lower productivity of local labour		

Finance and Accounting Strategy F3
"limit expenses"

	Statements	Score Total	Score Best
2	**On average the percentage of order delivered by surface (by ship) is**	3	4
	about 70%		
3	**On average the percentage of order delivered by air freight is**	3	5
	less than 50%		
4	**The wage payment system for machine operators is**	6	5
	the hourly wage system		
	the piece rate wage system with single base rate		
5	**Information is monitored by the Finance and Accounting department**	3	5
	a pc based system		
12	**The percentage cost of direct labour per order is**	3	5
	more than 40%		
13	**The percentage cost of indirect labour per order is**	3	5
	between 10 and 20%		
14	**The percentage of fabric and trims cost per order is**	5	5
	less than 20%		
15	**The percentage of other costs (building, electricity, logistics, etc...)**	5	4
	less than 20%		
16	**The percentage of turnover spend on training of direct labour annually**	3	5
	between 5 and 10%		
17	**The percentage of turnover spent on training of indirect labour**	3	5
	less than 5%		
18	**Over the last two years the company**	3	5
	has seen its profit margin decreasing		

Marketing Strategy M1

"to use the marketing department (including that in the company's home country)"

	Statements	Score Total	Score Best
1	**The marketing strategy is**	5	5
	to use the marketing department (including that in the company's home country)		
3	**Data transfer between the company and the customer is effected via**	9	18
	Telephone		
	Fax		
	Email		
4	**The main areas of activity for the marketing department include**	11	38
	Organisation of fashion/trade shows		
	Working on short term marketing plans		
	Working on long term marketing plans		
5	**Marketing is done (please tick any four)**	18	15
	using new designs (proposed samples)		
	using the company reputation		
	using personal contacts		
	using the brand name		
6	**The percentage of annual turnover spent on marketing is**	3	5
	XXX (don't know)		
7	**The average lead time for marketing (start of process to confirmed order from**	3	5
	between six months to one year		
8	**The product/customer/country combination aimed at by the marketing function for**	13	5
	similar products, same customers, same country		
	similar products, different customers, same country		
	similar products, different customers, different country		

Statements		Score Total	Score Best
9	**The product/customer/country combination served by the company over the past**	13	5
	similar products, same customers, same country		
	similar products, different customers, same country		
	similar products, different customers, different country		
10	**Over the past two years**	12	9
	there has been increasing pressure on quality of products		
	there has been increasing pressure on lead time reduction		
	there has been increasing pressure on order size reduction		
	there has been increasing pressures on price reduction		
11	**The market category serviced by the company is**	8	5
	Designer Wears (high price, high quality, stylish design, high variety, low volume)		
	Independent and Specialised Stores (moderate price, high quality, low variety, high volume)		
12	**The product marketed can be classified as being**	8	5
	on-going garments (non seasonal, stable demand throughout the year)		
	fashion garments (usually seasonal garments, however, requiring frequent change in styling)		
13	**Marketing is conducted for**	3	5
	make to order only		
14	**The company accepts**	3	5
	Orders for specific products with possibilities for minor design changes linked with CMT operations		
15	**The order size (number of pieces per order) marketed is**	5	5
	of the order of a few thousands		
16	**The competitive advantage of the company vis-à-vis its immediate competitors is**	20	30
	Product quality		
	Product design		
	Delivery reliability		
	lead time		
17	**On average, the percentage amount of products sold at mark down prices is**	5	5
	Less than 5%		

Statements		Score	
		Total	Best
18	The current marketing strategy is adopted because it has paid off over the past	5	10

Design And Development Strategy D3

"to work out the design as a joint effort between the customer and the PD&D department"

	Statements	Score Total	Score Best
1	**The strategy for product design and development is**	5	5
	to work out the design as a joint effort between the customer and the PD&D department		
2	**The extent of involvement of the customer in the product design process is:**	5	5
	the customer actively participates in the design process		
3	**In addtion to PD&D department, the other departments actively involved in the**	20	30
	Sales and Marketing		
	Planning and Control		
	Purchasing and Inventory		
	Manufacturing (CMT)		
4	**Data tansfer between the PD&D department and the departments actively involved**	6	15
	Formal meeting		
	E-mail		
6	**Garment specifications are**	5	5
	worked between customer and PD&D department		
7	**Garment patterns (graded) are**	3	5
	produced in house using a CAD system		
9	**The garment design process involves the extensive use of**	3	26
	XXX (None of the above)		
10	**Aspects of garment serviceability which are most emphasized upon during the**	18	24
	Comfort		
	Durabilty		
	Creativity/Innovation		
	Uniqueness		
11	**In making garment choices manufactured by the company, end users mostly focus**	46	30

	Statements	Score Total	Score Best
	Styling		
	Fabrics		
	Price		
	Brand name		
	Product presentation		
	Creativity in design		
	Uniqueness of design		
	Durabilty		
	Stability		
	Aesthetics		
12	**Cost estimates for the garment are worked out**	11	18
	based on past experience		
	based on customer expectations		
	based on competitor prices		
13	**The lead time for agreeing upon a fabric design with the customer is**	3	5
	between one to two weeks		
14	**The average lead time for the design of a new product is (from sample request to**	3	5
	between five and ten days		
15	**Design of a product line involves**	5	19
	adding differentiation features to past designs		
16	**Product design is evaluated against market place requirements through the use of**	3	14
	Product sales rate data		
17	**The differentiation features of the product vis a vis those proposed by competitors**	8	20
	the price		
	the quality		
18	**The present strategy for PD&D is adopted because**	5	5
	it is most competitive		

Planning And Controlling Strategy C2
"for medium term (3 to six months ahead)"

	Statements	Score Total	Score Best
1	**The strategy for planning and control is**	3	5
	for medium term (3 to six months ahead)		
2	**Production planning is carried out**	5	5
	by the planning department in collaboration with other departments		
4	**Production planning and scheduling is carried out**	3	5
	manually		
5	**Once manufacturing order is confirmed, material requirement is planned**	5	5
	using a computerised MRP system		
6	**The probability for changes in order size following order confirmation and prior to**	5	5
	less than 25%		
7	**The probability for changes in order size while the order is being manufactured is**	5	5
	nil		
8	**In the event of changes in order size during production, the production plans are**	5	5
	modified easily		
9	**Fabrics, trims and accessories are received in the factory**	5	5
	based on weekly work orders		
10	**Cut order plan is prepared**	5	5
	using a pc based software		
11	**Production time standards for sewing operations are set up using**	3	5
	method and time studies		
12	**Quality specifications for the finished garments are achieved through the use of**	3	5
	100% inspection of finished products		
15	**The average time to deliver the order to the curstomer by ship is**	3	5
	between four to five weeks		
17	**The Master Production Schedule (MPS) covers a period of**	3	5

	Statements	Score	
		Total	Best
	three to four weeks		
18	**On average the amount of scrap per order is**	5	5
	less than two percent		
19	**On average the amount of rework per order is**	5	5
	less than two percent		
20	**On average the amount of outgoing defects per order is**	5	5
	less than two percent		
21	**On average the amount of excess fabrics and trims per order is**	3	5
	two to five percent		

Purchasing And Inventory Strategy P2
"to use mulitple sourcing"

	Statements	Score Total	Score Best
1	**The purchasing strategy is**	3	5
	to use mulitple sourcing		
3	**The sourcing strategy for trims and accessories (T&A) is**	3	5
	to compare quotations from local and overseas suppliers and select best		
6	**Fabric from the supplier is mostly obtained**	3	5
	in bulk for the complete order		
7	**Trims and accessories are purchased**	3	5
	in bulk for the complete order		
8	**Data transfer between the company and the fabric supplier is via**	11	17
	Telephone		
	Fax		
	Electronic Data Interchange		
9	**Data transfer between the company and the T&A supplier is via**	11	17
	Telephone		
	Fax		
	Electronic Data Interchange		
10	**Purchasing is carried out**	3	10
	through the use of a PC based purchasing software		
11	**The inventory control system is**	5	5
	PC based-computerised MRP		
12	**Inventory control is determined**	3	5
	as and when materials are needed		
13	**On average, the lead time for obtaining the fabric is**	3	5
	between six and nine weeks		

	Statements	Score Total	Score Best
14	**On average the lead time to obtain the trim and accessories is**	5	5
	less than three weeks		
15	**On average, prior to production, the fabric is stored over a period of**	5	5
	less than one weeks		
16	**On average, the trims and accessories are stored over a period of**	5	5
	less than one weeks		
17	**On average, following manufacture, the finished garment is shipped**	5	5
	one week		
18	**The quality of the incoming fabric is ensured by**	3	5
	sample testing of the fabric		
19	**The quality of the incoming trims and accessories is ensured by**	5	5
	statistical quality control procedures for the trims and accessories		

Cut And Make Strategy A2 "to have batch production"			
		Score	
	Statements	**Total**	**Best**
1	**The CMT strategy is**	5	5
	to have batch production		
2	**In the CMT department, the ratio of machine operators to**	5	30
	production managers or production engineers is (150)		
3	**Method study and work measurement is conducted by**	3	5
	trained personnel		
5	**The material handling system used is the**	3	5
	manual rail system		
6	**Marker making is performed**	5	5
	using a CAD/CAM system (Digitised system)		
7	**The percentage of defective order due to poor marking is**	5	5
	less than 5%		
8	**Spreading is done**	3	5
	using automated spreading machine without fabric control devices		
9	**The cutting room involves**	11	5
	operator controlled cutting (use of portable cutting knives)		
	the use of band knives		
	the use of die cutting		
10	**Transfer marks on cut fabrics are obtained by using**	5	4
	vertical staright knives		
11	**Fusing is carried out using**	5	5
	continuous pressing machines		
12	**Machines used for the assembly of apparels are**	3	5
	manual requiring skillful operators		

Statements		Score	
		Total	Best
13	**Pressing is done using**	5	5
	block or die pressing		
14	**Line balancing is performed**	3	5
	manually		
15	**The production line layout is**	5	5
	reviewed and reset for each manufacturing order		
16	**To establish production standards work study (Method Study & Work Measurement)**	5	5
	on a regular basis during production		
17	**The product(s) most often manufactured by the company include**	5	5
	Shirts		
18	**The percentage of fabric defect is**	5	5
	less than 2%		
19	**The percentage of defects arising from wrong transfer marks is**	5	5
	less than 2%		
20	**The amount of waste produced duirng cutting operation is**	5	5
	less than 2%		
21	**The percentage of defects attributed to the fusing operation is**	5	5
	less than 2%		
22	**The percentage of defects due to incorrectly formed stitches**	5	5
	less than 2%		

Human Resource Management Strategy H1

"to maintain and develop an effective workforce"

	Statements	Score Total	Score Best
1	**The strategy for human resource management is**	5	5
	to maintain and develop an effective workforce		
2	**The number of management levels (hierarchy) in the company is**	3	5
	Four (Director, Managers, Supervisors, Working teams)		
4	**Operator performance data are collected using**	5	5
	bar codes		
5	**Operator productivity (output to input ratio) in the factory is**	5	5
	assessed using specialised software (individual, line, factory productivity)		
6	**To improve the efficiency of the operators, the company invests in**	5	30
	providing workers with on the job training		
7	**The company policy for preventing absenteeism is by**	3	5
	attending individual problems (communication)		
8	**On average the daily operator absenteeism rate is**	3	5
	between 5 and 10%		
9	**The annual direct labour turnover is**	3	5
	between 5 and 10%		
10	**The annual indirect labour turnover is**	3	5
	between 10 and 15%		
11	**Motivation programmes for the operators include**	10	35
	organised indoor and outdoor activities (games, sports, picnics etc...)		
	production related bonus schemes		
12	**The percentage of foreign labour in the company is**	5	5
	up to 10%		

	Statements	Score	
		Total	Best
13	**The purpose of recruiting foreign labour is**	8	10
	to cope with unavailability of skilled local labour		
	to cope with lower productivity of local labour		

Finance and Accounting Strategy F1
"promote new investment and expansion"

Statements		Score Total	Score Best
1	**The finance strategy is to**	5	5
	promote new investment and expansion		
5	**Information is monitored by the Finance and Accounting department by using**	5	5
	a network based accounting software		
7	**The percentage of sales earnings invested in plant and equipment is**	3	5
	less than 5%		
11	**Investment decisions on plant and equipment are based on**	28	33
	long term production plans		
	the quest to improve productivity by replacing worn out and obsolete equipment		
	the quest to expand production capacity		
	the quest to improve quality		
	the quest to improve safety and environmental factors		
	the availability of enough capital (sales revenue and/or through borrowing)		

Appendix G

Audit Results for Garment Making Sector in Mauritius

Marketing Percentage Overview		
	Statements	**%**
1	The marketing strategy is	
	to use the marketing department (including that in the company's home country)	59
	to use a local/overeseas agent	24
	to use the customer for marketing the product	18
2	The product is marketed	
	Directly to the retailers	12
	To wholesalers	47
	To sales agents	18
	through a manufacturing network	6
	through the customer	41
3	Data transfer between the company and the customer is effected via	
	Telephone	47
	Fax	59
	Electronic Data Interchange (EDI)	6
	Email	88
4	The main areas of activity for the marketing department include	
	Organisation of promotion and advertising campaigns	18
	Organisation of fashion/trade shows	18
	Participation in fashion/trade shows	12
	Participation in promotion and advertising campaigns	18
	Marketing research for identifying new customers and customer needs	59
	Marketing research for identifying new channels of distribution	12
	Working on short term marketing plans	6

	Statements	%
	Working on long term marketing plans	29
	Research to identify the strength and weakness of competitors	6
5	Marketing is done (please tick any four)	
	using previous designs	18
	using new designs (proposed samples)	76
	using the company reputation	41
	using personal contacts	41
	through government/parastatal/non government organisations	18
	using the brand name	41
6	The percentage of annual turnover spent on marketing is	
	Negligible	6
	Between 1% and 5%	12
	Between 6% and 10%	35
	Between 11% and 15%	6
	XXX (don't know)	35
7	The average lead time for marketing (start of process to confirmed order from customer) is usually	
	within one month	35
	between one to three months	53
	between three to six months	6
	between six months to one year	6
8	The product/customer/country combination aimed at by the marketing function for the coming two years	
	similar products, same customers, same country	18
	similar products, different customers, same country	12
	similar products, different customers, different country	47
	different products, same customers, same country	47
	different products, different customers, different country	24
9	The product/customer/country combination served by the company over the past two years is	
	similar products, same customers, same country	47

	Statements	%
	similar products, different customers, same country	24
	similar products, different customers, different country	12
	different products, same customers, same country	18
	different products, different customers, same country	12
	different products, different customers, different country	12
10	Over the past two years	
	the company has won customers in favour of its competitors	12
	there has been increasing demand of similar products	41
	there has been increasing pressure on quality of products	71
	there has been increasing pressure on design features	24
	there has been increasing pressure on lead time reduction	35
	there has been increasing pressure on order size reduction	6
	there has been increasing pressure on order size reduction	12
	there has been increasing pressures on price reduction	47
11	The market category serviced by the company is	
	Designer Wears (high price, high quality, stylish design, high variety, low volume)	18
	Independent and Specialised Stores (moderate price, high quality, low variety, high volume)	71
	Department Store and Retail Chains (moderate price, good quality, low variety, high volume)	41
	Bargain and Discount Stores (low price, moderate quality, low variety, high volume)	6
12	The product marketed can be classified as being	
	on-going garments (non seasonal, stable demand throughout the year)	53
	basic garments (non seasonal, limited change in style over a year)	35
	seasonal garments (demand is spread only over a particular season)	24
	fashion garments (usually seasonal garments, however, requiring frequent change in styling)	18
13	Marketing is conducted for	
	design and CMT operations	29
	make to order only	76
	make to stock	6

	Statements	%
14	The company accepts	
	Orders for specific products without possibilities for change once manufacturing starts	41
	Orders for specific products with possibilities for minor design changes linked with CMT operations	47
	Orders for specific products with small order sizes renewed on a regular basis with or without design	12
15	The order size (number of pieces per order) marketed is	
	of the order of a few thousands	47
	of the order of tens of thousands	12
	of the order of hundreds of thousands	6
	XXX (there is no specific limitation on order size)	35
16	The competitive advantage of the company vis-à-vis its immediate competitors is the (please tick any	
	Price offered	53
	Product quality	88
	Product design	35
	Delivery reliability	71
	Manufacturing flexibility	35
	Productivity level	35
	Industrial infrastructure	41
	lead time	53
17	On average, the percentage amount of products sold at mark down prices is	
	Less than 5%	47
	less than 10%	24
	between 10% and 25%	12
	XXX (don't know)	18
18	The current marketing strategy is adopted because	
	it has paid off over the past	29
	of cost constraints	12
	it is most competitive	35
	of time constraints	12

	Statements	%

Product Design And Development
Percentage Overview

	Statements	%
1	**The strategy for product design and development is**	
	to obtain the design from the customer	35
	to produce the designs using in-house expertise only (including experts from mother company, if	29
	to work out the design as a joint effort between the customer and the PD&D department	65
2	**The extent of involvement of the customer in the product design process is:**	
	the customer does not involve in the design process	6
	the customer has little participation in the design process	24
	the customer actively participates in the design process	41
	the customer leads the design process	41
3	**In addtion to PD&D department, the other departments actively involved in the design process**	
	Sales and Marketing	59
	Planning and Control	41
	Purchasing and Inventory	18
	Manufacturing (CMT)	24
	Finance and Accounting	12
	Human Resource Management (Personnel)	12
	XXX (not applicable/non of the above)	12
4	**Data tansfer between the PD&D department and the departments actively involved in the design**	
	Informal meeting	35
	Formal meeting	47
	E-mail	41
	Local area network (company information system)	24

5 **The fabric design is obtained from**

	Statements	%
	In-house designers	41
	The customer	65
	Fabric suppliers	29
6	**Garment specifications are**	
	obtained from customer	82
	determined in-house (including from mother company)	24
	worked between customer and PD&D department	18
7	**Garment patterns (graded) are**	
	supplied by the customer	24
	in house manually	29
	produced in house using a CAD system	59
	produced in house using a CAD/CAM system	12
8	**Fabric design is carried out using**	
	a manual system (hand sketch)	29
	a CAD system	12
	specialised fabric design software	18
	XXX (None of the above, Not applicable, Don't know)	47
9	**The garment design process involves the extensive use of**	
	Point of sale data	24
	End of season sales data	6
	Specialised apparel design systems (CAD, Electronic sketching systems, template programmes)	24
	past design	18
	XXX (None of the above)	41
10	**Aspects of garment serviceability which are most emphasized upon during the design process**	
	Comfort	65
	Durabilty	41
	Funtional use	12

	Statements	%
	Creativity/Innovation	53
	Uniqueness	24
	Twist	6
	Shrinkage	41
	XXX (Don't know)	18
11	**In making garment choices manufactured by the company, end users mostly focus on (please tick**	
	Styling	59
	Fit	35
	Fabrics	53
	Price	65
	Brand name	47
	Product presentation	24
	Creativity in design	24
	Uniqueness of design	29
	Durabilty	12
	Stability	12
	Aesthetics	6
	XXX (Don't know)	12
12	**Cost estimates for the garment are worked out**	
	based on past experience	41
	using specialised software	24
	based on customer expectations	53
	based on competitor prices	24
13	**The lead time for agreeing upon a fabric design with the customer is**	
	less than one week	12
	between one to two weeks	41
	between two to three weeks	29
	more than four weeks	6

	Statements	%
14	**The average lead time for the design of a new product is (from sample request to confirmed**	
	less than five days	6
	between five and ten days	53
	between ten and fifteen days	6
	between fifteen and twenty days	12
	more than twenty days	12
15	**Design of a product line involves**	
	adding differentiation features to past designs	29
	designing completely different products	35
	preparing cost estimates (quotations) for manufacturing the product	41
	generating the product specifications	24
	producing the graded patterns	35
16	**Product design is evaluated against market place requirements through the use of**	
	Market Surveys	12
	Product sales rate data	24
	Fashion/trade shows	29
	XXX (None of the above, Don't know)	47
17	**The differentiation features of the product vis a vis those proposed by competitors are in terms of**	
	the brand	18
	the price	59
	the quality	65
	product fit	12
	the styling	35
	the service quality	24
	XXX (Don't know)	18
18	**The present strategy for PD&D is adopted because**	
	it has paid off over the past	18
	of cost constraints for investment in more appropriate technology	12

	Statements	%
	of the policies of the mother company	6
	it is most competitive	35

Planning And Control
Percentage Overview

	Statements	%
1	**The strategy for planning and control is**	
	for short term (less than 3 months ahead)	35
	for medium term (3 to six months ahead)	41
	for long term (6 months or more ahead)	29
2	**Production planning is carried out**	
	by the planning department in collaboration with other departments	59
	by the planning department alone	18
	by the marketing/merchandising department	18
	by the director	12
3	**Long term production plans (covering 6 months or more ahead) are based on**	
	sales forecasts	29
	none confirmed orders	12
	confirmed orders	65
	XXX (not applicable)	6
4	**Production planning and scheduling is carried out**	
	manually	53
	using a PC based production planning and control (MRP) system	6
	using a company based computerised production planning control system	35
5	**Once manufacturing order is confirmed, material requirement is planned**	
	manually	35
	using a computerised MRP system	29
	using just-in-time principle	35
6	**The probability for changes in order size following order confirmation and prior to start of production**	

	Statements	%
	nil	35
	less than 25%	59
7	**The probability for changes in order size while the order is being manufactured is**	
	nil	65
	less than 25%	29
8	**In the event of changes in order size during production, the production plans are**	
	modified easily	53
	reviewed with much difficulty	18
	are not changed	6
	XXX (not applicable)	18
9	**Fabrics, trims and accessories are received in the factory**	
	well in advance, for stock	29
	on a just-in-time principle	41
	based on weekly work orders	12
	based on monthly work orders	12
10	**Cut order plan is prepared**	
	manually	53
	using a pc based software	41
11	**Production time standards for sewing operations are set up using**	
	sample product data	12
	company standards data based on past experience	35
	method and time studies	59
	General sewing data software (GSD)	12
12	**Quality specifications for the finished garments are achieved through the use of**	
	100% inspection of finished products	65
	acceptance sampling procedures	18
	Quality audits for finished garments	29
	ISO procedures	6

	Statements	%
13	**The company usually has production plans for**	
	one to three months ahead	59
	three to six months ahead	24
	six to nine months ahead	6
	nine to twelve months ahead	6
14	**The average lead time between customer confirmed order and delivery is usually**	
	within one month	24
	between one to three months	53
	between three to six months	18
15	**The average time to deliver the order to the custormer by ship is**	
	less than two weeks	12
	between two to three weeks	18
	between three to four weeks	24
	between four to five weeks	24
	between five to six weeks	18
16	**The average time to deliver the order to the customer by air freight is**	
	less than two days	6
	between two to three days	41
	between three to four days	18
	between four to five days	18
	more than six days	12
17	**The Master Production Schedule (MPS) covers a period of**	
	one week	6
	one to two weeks	12
	two to three weeks	6
	three to four weeks	41
	four to five weeks	6
	five to six weeks	6

	Statements	%
	six to seven weeks	6
	eight weeks or more	24
18	**On average the amount of scrap per order is**	
	less than two percent	53
	two to five percent	29
	five to eight percent	12
19	**On average the amount of rework per order is**	
	less than two percent	47
	two to five percent	29
	five to eight percent	6
	eight to ten percent	6
20	**On average the amount of outgoing defects per order is**	
	less than two percent	59
	two to five percent	24
	five to eight percent	6
	more than ten percent	6
21	**On average the amount of excess fabrics and trims per order is**	
	less than two percent	53
	two to five percent	35

Purchasing And Inventory
Percentage Overview

	Statements	%
1	**The purchasing strategy is**	
	to use single sourcing without strategic partnership relatationship	18
	to use mulitple sourcing	53
	to allow for supplier/customer integration	29
2	**The sourcing strategy for fabrics is**	
	to obtain the fabric from a supplier recommended by the customer	18
	to compare quotations from local suppliers and select best	12
	to compare quotations from local and overseas suppliers and select best	35
	through a partnership relationship with specific supplier(s)	29
3	**The sourcing strategy for trims and accessories (T&A) is**	
	to obtain the T&A from the customer	6
	to obtain the T&A from suppliers recommended by the customer	18
	to compare quotations from local suppliers and select best	24
	to compare quotations from local and overseas suppliers and select best	53
	to use a multiple suppliers	6
	through a partnership relationship with specific suppliers	12
4	**Selection of the fabric supplier is mainly based on**	
	the price quoted	29
	the quality of the fabric	47
	the order to delivery lead time	18
	delivery reliability	18
	the involvement of the supplier as a partner for enhancing product competitiveness	35

	Statements	%
	the track record for the supplier	29
5	**Selection of trim and accessories supplier is mainly based on**	
	the price quoted	35
	the quality of supplies	53
	the order to delivery lead time	29
	delivery reliability	24
	the involvement of the supplier as a partner for enhancing product competitiveness	18
	the track record of the supplier	35
	XXX (Not applicable)	6
6	**Fabric from the supplier is mostly obtained**	
	in batches as and when requested by the company	41
	in bulk for the complete order	41
	on a just-in-time principle	18
7	**Trims and accessories are purchased**	
	in batches as and when requested by the company	18
	in bulk for the complete order	71
	on a just-in-time principle	12
	XXX (Not applicable)	6
8	**Data transfer between the company and the fabric supplier is via**	
	Telephone	47
	Fax	71
	Electronic Data Interchange	12
	Internet EDI	12
	E-mail	18
9	**Data transfer between the company and the T&A supplier is via**	
	Telephone	53
	Fax	88
	Electronic Data Interchange	18

	Statements	%
	Internet EDI	12
	E-mail	24
10	**Purchasing is carried out**	
	manually (use of purchase order forms)	65
	through the use of a PC based purchasing software	18
	through the use of a company based computerised inventory control system	18
	through the use of EDI	6
11	**The inventory control system is**	
	manual	53
	PC based-computerised MRP	12
	Company computerised system on a local area network	41
	Company computerised system on a wide area network	6
12	**Inventory control is determined**	
	using an Economic Order Quantity (EOQ)	12
	using the just-in-time principle	41
	when stock falls to re-order level	18
	as and when materials are needed	35
13	**On average, the lead time for obtaining the fabric is**	
	less than three weeks	53
	between three and six weeks	29
	between six and nine weeks	6
	more than nine weeks	6
14	**On average the lead time to obtain the trim and accessories is**	
	less than three weeks	65
	between three and six weeks	29
15	**On average, prior to production, the fabric is stored over a period of**	
	less than one weeks	35
	one week	47

	Statements	%
	one to two weeks	18
	more than four weeks	6
16	**On average, the trims and accessories are stored over a period of**	
	less than one weeks	35
	one week	29
	one to two weeks	24
	two to three weeks	6
	three to four weeks	6
17	**On average, following manufacture, the finished garment is shipped within**	
	one week	71
	one to two weeks	24
	two to three weeks	6
18	**The quality of the incoming fabric is ensured by**	
	the reputation of the supplier	6
	the test results from the supplier	12
	100% inspection of the fabric	29
	sample testing of the fabric	59
	statistical quality control procedures for the fabric	12
19	**The quality of the incoming trims and accessories is ensured by**	
	the reputation of the supplier	18
	the test results from the supplier	24
	100% inspection of the trims and accessories	18

Cut Make And Trim
Percentage Overview

	Statements	%
1	**The CMT strategy is**	
	to have long run production	53
	to have batch production	29
	to have short run production	18
2	**In the CMT department, the ratio of machine operators to**	
	helpers is (15)	24
	foremen is (30)	18
	supervisors is (60)	18
	quality controllers (60)	6
	production managers or production engineers is (150)	12
	industrial engineers (time and method study personnel) is (300)	18
3	**Method study and work measurement is conducted by**	
	experienced workers	24
	trained personnel	59
	industrial engineers	24
4	**The actual layout of the factory is**	
	line or product-oriented layout	82
	functional or process-oriented layout	18
	cellular layout	6
5	**The material handling system used is the**	
	progressive bundle system (PBU)	47
	cellular production system	6
	manual rail system	35
	automatic computerised rail	29

	Statements	%
6	**Marker making is performed**	
	manually on the fabric	6
	manually using a marker paper and carbon copies	12
	using a CAD system	47
	using a CAD/CAM system (Digitised system)	35
7	**The percentage of defective order due to poor marking is**	
	less than 5%	100
8	**Spreading is done**	
	manually	65
	using automated spreading machine with fabric control devices(tension.position, end treatment)	71
	using automated spreading machine without fabric control devices	12
9	**The cutting room involves**	
	operator controlled cutting (use of portable cutting knives)	71
	the use of band knives	65
	the use of die cutting	18
	servo assisted cutting	12
	computer controlled cutting (CAD/CAM system)	18
10	**Transfer marks on cut fabrics are obtained by using**	
	vertical staright knives	53
	drills	12
	templates and wax pen	24
	manual systems	24
11	**Fusing is carried out using**	
	rollers presses	47
	flat-bed presses	18
	continuous pressing machines	53
	irons	18
12	**Machines used for the assembly of apparels are**	

	Statements	%
	manual requiring skillful operators	59
	semi automatic with control devices	47
	fully automatic	29
13	**Pressing is done using**	
	buck press	24
	iron press	18
	block or die pressing	6
	form pressing (topper press)	29
	steamers	29
	manual steam iron with suction table	47
14	**Line balancing is performed**	
	manually	88
	using multi-skill operators	24
15	**The production line layout is**	
	reviewed and reset for each manufacturing order	71
	the same all the time	18
	is reviewed and reset in the event of line balancing problems	24
16	**To establish production standards work study (Method Study & Work Measurement) is normally**	
	on and off to solve problems on the line	35
	on a regular basis during production	71
	only at the start of manufacture of each order	12
17	**The product(s) most often manufactured by the company include**	
	Shirts	24
	Trousers	24
	Skirts	18
	Blouses	24
	T-shirts	47
	Kidswear	12

	Statements	%
	Dresses	18
	Jackets	6
	Denim Wear	18
18	**The percentage of fabric defect is**	
	less than 2%	35
	between 2% to 4%	53
	between 5% to 7%	6
19	**The percentage of defects arising from wrong transfer marks is**	
	less than 2%	76
	between 2% and 4%	18
20	**The amount of waste produced duirng cutting operation is**	
	less than 2%	65
	between 2% and 4%	12
	between 5% and 7%	12
	between 8% to 10%	12
21	**The percentage of defects attributed to the fusing operation is**	
	less than 2%	88
	between 2% and 4%	6
	between 5% and 7%	6
22	**The percentage of defects due to incorrectly formed stitches**	
	less than 2%	71
	between 2% and 4%	18
	between 8% and 10%	6

Human Resource Management
Percentage Overview

	Statements	%
1	**The strategy for human resource management is**	
	to maintain and develop an effective workforce	94
	to attack or take advantage of cheap labour	12
	use the carrot and stick principle	6
2	**The number of management levels (hierarchy) in the company is**	
	Three (Director, Managers, Working teams)	6
	Four (Director, Managers, Supervisors, Working teams)	59
	five (Director, Managagars, Supervisors, Foremen, Operators)	35
3	**The percentage of indirect labour to direct labour is**	
	less than 5%	29
	between 5 and 10%	24
	between 10 and 15%	12
	between 15 and 20%	18
	more than 20%	18
4	**Operator performance data are collected using**	
	bar codes	18
	job tickets	53
	real time, on line data collection system	29
5	**Operator productivity (output to input ratio) in the factory is**	
	assessed manually	35
	assessed manually for a production line	29
	asseessed using a software (line and factory productivity)	24
	assessed using specialised software (individual, line, factory productivity)	12

	Statements	%
6	**To improve the efficiency of the operators, the company invests in**	
	continuously improving the working environment (lighting, cooling, wall painting, housekeeping etc...)	47
	providing workers with on the job training	41
	providing workers with bonuses and benefits for amount of works completed on a piece rate system	59
	providing workers with an ergonomic working environment (chairs, tables, machine orientation	18
	the state of the art equipment	18
	an effective equipment maintenance system	29
7	**The company policy for preventing absenteeism is by**	
	providing attendence bonus	94
	providing production bonus	47
	using warning systems	29
	promoting team work (team spirit)	6
	attending individual problems (communication)	18
8	**On average the daily operator absenteeism rate is**	
	less than 5%	35
	between 5 and 10%	65
9	**The annual direct labour turnover is**	
	less than 5%	24
	between 5 and 10%	53
	between 10 and 15%	12
	between 15 and 20%	6
	more than 20%	6
10	**The annual indirect labour turnover is**	
	less than 5%	35
	between 5 and 10%	41
	between 10 and 15%	12
	between 15 and 20%	12
11	**Motivation programmes for the operators include**	

	Statements	%
	organised indoor and outdoor activities (games, sports, picnics etc...)	41
	production related bonus schemes	82
	award competitions (best operator, team, team leader etc...)	41
	regular on the job training programmes	18
	regular out of the job training programmes	6
	fair and wide scope promotion	6
	opportunities for changing jobs and responsibilities	24
12	**The percentage of foreign labour in the company is**	
	nil	18
	up to 10%	12
	between 10 and 20%	6
	between 20 and 30%	18
	between 30 and 40%	41
	between 40 and 50%	6
13	**The purpose of recruiting foreign labour is**	
	to cope with unavailability of skilled local labour	41
	to cope with increasing cost of local labour	24

Finance And accounting

Percentage Overview

	Statements	%
1	**The finance strategy is to**	
	promote new investment and expansion	47
	promote company reputation	29
	limit expenses	47
2	**On average the percentage of order delivered by surface (by ship) is**	
	100%	12
	about 90%	59
	about 80%	12
	about 70%	12
	about 50%	6
3	**On average the percentage of order delivered by air freight is**	
	about 50%	6
	less than 50%	94
4	**The wage payment system for machine operators is**	
	the hourly wage system	41
	the piece rate wage system with single base rate	53
	the piece rate wage system with variable base rate	24
5	**Information is monitored by the Finance and Accounting department by using**	
	a manual system	18
	a pc based system	35
	a network based accounting software	59
6	**The average time to process and ship orders, after manufacturing is complete, is**	
	less than one week	71
	between one and two weeks	18

	Statements	%
	between two and three weeks	12
7	**The percentage of sales earnings invested in plant and equipment is**	
	less than 5%	29
	between 5 and 10%	24
	between 10 and 15%	18
	between 15 and 20%	6
	between 20 and 25%	12
	more than 25%	6
8	**The shipping cost as a percentage of order cost is**	
	less than 5%	41
	between 5 and 10%	35
	between 10 and 15%	6
	between 20 and 25%	12
9	**The air freight cost as a percentage of order cost is**	
	less than 5%	12
	between 5 and 10%	6
	between 10 and 15%	24
	between 15 and 20%	29
	between 20 and 25%	18
	more than 25%	6
10	**The percentage of of orders meeting on time shipments is**	
	more than 95%	35
	between 90 and 95%	6
	between 85 and 90%	18
	between 80 and 85%	12
	less than 80%	24
11	**Investment decisions on plant and equipment are based on**	

	Statements	%
	long term production plans	59
	the quest to improve productivity by replacing worn out and obsolete equipment	41
	the quest to expand production capacity	24
	the quest to improve quality	35
	the quest to produce new product lines	35
	the quest to improve safety and environmental factors	12
	the availability of enough capital (sales revenue and/or through borrowing)	12
12	**The percentage cost of direct labour per order is**	
	less than 10%	24
	between 10 and 20%	18
	between 20 and 30%	29
	between 30 and 40%	18
	more than 40%	6
13	**The percentage cost of indirect labour per order is**	
	less than 10%	29
	between 10 and 20%	53
	between 20 and 30%	12
14	**The percentage of fabric and trims cost per order is**	
	less than 20%	18
	between 20 and 30%	35
	between 30 and 40%	12
	between 40 and 50%	18
	more than 50%	12
15	**The percentage of other costs (building, electricity, logistics, etc...) per order is**	
	less than 20%	65
	between 20 and 30%	29
16	**The percentage of turnover spend on training of direct labour annually is**	
	less than 5%	82

	Statements	%
	between 5 and 10%	6
	between 15 and 20%	6
17	**The percentage of turnover spent on training of indirect labour annually is**	
	less than 5%	88
	between 10 and 15%	6
18	**Over the last two years the company**	
	has seen its profit margin increasing	18
	has seen its profit margin stable	47