

**A STUDY INVESTIGATING THE USE OF  
COMPUTER AIDED DESIGN (CAD) IN THE  
CLOTHING SECTOR TO SUPPORT SMALL AND  
MEDIUM ENTERPRISES (SMES) IN THE  
ETHEKWENI AREA**

By

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## ABSTRACT

Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) systems have contributed significantly towards the quality and efficiency levels at large clothing companies. The disadvantages that SME's entrepreneurs face through the lack of access to new technology and technological skills affect their productivity and competitiveness.

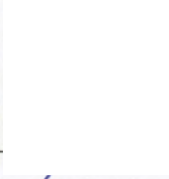
This study investigates the use of CAD through a support initiative to be based in the Fashion Department at the Durban Institute of Technology. Incubators/technology hubs and service centres serve as mechanisms of support interventions to emerging entrepreneurs and practicing SME entrepreneurs. It is apparent that institutions of higher learning focus on extending their roles at a local level by taking forward and participating in human resources development policies that government has instituted. Entrepreneurial development is necessary to meet the requirements of innovation and a knowledge-driven economy as South Africa faces the challenges of globalisation.

Clothing/fashion entrepreneurs are innovative, they respond to market needs with supplies of fashion goods that have short product life cycles. Changes in fashion occur at an accelerated speed, reaching consumers through mass media and television. The need for 'Quick Response' in a highly competitive industry demands the use of technology. The impact of CAD and its benefits in terms of consistent quality, efficiency, reduction in number of manufacturing processes and lead times has contributed to the success of many companies. The findings of the survey reveal that the performance of SME entrepreneurs is impeded by the lack of access to technological resources and under developed skills. Entrepreneurs need to embrace current technical skills and practices to succeed in their field of work. As students enter the 'working world' they require assistance to commercialise their acquired skills in their new ventures.

In offering SME entrepreneurs specific/specialized needs, entrepreneurial growth, sustainability and job creation opportunities can be facilitated. Additionally, empowerment through technology support enhances the process of life long learning in innovative areas that require continuous updating of knowledge and skills.

## Declaration

This thesis is the original work of the researcher and no submission in any form has been made to another technician. Due acknowledgement has been given in the text and in the bibliography when use of other work has been made.



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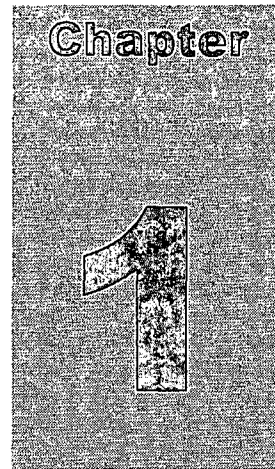
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## INTRODUCTION TO THE STUDY

### 1.1 Introduction

South Africa is the biggest clothing sector employer in sub-Saharan Africa employing about 130,000 people and is also regarded as the economic giant of the African continent. The wealth of natural resources, a sophisticated financial service industry and an entrepreneurial business culture, which is well established, are stated as valuable in the assessment of its economic status. In earning confidence both from within and internationally, the GDP predicted was significant, as it was forecasted to grow by around 3.2 per cent in 1995, this growth being activated by stronger fixed investments. The policy changes within South Africa and the opportunity to participate in international trade and foreign investment, has increased the potential for competing in the global economy. South Africa is in a strategic position to bring about economic reform and prosperity, provided that certain steps are taken in strengthening its manufacturing base (Anson 1995:6).

From the experiences of other countries it can be discerned that international competitiveness requires industries to benchmark themselves against global standards and practices (ILO 2000:1). Therefore to accelerate productivity, growth and efficiency in the clothing sector, it is imperative that the entrepreneurs in small and medium enterprises (SMEs) are harnessed to create jobs. For the industry to achieve more sophisticated competitive advantages it requires manufacturing products of quality in a more efficient manner (Porter 1990:10). SMEs are faced with problems and constraints that impact on their performance. Although financial support and

training are listed high as the most pressing needs, access to information, networking environment, consultation and technology transfer are essential as the industry becomes highly technological.

The recent revision of the Labour Relations Act and the Basic Conditions of Employment Act, seems to be in conflict with the belief that, better legislation is the only solution to the problem of the unemployment rate of about thirty per cent, which resulted in a loss of half a million jobs in the formal sector since 1994. Government is being cautioned in this respect to take advice on supporting the activities of entrepreneurs and to work towards creating a more “enabling environment” for them (Wightman 2002:8). Other views expressed in this regard also highlight a national and an international concern. Recommendations include, forming relationships between the established big business and the SMEs, and the pooling of resources to be encouraged. The creation of economies of scale is to be considered in order to take advantage of the global opportunities and the most important challenge of job creation has to be addressed (Randeree 2001:1).

The development of SMEs has been given priority, as they are perceived world wide to be the contributors to job creation and economic development. It is in this similar vein that Nyoka (2001:35) expresses that, ‘It is clear that government, alone, cannot create jobs. As a result the South African government is fostering a strong entrepreneurial spirit in its citizens.’ Lateral thinking and creativity should also be encouraged as part of being entrepreneurial and technology must be made available freely in the future for the youth to be able to compete in the global business (Nyoka 2001:36). With the shift to a more global economy, unprecedented opportunities are opening up for small business. The responsibility for educationists is being increasingly challenged as they nurture and promote ‘entrepreneurial thinking’ among tertiary students in preparation for self-employment.

The barriers of time and distance are being significantly reduced by technology such as the internet and applications such as electronic commerce, hence, the playing field is being made more equal for large and small firms alike. Consequently, it is important that, up-to-date information becomes an essential tool as, knowledge, innovation and technology are driving the new economy. Countries all over the world, both developed and developing nations, recognize that for small business and SMEs to compete successfully, SMEs have to be acquainted with the changing regulations, emerging

technologies, and access to certain critical resources. The most important resources that SMEs are deprived of are finance, technology and managerial skills. In order to nurture these capabilities special support measures are necessary (Industry Portfolio Office 2001:1).

Research done by the Industrial Strategy Project (1995:74) proposed that specific support is required with regards to technology development. As every group of SMEs and every individual SME would have particular technology needs, generalized support is seen to be ineffective. Institutions need to design and deliver new institutional support on a decentralized basis and with immediate effect. Institutional business centers are further recommended for technical assistance and technical capacity building among SMEs and small business (Davies 2001: 33, Joffe et al. 1995:72,73).

In the fashion industry rapid diffusion of technology over the past two decades has transformed the way in which the industry functions. As technology paved new paths in the changing cycle of the fashion world, less expensive fashion goods are readily available in larger quantities than ever before (Chase 1997:xi). The impact of computer technology at a local level seemed to have improved in recent years with the clothing industry adopting Computer Aided Design (CAD) systems (Anson 1995:6).

The support required in CAD would empower the budding entrepreneurs to become more competitive and productive in the face of the changing dynamics in the production of clothing. The use of the CAD system has proved to increase competitiveness by reducing costs, contributing to quick response, increasing creativity, minimizing technical procedures and enhancing quality and efficiency (Gray 1998, Chase 1997). Thus CAD has become an integral part of the design process, the benefits of which are mainly reaped by larger firms.

Graduates leaving tertiary institutions as new start-ups and experienced SMEs in the fashion business face many hurdles and obstacles and therefore are disadvantaged. Access to technological resources that apply to their world of work are beyond the reach of any new business to invest in, consequently, computer technology is seen as a

luxury and as state-of-the-art equipment. The acquired skills in CAD need to be commercialized in order for the students/graduates to become high potential entrepreneurs. Applying theoretical and practical knowledge in the workplace will give credence to the relevance of the new and changing curriculum needs. In recognizing SMEs needs, it becomes significant to provide them with their specific environment together with other vital skills like best practice and entrepreneurial networking to ensure sustainable growth of entrepreneurs (Joffe et al. 1995:72, 73).

As South Africa is faced with increasing pressure from foreign markets, the import of goods from countries like Malawi, China and India are making substantial inroads into the marketplace and are far exceeding the export output. The 1998 statistics for clothing export were in the region of R772,0000 whilst the import indicators reflected R931,0000 (Clofed 2000/1:62,68). The export potential for South Africa lies in exploiting opportunities in niche products that are Afrocentric in design, therefore clothing exporters need to focus on product development and licensing (Salinger et al. 1999:2). Vast opportunities exist for innovative SMEs in the fashion area to take up the challenge offered by various export promotion agencies and the Department of Trade and Industry (DTI). For example 'Buy Africa' was started in 1998 by Liberty Foundation and is one of the many that provide the service, thus resolving problems confronting entrepreneurs with sourcing international markets (*Daily News*, August 2001). Export competitiveness requires efficiency and quality in production, CAD systems are able to maintain and ensure consistency in standards. Adhering to standards provide the basis for applying for ISO9000 accreditation, which can provide a distinctive advantage for export purposes (Gray 1998:4).

Capacity building among entrepreneurs in the small-medium enterprises in South Africa has been a long-standing issue, for which support mechanisms and strategies have been implemented and seen as high priority for policy making at national government level. In recent Parliamentary media briefings by Dr Ben Ngubane, the Minister of Arts and Culture Science and Technology, (2001:1), proposals included working towards, 'smart, programme interventions to re-skill the workforce and to drive the new entrepreneurial ventures.' Part of the government's commitment includes the placement of specific resources in Technikons to support SMEs

development in technological skills, in order to align with international best practice. Tertiary institutions should gear themselves to extend their services in providing focused support strategies and life-long learning to entrepreneurs. Central to this issue of specific support is the designing of 'technology delivery' programmes that are decentralized and for which access is immediate and locally available (Joffe et al. 1995:79-80).

## **1. 2 The Statement of the Problem**

This research has undertaken to identify how SMEs in the fashion industry are disadvantaged by the lack of resources i.e. CAD and in order to improve their productivity and competitiveness, a support strategy to access computer technology is investigated.

### **1. 3 Objectives of the Study:**

- To determine the extent to which SMEs are disadvantaged through the lack of Computer Aided Design (CAD) compared to larger companies;
- To assess what specific needs would increase their productivity and competitiveness through the use of CAD;
- To ascertain the possibilities of networking and hence achieving best practice;
- To evaluate the benefits the envisaged support service would have on the SMEs; and
- To provide transfer of technology skills and opportunities for life-long learning.

### **1. 4 Delimitations**

The study is confined to the CAD systems operating on the technical aspects in the design- room i.e. the pattern development aspects and excludes the design and manufacturing. The study is focused, because of time constraints imposed by the vast nature of the CAD applications, in the clothing sector.

## **1. 5 Definitions related to the study:**

### **1.5.1 Computer Aided Design (CAD)**

The more popular term CAD is used to describe both the design and manufacturing segments. CAD has come to include graphic applications used for purposes of visualizing design as well as specifications and functions (Chase 1996:2).

### **1.5.2 Transfer of Technology**

The technology-transfer process helps a manufacturing company more effectively use its human, physical, and capital resources by providing information or assistance, which leads to improvements in its facility, equipment, manufacturing methods, management methods, or marketing methods (Cooke and Mayes 1996:4).

### **1. 5 3 Entrepreneurship**

Entrepreneurship is the dynamic, integrated chain of activities, starting with the identification of a new concept to meet a market opportunity, followed by its pursuit to commercial realization. The innovation itself may originate in a corporate or public laboratory, on the factory floor or in the street, often an incremental change rather than a major break-through. It does need investment in technology - one's own or spill-offs from others, the import of know-how and equipment, or the foreign investment that brings these in. It is facilitated by a university linkage, some engineering, production and marketing capabilities, and almost always requires a committed entrepreneur or champion to mobilize resources, start the venture, survive, and (with luck!) thrive (Lalkaka 1999:1).

### **1.5. 4 Business Incubator**

A business incubator is an economic development tool designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services. A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. These incubators "graduates" create jobs, revitalize neighborhoods, commercialize critical new technology and strengthen local and national economies. Critical to the definition of an incubator is on-site management, which develops and orchestrates business, marketing and management resources tailored to a company's needs. Incubators usually also provide clients access to appropriate rental space and flexible leases,

shared basic office services and equipment, technology support services, and assistance in obtaining the financing necessary for company growth (National Business Incubator Association 2002:1- 2).

#### 1.5.5 Fashion Incubator

The Fashion incubator is a business incubator. It provides specialist fashion business training for fashion entrepreneurs within a highly creative and support environment (Fashion Incubator, Auckland University 2002:2 of 3).

#### 1.5. 6 Network

Network is a collection of firms working in co- operation though not necessarily in the same place (IDS, 2001).

#### 1.5.7 Quick Response

Quick Response is providing the garments the customer wants in the right place, at the right time, at the right price. It depends on integrating all the parts of the pipeline (fiber producers, fabric manufacturers, clothing manufacturers and retail stores) in one overall organization totally responsive to the customer (Carr and Pomeroy 1992:14).

#### 1.5.8 Value Chain

The value chain describes the full range of activities that are required to bring a product from its conception, through its design, its sourced raw materials and intermediate inputs, its marketing, its distribution and its support to the final consumer. In other words, the chain can be seen as incorporating production, exchange distribution and consumption from the cradle to the grave of a given product or service (Institute of Development Studies 2001:1).

#### 1.5.9 Best Practice

Benchmarking is a systematic and continuous process of searching, learning, adapting and implementing the best practices from within ones own organization or from other organizations towards attaining superior performance (Federation of Malaysian Manufactures Best Practice for SMEs 2002:1).

## **1.6 Contribution of the Study:**

- SMEs (entrepreneurs) will be afforded maximum use of state-of-the-art resources thus enhancing their skills in computer technology and the application thereof;
- New opportunities can be created for participating in the export and local markets;
- With empowerment gained through technology transfer skills, competency in serving the larger companies for contract work can be achieved;
- Life-long learning will be encouraged and nurtured; and
- Best practice methods through networking will be strengthened.

## **1.7. Summary of Chapters**

### **Chapter 1: The Problem**

Chapter One discusses the background to the problem, the objectives of the study and the limitations and the definitions pertinent to the study.

### **Chapter 2: Review of related literature.**

- 2.1 This section examines studies on entrepreneurship that identify with the characteristics of fashion entrepreneurs. The importance of technology in empowering women is also highlighted.
- 2.2 The Impact of Technology in the clothing industry and its implications on SMEs. New developments in Computer Aided Design (CAD) are discussed to show the extent to which technology is changing the way in which industry operates.

- 2.3 A general perspective of the clothing industry is presented at this point, followed by the competitiveness and productivity factors that affect SMEs' competitive advantage. The commercializing of skills by graduates is outlined. The section concludes by briefly discussing the opportunities for SMEs in the eThekweni area.
- 2.4 The SMEs' enhancement through support mechanisms is discussed as well as the role of incubators and service centers. International fashion incubators offering special services are traced.
- 2.5 This section focuses briefly on the constraints that inhibit entrepreneurial activity. It also identifies the plans and challenges of national education in developing new skills and technology capacities that fulfill the needs of the country.

### **Chapter 3: Methodology of data collection**

The chapter outlines the research methodology used to collect the data. To fulfill the objectives qualitative data was used to test the hypotheses.

### **Chapter 4: Analysis of data collected**

The chapter has focused on the presentation and analysis of the data that was collected. Research results are interpreted.

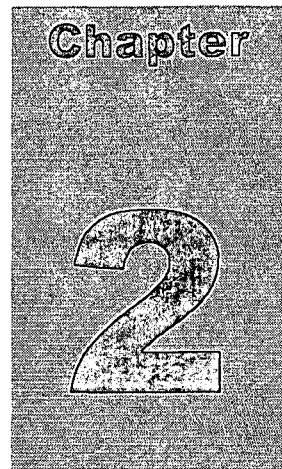
### **Chapter 5: Conclusions and implications of findings.**

The final conclusions, the implications of the findings and future research possibilities have been made in this chapter.

## **1.8. Conclusion**

This chapter has covered the problems that SME entrepreneurs experience with regard to capital-intensive resources. The accessing of technology and technology development has been identified as the key issues by several researchers. To empower SMEs in the clothing sector, the use of Computer Aided Design is being investigated. In order to commercialize their skills, fashion entrepreneurs require support in new technology.

Chapter Two attempts to review the relevant literature that provides the empirical evidence to underpin the issues at hand and to find the possible solutions/recommendations.



## LITERATURE REVIEW

### 2.1 SMALL AND MEDIUM ENTERPRISES (SME) ENTREPRENEURS

#### 2.1.1 Introduction

Many small firms whose aspirations lie in operating their own businesses, characterize the fashion industry (Easey 2002:8). Unfortunately many of these imaginative and innovative entrepreneurs fail because of many constraints, reasons for which range from finance to networking. Small And Medium Enterprises (SMEs) have unique qualities, which enable them to create and provide job opportunities, stimulating initiatives and innovations (Kroon 1998:29). With the rapid advances in technology, entrepreneurs are being pressurized for 'technological literacy'. In changing to a 'knowledge based' economy, South Africa needs new industries and wealth creation opportunities that have a technology intensive environment, as the market becomes global and competitive (Ngubane 2001:1).

#### 2.1.2 Related Studies On Entrepreneurs

Attention to theories of entrepreneurship has become a focal point in the recognition of the importance of the SME sector for economic development and job creation. The view of the French writer, Say, is appropriate in describing the entrepreneur as, 'the pivot of the economy and a catalyst for economic change and development,' who is ready to take the risk in combining the various factors of production together on a 'commercial stage' (Deakins 1996:10). Fashion entrepreneurs are able to fulfill this

role by combining their technical and creative backgrounds and are able to design and produce goods for the ever-changing demands of the marketplace.

In the study of entrepreneurship, Deakins (1996) cites various writers who provide examples of characteristics close to that of fashion entrepreneurs. Schumpeter describes the entrepreneur as an innovator who brings about change through the introduction of new technological processes or products. Schumpeter believes that the entrepreneur moves production constraints, by using innovative activity changes and technological possibilities. Besides the constraints, small firms also face disadvantages in Research and Development, which is often expensive, and time consuming to develop. Schumpeter also believes that only large firms carry out technological change. In terms of the Schumpeterian view, certain and special people have the ability to be entrepreneurs as they need to have the ability to recognize the commercial application of the technological advancement.

Comparison between the works of Shackle and Kirzner as cited in Deakins (1996), lends valuable information to the concept of entrepreneurship. The former sees entrepreneurs imagining opportunities, and the latter's view is that the entrepreneur perceives and takes opportunities. Much of Shackles' other viewpoints fit in with the fashion entrepreneur. He regards the entrepreneur as someone who is creative and imaginative, and believes everyone has the creative potential, which is put into action by making choices.

### **2.1.3 Female Entrepreneurship**

Since eighty per cent of fashion students are female, it is deemed necessary to explore female entrepreneurship for the study. Deakins (1996) in the study of female entrepreneurship cites Goffee and Scase who suggest that two sets of factors influence female entrepreneurship. These factors are the attachment to entrepreneurial ideals, and the extent to which they accept conventional gender roles. Further entrepreneurial ideals are defined as, high motivation for self-advancement, self-reliance and the strong attachment to 'work ethics.' They also support their male partners by fulfilling the accepted role that women play towards their career aspirations (Deakins 1996:11,12).

Literature on women in the clothing related businesses and clothing manufacture reflects some pertinent reasons why so many females adopt a career in business. West Midlands in the UK is one example of a Clothing Resource Centre established to carry out training, advice and support in clothing related skills. A research study conducted by the centre indicates that women seek self-employment in this area as a means of using their skills flexibly to gain financial independence. The resource centre initiatives were aimed at encouraging and sustaining self-employment among groups of people who were disadvantaged in the labour market, through discrimination and unemployment (Kaur and Hayden cited in Allen and Frumen 1993:102).

In applying this to the South African context we find that entrepreneurs share some of the characteristics and similar plights in the industry. SA has a rate of 9.4% as its entrepreneurial activity, making it the lowest among developing countries. Pertinent to the study are statistics on the number of firms by economic sector, which stands at 13.9% (Global Entrepreneurship Monitor Survey 2001:14). Recent statistics show that twenty nine per cent of women are entrepreneurs. Contribution by women to the economy in general was hampered in the past by the discrimination they suffered historically. Women enter the job market as sole breadwinners and women head 30% of households today. Gender equality enshrined in the new constitution of the post-apartheid South Africa brought about many legislations, policies and support programmes. These related to women in the 'world of work', the state's support for women's emancipation, and an end to discrimination. In response to the problems, government had put into place several projects particularly for disadvantaged communities. The results of the efforts were disappointing; there were no significant changes in the number of SMEs or in entrepreneurial improvements among the targeted group (Cleobury and Morgan 2001:11,12,20).

Therefore women entrepreneurs need support interventions that will increase their chances of success, considering the additional constraints they endure and face. Discrimination in technology seems to be disguised in the past but writers now argue that male technology controls and imprisons women most of all (Beynon and Makay 1992:17). Beynon also cites the view of Cockburn who believes that production and power are means by which men keep women in place. Her most significant view is that although women were liberated in the second half of the twentieth century their relationship with technology has not changed. "They are to be found in great numbers operating machinery ... but continue to be rarities in those occupations that involve

knowing about what goes on inside the machine... Women may push the buttons but they may not meddle with the works” (Cockburn1985).

According to Mtsali (2002:1), the South African government through the Programme of Technology for Women in Business (TWIB) is aiming to enhance the accessibility of science and technology among women. The services are being extended to existing and aspiring businesswomen through accelerating partnerships, education, training, and mentoring. The programme supports the establishment and promotes co-operation between Small, Medium and Micro enterprises (SMMEs). It can be acknowledged that technology now plays an important role in female entrepreneurship.

In summarizing one can say that the scenario has to change; opportunities have to be created to empower SME entrepreneurs in the clothing industry to use technology for increasing their productivity and competitiveness. As computer technology is here to stay, it is imperative to provide access to all, to those who have been exposed and to those who may need to be exposed in the future.

## **2.2. Impact of Computer Technology in the Clothing Industry.**

### **2.2.1 Introduction**

The advances in computers and communication (IT) have changed the financial, economic and political world. These changes impacted on the apparel industry so much that the whole organizational structure has made radical and significant shifts in the way it functions (McPherson 1988:1-3). The industry rapidly transformed from a traditionally labour intensive one to a highly technological and capital-intensive industry (Stylios 1989:4). The view that computer technology requires skilled workforce, and though re-training becomes essential, the idea of redundancies cannot be discounted (Easey 2002:18). More importantly, employment in this sector has been affected, as the need for workers is reduced. New generation of equipment is capable of handling all aspects of manufacturing and new skills are required to use and maintain computers and computer systems (Hunter 1993:149). It can be assumed that new technology has created other forms of employment in the computer field, from

software suppliers to technicians, all playing an equal role towards its success and adoption.

### **2.2.2 Phases of entry into the market**

Fashion processes change constantly and if there is any technology that can make the change, in a faster way, the change is adopted (Chase 1997:13). The gradual patterns of entry marked the changes that affected small firms, as larger firms benefited sometimes at their expense. The technology development at various stages was: the result of the perceived need of industrialised countries to improve labour productivity; the reduction in manufacturing costs as a means of protecting themselves against low cost competitors; time based competition; quick response and the changing structures in supply chain relationships (Byrne 2000:1,10). The steady pattern of adoption as technology became available is evident in the following phases:

- In the 1950s related industries, like textiles, saw many fiber innovations in both process and product;
- The 1970s were marked by developments in automation in textiles and apparel, making significant break-through in the 1980's with Computer Aided Design, Computer Aided Manufacture and Unit Production System; and
- In the 1990s the focus of technology intensity moved down-stream in the apparel pipeline i.e. the retailing sectors, causing much pressure on the up-stream areas. Thus the pipeline is regarded not only as marketing and manufacturing pipeline, but also as a technological pipeline in which the sectors are connected in all respects (Hunter 1993:151,152). For SMEs to succeed they have to join the pipeline activities which are based on technology and in which timeous input is required.

The importance of technological change in the clothing industry is fundamental to economic growth and development. In South Africa SMEs in the manufacturing sector

are faced with a number of constraints that hamper their progress. In response to the problem both researchers and governmental authorities have recommended the enhancement of technological capacity in this sector (Hoffman and Rush 1988. Joffee et al. 1995, Ngubane 2001) .

### **2.2.3 Diffusion of Technology in the Clothing industry**

In the early 1970s CAD/ CAM systems made their appearance in the clothing industry by firstly implementing the applications to design ‘lay plans’; gradually as the demand and use increased other processes were introduced into the market. This application minimizes fabric wastage, which is very important for saving costs on material usage.

The introduction of the new technology required manufacturers to reorganize the production, by implementing new tasks, new methods of operation, and a strong management team with the relevant skills, for the efficient use of the systems. Altman’s (1994:34) study revealed that CAD may contribute to the decrease in material costs of 4-6% and a 50-70% reduction in grading /marking labour costs. As an increased range of functions were added to the basic capability, by 1982 large firms in the United States and Europe had installed CAD equipment (Hoffman and Rush 1988:78).

In the late 1980s the suppliers of CAD/CAM responded to the enthusiasm created in the market, by refining their products and adding many more functions specifically for the fashion market. There was increasing pressure on designers to satisfy a variety of markets, adaptation of ideas required easy implementation. CAD/CAM is able to perform these tasks without repeating all the steps of the design process (Gray 1998:6,7).

#### **2.2.4 Adoption Patterns**

In the 1980s the developing countries at this stage were thought to be slow at adopting the technology, due to the lack of marketing efforts on the part of the suppliers, the difficulty in justifying the investment, and in coping with the systems efficiently. Further indications reveal that the initial reluctance and resistance towards the new technology, was in terms of the 'size of the financial and technological leaps,' and educating the customer presented a problem, taking many months to sell the system (Hoffman and Rush 1988:78).

In the 1990s third world countries began to compare favourably with many of the most developed nations. They were prepared to invest in technology because of the organizational benefits that were gained from best practice. Countries like Mauritius, Sri Lanka and India improved production by 15%, gaining on low labour cost, in addition to the advantages derived from the new technology (Timpson 1998:11). Major exporting countries like Hong Kong, Taiwan and South Korea are investing in technology in order to provide greater responsiveness to European and US customers. Far Eastern countries have done this by freeing low labour and allowing them to take part in other industrial activities at a higher income. Nations do find ways and means of investing and as cited by Hunter (1993:149), Henry Ford forty years ago put it quite aptly, 'If you don't invest in new technology you will pay for it without ever owning it'.

#### **2. 2. 5 Criticism of the new technology**

The slow uptake on the new technology went beyond financial implications and justifications: traditional methods, knowledge application and technical capabilities and limitations were being questioned. The differing opinions expressed are outlined as:

- Design room personnel were leveling different attitudes towards CAD as a tool. The medium was thought to be sterile and lacking in tactile appeal of the traditional methods, whilst the older generation lacked confidence in learning (Gray 1998, Aldrich 1992);

- An opposing view by Brodner (1989:39,40) regarding the traditional structures of production and technology replacing human expertise, highlights the challenge in accepting the use of computers. He argues that product and process innovation become questionable, undermining the capability of innovation. The most important force related to production being sensory perception, tacit knowledge and human skills are not considered by these computer applications; and
- Further literature reveals that the scale of the work on the screen presents a problem, due to this, a certain amount of strain is experienced on the eyes. The whole pattern is not accessible, and working with many commands makes it cumbersome, at times sacrificing some of the techniques that are essential in achieving good results (Taylor 1990:201).

This is not altogether the reality; presently the software has advanced and to a large extent most of these disadvantages have been eliminated. Recent research and personal experience of the researcher can verify that the present systems are much more user-friendly, offering flexibility and labour saving process.

Overriding the negativity, Gray observes that the effectiveness of CAD/CAM systems, with their inherent qualities of efficiency and ease of operation, are dependent on the people and not the equipment. However, with the increased benefits derived from computers, leading companies use the technology as a means of survival, as newer tools provide significant creative capabilities and labour saving processes (Gray 1998:5,81). To substantiate the success of CAD further, a research survey conducted in the United States of 228 fashion designers, reported that 76 per cent of them used CAD to execute their daily work, and the designers agreed that there were many benefits offered. Thus increasing productivity and creativity in a highly competitive market (Dockery 1995:68,69).

### 2.2.6 New Developments

Information technology in the apparel industry has provided opportunities for new service concepts in search of enhanced competitiveness. The clothing industry technology in the 1990s was therefore driven by notable emphasis based on design, innovative fabrics, flexibility, quick response, quality and service; although these are not altogether new ideas, they have become powerful. These have been accentuated by the considerable changes in the structure of retailing worldwide and the awareness of the needs of the consumer. The use of computers together with Electronic Point of Sales (EpoS) and Electronic Data Interchange (EDI) are becoming important elements in the implementation of Quick Response (QR) speeding up the flow of information between suppliers and customers (Byrne 2000:3,12). Figure 1 shows the dramatic increase in the use of computers by the fashion industry making great inroads to improve the quality and to increase speed of manufacture. The main use of computer systems is that of computer-aided design (CAD).

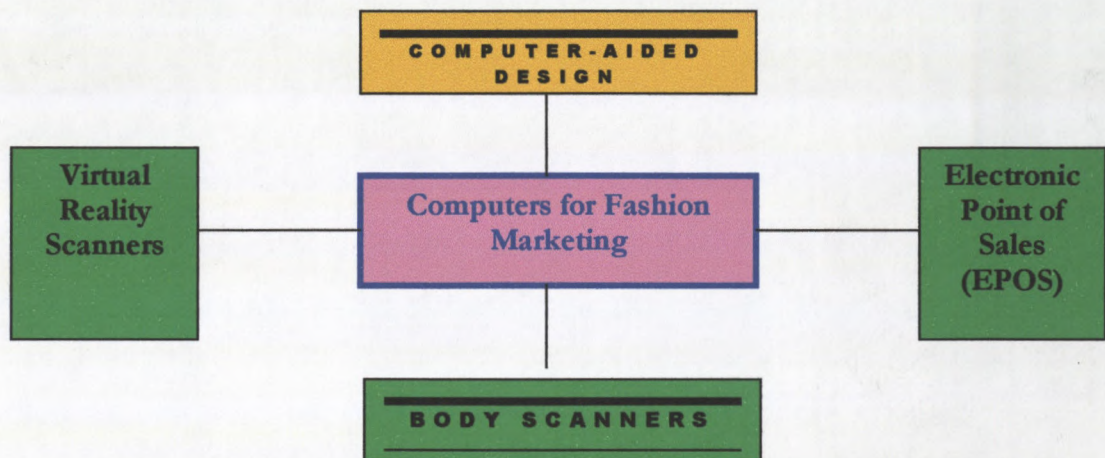


Figure 1 Computers in fashion marketing (Easey 2002:30)

The enormous changes brought about by computers have had many ramifications, in terms of output. The consumers demand new lines to be replaced in short spaces of time, thus the value chain responds by using technology to achieve production output.

As the environment becomes more challenging for businesses, the inter-dependence existing between retailers and manufacturers working in partnership, helps in achieving the increased need for 'quick response'. The clothing retail market no longer works on standard range of goods, but on a variety of small stock that is produced efficiently, is value for money and has good design quality throughout the supply chain (Gray 1998:27). Consumers are becoming increasingly aware of their wants and needs. Quality, comfort, and easy-to-wear rather than cumbersome, un-wearable clothing is what most consumers prefer for today's life-style.

Technology gives firms the power to circumvent scarce factors via new products and processes. It has also reduced the importance of certain factors of production that were once essential and overpowering. Flexible automation, which works for small quantities of sizes and easy changes on any model, is now reducing the labour requirements of products in many industries (Porter 1990:4). Labour implications are unique as technology demands technically skilled workforce in the industry.

Further developments in the past decade have challenged the era of mass production to that of mass customization, serving online retail markets with a totally new shopping experience. Individual consumer preferences are being met by utilizing cutting edge technology to the online marketplace (Mckinnon 2001:41). The interconnectivity created by linking information from all over the world by way of design, manufacture merchandising and marketing of the product is a reality (Chase 1997:xi). CAD applications in the 2-D conventional areas are becoming more sophisticated and easier to use, the next generation of CAD technology is turning to real world applications. Tait (2001:27-30) regards some of the innovations like digital printing, body scanning and virtual catwalks as the turning point in CAD technology.

This exemplifies the length and depth of new technology in the fashion business in terms of applications, speed, communication, cost effectiveness and innovation. If entrepreneurs in the fashion industry are unable to utilize the basic applications, if not

the sophisticated ones, the technology gap will increase even more over time. Emphasizing the success, Gray (1993:2) describes the new technology in the fashion and related industries as evidence of new applications that have come about at affordable prices.

### 2.2.7 Cost of Technology

Computer technology in its infancy was mainly aimed at 'wealthy' companies. Suppliers in the technological age are now exploring the untapped markets of small to medium sized businesses (Timpson 1998/9:36-37). In the early days it was the personal computers (PC) based systems that changed the market place, and computer technology became affordable by the 1990's, increasing the user base even among the small firms (Aldrich 1992:51). Figure 2 illustrates the price pyramid of CAD/CAM users, as the price decreased, the user base increased. The price of PCs has expanded the use of CAD/CAM to all sizes of companies from the one-person design studio to the multi-site corporations (Gray 1998:6).

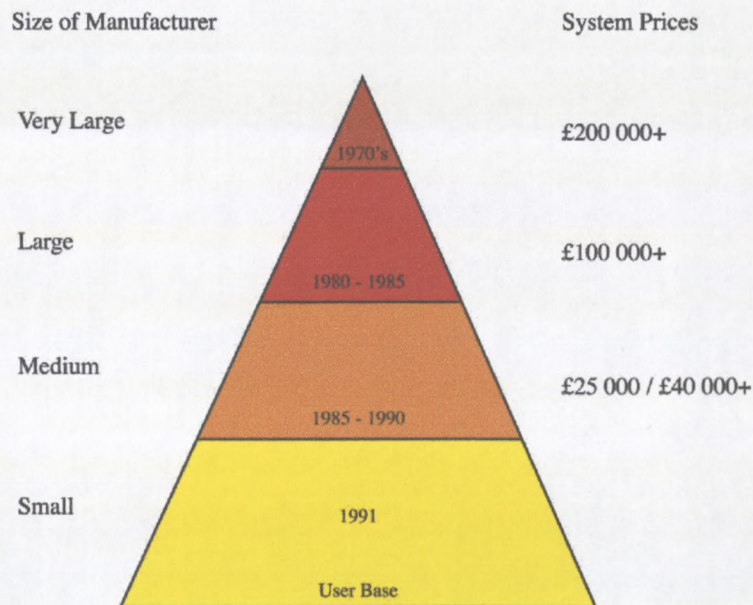


Figure 2 The price pyramid of CAD/CAM (Aldrich 1992:51)

Although research literature reflects the adoption of computer technology by small firms, this is not true of the South African situation when applied to entrepreneurs and most small firms in the fashion industry (Salinger et al. 1999:26). A study conducted by Flaherty et al. (1998:8) suggests that strategies for enhancing competitiveness among small-sized firms can be achieved by several factors, one of which is improvement in usage of CAD and CAM. Implications for SMEs are that innovation and competition through the use of technology have far reaching benefits for expansion and growth.

In concluding this section, Chanatarankaracha (2002:36) provides the most current view from abroad, which is the common and growing concern of the fashion industry. There are demands on manufacturers from all sides of the value chain. 'Faced with dramatic change in consumer behavior, the retail environment and technological advancements, it is clear that future success will require improvement of core capabilities, both at operational and at strategic levels.'

The Clothing Industry works under enormous pressure in trying to meet the internal and external demands of the supply chain. Time is related to cost, cutting down costs to the bare minimum and improving on quality output to meet consumer demands is applicable to large firms as well as SME entrepreneurs.

## **2.3 Competitiveness and productivity in the Clothing Industry**

### **2.3.1 Background of the Industry**

South African firms being freed from years of isolation have once again become trade partners with the international community. The end of apartheid brought investments back into the country and trade patterns increased, creating macro-economic pressure on the policy makers.

The competitiveness of South African industries continued to suffer as portfolio capital inflows caused further appreciation of the Rand. In mid 1996 the Growth Employment and Redistribution Act (GEAR) was announced; its macro economic

strategy was to dampen the inflation and stabilize the Rand. Gear was criticised for a number of reasons mainly that it increased the unemployment figures even more.

The reality is that South Africa's accession to the World Trade Organization (WTO) has meant the elimination of export subsidies, phased reduction of tariff promotion and their replacement with export promotion measures. Important statistics to note are that in the manufacturing sector, which is the highest contributor to the GDP at 24% and is also the largest employer at 42% of all private non-agricultural employment, South Africa is now exposed to foreign competition. With large-scale illegal imports entering the country, manufacturers are unable to compete with international suppliers. Consequently this has had a negative effect on employment (Salinger et al.1999:2).

The study conducted by Salinger et al. (1999) dealing with competitiveness and labour productivity provides a very meaningful insight to the clothing manufacturers in South Africa. Studies conducted by Altman (1994) and Joffe et al. (1995) are significant, as one is able to compare their research on the South African Clothing Industry and the problems associated per se. The review of their research as well as current research can be used to draw conclusions on how SMEs are able to compete and be more productive given the support of using the CAD system.

### **2.3.2 Competitiveness and productivity factors faced by SMEs**

The introduction of CAD technology is the most radical technological innovation developed since the advent of sewing machines more than 100 years ago (Hoffman and Rush 1988:73). Technological innovation has transformed the ways in which competitiveness has been applied to the various sections of the textile and apparel industries. Manufacturers and retailers respond to consumer demands in a faster and more flexible manner than their competitors who implement 'Quick Response' (QR) strategy. In the manufacturing industries, to be successful, competitive and to achieve efficiency and productivity, the most advanced IT concepts and methods including computer-aided design (CAD) must be used (Yan and Fiorito 2001:132). The importance of CAD in the clothing industry has been emphasized and recommended for small firms and entrepreneurs as they have become more affordable. In most developing countries SMEs are adopting CAD, but in South Africa SMEs find the investment in CAD beyond their reach as they face many constraints from financing to networking.

### **2.3.2.1 Studies on Productivity and Competitiveness**

Improvement of productivity through the adoption of a whole new philosophy requires consideration of certain concepts i.e. quality, throughput and efficient production processes. Productivity is also tangible and can be measured; it is also about people getting to work 'smarter' not 'harder.' Ultimately it is about increasing profits, bringing down costs and maintaining quality, with the entire workforce working towards what the customer wants (Gore 1995:32). CAD lends itself most proficiently to the productivity strategy. Gray (1993:1) mentions that CAD improves competitiveness by reducing time to the market, streamlines new development processes and that the features available have to be capitalized for gaining on manufacturing efficiency.

Altman's (1994:73) study on competitiveness is based on Cost-factors and Non-Price factors. Salinger et al. (1999:3) defines the term competitiveness as 'qualitative' when related to strategic management and 'quantitative, as related to cost. Although these two studies provide a very useful insight for the research, Hoffman and Rush (1988) provide a more direct and relevant approach for the study. Joffe et al. (1995) highlights the disadvantages SMEs face through their weak technological capacities and lack of support from institutions. The factors outlined by Altman (1994:73) for productivity enhancement entailed long term and short-term disadvantages and included many factors that are discussed in the Salinger et al. study (1999). Some of the most important factors include market access, high cost of raw materials, quality, low productivity, lead times, export-markets and training. Figure 3 illustrates the competitive position taking into account these factors. Although Altman's study provides a good framework of contributing factors for competitiveness, the use of new technology has not been fully explored. Salinger et al. (1999:27) refers to theories of innovation to assess firm competitiveness and therefore it is deemed necessary to discuss innovation as a concept.

Competitive position of the S.A. Clothing Industry			
Long Term		Short Term	
Advantage	Disadvantage	Advantage	Disadvantage
Market Access			
	<i>End of MFA</i>	<i>Lack of quotas</i>	<i>Vestages of sanctions</i>
Cost Factors			
Local raw materials	High cost of raw materials  Exchange rate policy	Avalability of local consultants	14% tariff into EC  Low productivity  Incosistent trade policy
Non- Price Factors			
Infrastructure  Reversed seasons  Strong union	Distance form export markets  Political uncertainty	Discipline of local retails  Timeless Quality  Will produce short runs	Lead times  Weak training  Weak design  Uncertainty of stoppages  Weak apparel textiles

Figure 3 Cost-Factors and Non-Price factors (Altman 1994:75)

### 2.3.2.2 Innovation and New Technology in Clothing

Innovation, broadly defined means improvements both in technology and better methods or ways of doing things (Porter 1980:45). In clothing manufacture, as described by Salinger et al. (1999:2,3) product innovation is related to design and fabric; processes were related to production and labour. CAD is able to perform these innovations with all its inherent features. Thomas cited in Giaoutzi et al. (1988:52,53)

refers to the creation of new technical possibilities that are achieved through a specific new technology-based industry or technological paradigm. These technical possibilities are associated with the creation and discovery of important techniques that are able to adapt to the task in a particular field e.g. clothing production and design environment. The technical advances (indicating progress in a technique) are viewed as incremental innovation, which divide into product and process innovation. As Salinger's (1999:27) innovation theory formed part of the competitiveness profile, the study provides a very useful indication of the extent to which the lack of access to computers disadvantages the SMEs.

### **2.3.2.3 The Impact and Effectiveness of CAD**

In the Salinger et al. (1999) study, in assessing competitiveness of firms the impact of firm management and innovation on growth performance were used as indicators. These indicators were based on qualitative (non-cost) factors. The factors included capital equipment, design capability in relation to the degree to which functions were computer related, management sophistication, and the use of advanced information systems that record all production activities besides accounting records. The implications of these systems on skills of workers, which eventually streamline operations and allow integration into world markets, were seen as incumbent to the process. Competitiveness was also seen as labour-related where re-skilling of work force meant improvement in productivity. Innovation in terms of product manufacturing processes formed part of the competitiveness profile. While product innovations were related to design and fabric, processes were related to production and labour (Salinger et al. 1999: 28, 29).

The study by Hoffman and Rush (1988:75,76) by way of a sample of user firms in the UK provides conclusive evidence of the advantages derived from the use of CAD. Small firms were disadvantaged by the benefits accrued by larger firms. Five significant areas detailed in the study are:

a) Fabric Usage

Fabric costs accounted for between 40 and 60 percent of the total cost of the garment. Savings by firms in the sample were recorded up to 4 to 6 percent on average. The savings were achieved by a number of time saving procedures, which under normal circumstances would involve many manual hours and effort. Technical constraints and limitation caused by surface design and match of prints etc. were easily facilitated by the system. Markers were compared to that of computer designed markers but they recorded a gain of 10 percent of fabric savings.

b) Skill and labour requirements

The choice of acquiring CAD systems was based on the difficulties faced with attracting graders and markers with experience. The rise in output increased enormously with the use of CAD although labour requirements were reduced. Training and skill requirements of CAD systems were affected in numerous ways.

c) Reduction in lead-time and increased flexibility

Through the use of CAD considerable savings in lead-time were gained. The flexibility and quick response of CAD systems proved to be very beneficial to firms that competed in a volatile market. Firms also reported work being accomplished in a single hour compared to three to four days previously. Flexibility of storing patterns was enhanced, change in style requirements were implemented frequently according to customer needs. Production processes were reduced by as much as 50%. Completed patterns sets were added to the file for future use.

d) Re-organization and management skills

A number of changes were required for the effective use of CAD. Systems managers and other specialists had to be appointed to oversee activities to ensure a smooth transition to new techniques. The benefits very much depended on the new set of skills that were required and full commitment was expected to ensure success. To be cost effective the CAD system required to be operated over two

or three shifts. The continuous work supply could be guaranteed without causing long periods of non-use or over queuing of work in progress.

e) Overall firm level savings

Many large firms in the sample were actively expanding to increase capacity. Large and small firms were considering the technology and none were at a point of returning to manual methods. In summing up the advantages, an interview with a large firm in the sample was very useful. A large shirt manufacturer claimed that with the system the firm had a wide variety of (700) styles including 1000 variations of other parts. These variations did not exist before CAD was adopted. The firm was able to compete by handling the complexities involved in pre-assembly with the type of operation. CAD had made it possible to produce better products more efficiently and in bigger quantities. The overall estimation of CAD included increased fabric utilization, enhanced quality with fewer seconds and returns, consistency, accuracy, an improved work rate and increase in capacity (Hoffman and Rush 1988:78).

#### **2.3.2.4 Competitive Advantage for large firms**

Through the review of this study it can be postulated that larger firms do stand to benefit from CAD technology through organizing and performing activities efficiently to meet consumer demands. The value chain that is referred to by Porter (1980: 40, 41) is evident in firms trying to gain competitive advantage by adopting new ways, employing new procedures, new technologies or different input. The value chain activities contribute towards the value the buyer will receive in the products. The network of activities performed, form these linkages, which affect each other. Some activities may be more important in the value chain as in clothing manufacture. Each activity is connected in terms of moving from one activity to another; any miscalculation or hiccups would affect the value chain and hence the quality of products (garment) that the buyers receive. Figure 4 illustrates the various support activities and the primary activities which form the value chain.

Large firms, unlike small firms have identifiable departments. Kroon (1998:35) notes that SMEs do not have clearly identifiable divisions (as seen in figure 4) or sophisticated buildings, bargaining power with suppliers or resources of a capital nature. It has been recognized that SME entrepreneurs provide 57% of employment in South Africa, producing goods under compromising and constraining conditions. To add value to their enterprises, support is essential as the disadvantages they face in terms of new technology input has adverse effects on their competitiveness and productivity.

The Competitive Advantage of Firms in Global Industries

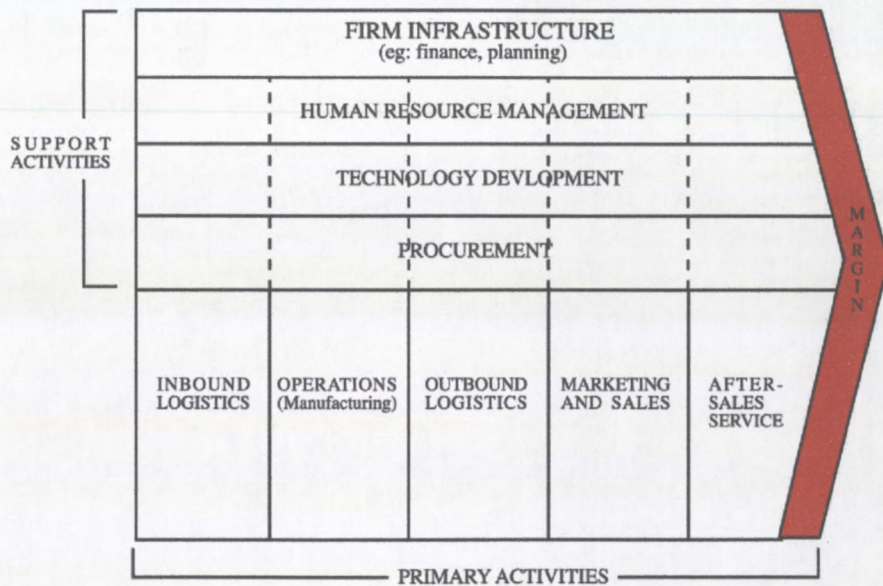


Figure 4 Value Chain (Porter 1980:41)

Research also reveals that SA manufacturing firms have strong production capabilities but are weak in customizing products and in innovating products. Innovation would probably apply to niche products of African influence as suggested by Salinger et al. (1999) for markets overseas. Those firms that were more technologically advanced were found to be conscious of enhancing product quality and product innovation. Firms that adopted international best practice were also more technologically advanced (Joffe et al. 1995:246).

The review of the studies provides ample evidence of many disadvantages SMEs are faced with. Kurt Salmon Associates (1995:6) believe that three changes in the 21<sup>st</sup> century will affect the clothing pipeline. The emergence of a truly global market place, the acceleration of technological advances and the emancipation of the consumer, are the challenges for transformation in the future. To empower SMEs in the clothing sector to meet the challenges requires the transfer of technology and the commercializing of acquired skills. The provision of support services through institutions was recommended by the Industrial Strategy Projects of both Altman (1994) and Joffe et al. (1995).

### **2.3.3 Commercialising Skills of Entrepreneurs**

A survey by the Human Resources Council (HRC) as cited by Ndiyane (1998) shows that 72 percent of blacks have not been absorbed in the job market. Students graduating from higher education institutions are being trained in fields for which there are no great demands. A recommendation was put forward to revisit the curricula to make learning applicable and relevant so that students become employable (Ndiyane 1998). The imparting of relevant knowledge and skills that can be commercialized has become essential. As future entrepreneurs, contribution to the income generation and economic growth by SMEs is important. Despite their important contribution, emerging entrepreneurs and SMEs are neglected in terms of finance, technology, training and marketing knowledge.

#### **2.3.3.1 Curriculum Needs**

Van der Linde (2000:4) emphasizes that the curriculum must be analyzed to determine how it complies with the needs of a country and people. A well-trained workforce, with up-to-date knowledge and learning skills are important for the twenty-first century. The core focus of the curriculum has changed in tertiary institutions as is evident in Chen's (1998:2) estimation and would apply to the present research study. According to Chen, in the new century, knowledge-based economies demand entrepreneurs that are technically conversant. They should be able to spot opportunities in high tech or high value-added products and processes. Entrepreneurs

having commercialized many innovations of today are those that have possessed the skills to be globally successful. Singapore would require high technology entrepreneurs or technopreneurs and they are likely to be tertiary educated. A similar concept has been outlined in the National Plan for Higher Education in South Africa. The plan incorporates learning towards high quality skills training, technology transfer and technology diffusion programmes, in anticipation of providing technological literacy.

At an international level colleges have kept their pace with industry by introducing computer systems and thus preparing future designers for high tech fashion (Kalcharyan 1988:66). The move towards adoption of CAD/CAM in the clothing industry has had an impact on the curriculum. The findings of Yan and Fiorito's (2001:140) research analysis have revealed that as the adoption of CAD/CAM increases, educators should prepare to give students opportunities to be efficiently trained in the hardware and software that the industry will depend on as future tools for responding competitively.

Embracing computer skills and not being able to commercialise their skills as a return on their educational endeavours would be fatal for entrepreneurs. The concept of entrepreneurship, as defined by Lalkaka (1999:2) is, 'an integrated chain of activities starting with concept identification to meet market opportunities, followed by commercial realization'. In effect entrepreneurs with CAD know-how need to make full use of their acquired knowledge by using computer systems to compete successfully in the market place.

### **2.3.3.2 Opportunities for SMEs in KwaZulu Natal**

The skills and technology base of the manufacturing sector are underdeveloped, SMEs entrepreneurs are purported to be weak and have a notable record of lack of inter-firm co-operation (Joffe et al. 1995). The Industrial Strategy Project believed that in improving manufacturing competitiveness a commitment to human resource development was crucial. Although the SMEs are faced with constraints, the region of KwaZulu Natal has a conducive environment to offer SMEs in the clothing sector. Statistics of the South African Clothing Industry and the importance of the KwaZulu manufacturing-sector reflect the following: The unemployment figures according to most recent statistics indicate a low of approximately 27%. Employment trends in

clothing manufacture show that of the 160 000 employed, 43% are in the formal sector (Textile Sector Profile 2001:3).

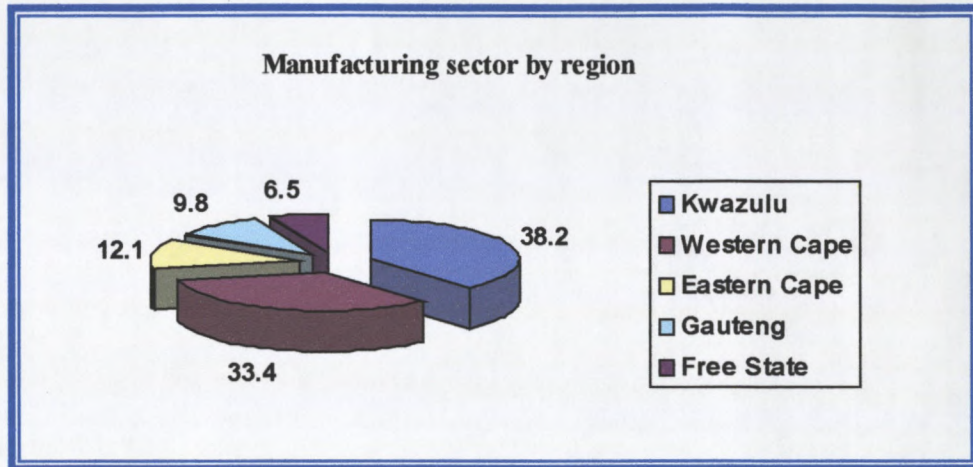


Figure 5 Manufacturing Regions in South Africa (Textile Sector Profile: 2001)

The importance of KwaZulu Natal as a manufacturing region is evident by the fact that about 958 companies represent KwaZulu-Natal, which is 38.3% of the total number in South Africa. Eastern Cape is very close with 33.4% representing 835 companies and the lowest being the Free State 6.8% with 170 companies (Textile Sector Profile 2001:3). It is important to note that the region of KwaZulu-Natal is regarded as a region of opportunity, according to a Report by Richmond (1995:1-4). American companies interested in the South African Market have placed KZN on top listing. Due to its position (Durban) is to become the largest industrial hub and therefore has the potential to grow and prosper economically.

According to Richmond (1995) a recent study conducted by an analyst in the US, KZN was placed as the most globally competitive region. Inexpensive transport cost, its location provides proximity to Asian markets and has the lowest rate of electrical power in the world. There are at least thirty US companies in the country. The Company Sara Lee, America's largest employer in South Africa is an example of American presence (Richmond 1995:1-4).

KZN contributes 15% of the nations GDP and has South Africa's largest provincial economy. Given its strategic position, efforts to boost the entrepreneurial activity have been made at a local and national level by government-supported initiatives.

## **2.4 SMEs Enhancement through Technology Support Mechanisms**

Many countries promoting innovation and creating entrepreneurial ventures require the formulation of strategies to be put into place to assist entrepreneurs and SMEs. Technology-based enterprises are assisted in being started up by business incubators and technology parks, are now proving to be cost effective (Lalkaka 2002:1). The role of business incubators and technology parks is significant and many countries have placed emphasis on developing SMEs through these relatively new and successful mechanisms of support. Specific support mechanisms have been recommended in the various reviews undertaken (Joffe et al. (1995), Carson et al. (1995), Davies (2001).

### **2.4.1 Specific Needs And Support**

Grierson (2000:26) highlights that all types of SME support agencies or support services should consider 'needs of the clients' and maintain close contact with local markets, in order to ensure that the demand-driven impulse is not weakened. It is implicit that general support would be ineffective, as entrepreneurs have specific needs. Technological development of SMEs is said to be specific to individual needs and therefore the application of technology within a particular environment needs specifically designed support (Joffe et al. 1995: 81). Joffe's study further revealed that technology delivery to SMEs must be content-specific and available in the immediate neighbourhood or localities of the enterprises. Tertiary institutions have been identified to play an active role by formulating support strategies that benefit the SMEs in the various sectors of the economy (Ramjugernath 2000, Davies 2001).

Davies (2001:33) recommends that institutional business centres should be created and advises that customised consultancy, training for the growth of new industries and facilitation of networking opportunities should be considered in the support strategies. Supporting SMEs to further their technology development, implementation of new technologies and assisting with quality control are seen as essential to their growth and effectiveness. Davies re-affirms the views and recommendations of the study conducted by Joffe et al. Hence incubator interventions are essential as support mechanisms for SME entrepreneurs. The potential for increasing the chances of survival of new firms in the early stages of

development are made possible by specific support. Various international support models have demonstrated and proved the success of incubator programmes.

#### **2.4.2 Incubators**

There are different categories of incubators, depending on the type of support, information, contacts, shared resources, offices, manufacturing spaces, cubicles, business and technical advice, mentors and financial resources, organized training, mentoring and counseling. The following four types of incubators identified are:

- Business Incubators are supportive environments designed to assist start-up and early-stage companies to grow successfully;
- Technology Incubators support the growth of companies involved in emerging technologies. These incubators focus on commercialization of technology as well as research and development;
- Empowerment/ Micro- enterprise incubators focus on the growth of the businesses located in high unemployment and neighbourhood deterioration areas, that face economic difficulties and support to low-income, minority and women-owned businesses; and
- Mixed Use or General incubators promote and support all kinds of businesses (Pacific Incubator Networks 2002:1).

#### **2.4.3 Successful International Support Interventions**

Manufacturing technology transfer projects implemented by USAID called 'FABRYKAT' and the often-quoted 'Third Italy' are excellent examples of specific support approaches and of technology within the design environment. Other international examples include Fashion Incubators in Canada, UK and New Zealand providing specific support to enhance skills of fashion entrepreneurs in special environments. They offer fully equipped production facilities and professional environments to nurture new fashion innovators. These incubators work on either a profit or non-profit basis. The literature search has revealed that the fashion incubators in each one of these examples have a unique set of services to offer. Therefore, it can be presumed that the type of service is based on the needs of the entrepreneurs or the clients. The following examples explain the set-up and service provided by the fashion incubators in the different countries:

#### 2.4.4.1 Fashion Incubators

- **Fashion Incubator in New Zealand:** The fashion incubator at the Auckland University of Technology's Tech Park provides the fashion incubator designer a professional standing within an excitingly creative and innovative environment. Important links with the fashion industry are formed and access to people and knowledge needed to turn concepts into reality are made possible. These services and packages meet the real needs of the emerging fashion entrepreneur (Fashion Incubator: [http:// fashion incubator.co.za /about.html](http://fashionincubator.co.za/about.html)).
- **Toronto Fashion Incubator (TFI):** The Toronto Fashion Incubator is a non-profit, small business centre mandated to nurture, promote and assist new fashion designers and entrepreneurs. The incubators provide contemporary, professional environment for staff and TFI members. Studios are available for rental and production facilities are equipped with industrial sewing machines. The resource library contains current and past forecasting books and the Eveleen Dollery Showroom where a professional environment prevails (See pictures in Appendix D). The TFI members are able to make presentations to buyers and editors in the studios (TFI-[http://www.fashion incubator.on.ca/](http://www.fashionincubator.on.ca/)).
- **Emtex: Designer Forum Centre:** The Designer Forum is set up within the East Midlands Clothing & Textile Association (Emtex) to provide variety of business and design support to Designers, Consultants, Design-led Companies and Undergraduates and Graduates. The Designer Forum operates from its own purpose-built studio and is responsible for running a number of UK and European funded projects. Internet-based fashion and textile resource and the availability of the service of a CAD Bureau are its main features. (Designer Forum EMTEX, Designer Forum Studio <http://www.emtex.org.uk/designerforum.asp>).

#### **2.4.4.2 Successful Models of Technology Incubators**

##### **a) FABRYKAT 2000: USAID FINAL REPORT (2000:1-8)**

USAID/Poland conducted a Manufacturing Technology Transfer Project called 'FABRYKAT 2000' from September 1998 – September 2000. The purpose of the first technology transfer project was to develop the capacity of four TTCs (Technology Transfer Centres) in the Polish cities. All the centres are now in operation and have successfully established themselves as key players in the economic growth of the region. Polish and US industry specialist addressed the manufacturing extension needs of SMEs clients through:

- Plant layout analysis;
- Manufacturing process improvement;
- Product improvement;
- New product development;
- Development of new markets; and
- Attraction of joint return partners and other services.

The technology commercialising activities supported the special needs of high technology firms. They provided access to seed capital financing, management assistance and networking opportunities. FABRYKAT 2000 has proven that technology-transfer is an important function of the Polish SMEs assistance programs. Established SMEs showed a strong demand for manufacturing extension programmes which is beyond the capacity of the TTC to provide. Technology commercialisation is also in demand among the SMEs. According to the report it is noted that, the rapid success of FABRYKAT 2000 in Poland sets a good example for its application in less developed economies where resources are scarce. Improvement of SME productivity and international competitiveness can be provided through similar programmes. International donors have made a very important observation that SMEs in developed countries need specialised help.

### **b) Industrial District – ‘Third Italy’**

The districts of north central Italy are commonly known as ‘Third Italy’ in order to distinguish between northern and southern Italy. The industry districts of Emilia Romagna are identified as the “the model” of contemporary Marshallian industrial districts. In Italy firms employ skilled craftsmen and craftswomen who participate fully in the management of the business. The governance structures of these districts are based on trust and co-operation (Danson and Whittam 2002:1). The following is one example/model of a collective service center developed in Emilia Romagna utilizing new technology:

ERVET (Regional Board for Economic Development) promotes new technology activities in the industrial district of north central Italy. CITER (Centro Informazione Tessile Emilia-Romagna) was established in 1980 as a sector specific centre, operating in the knitwear industry. The regional board ensures that small firms have access, and do not suffer cost disadvantages. Other activities include, export promotion and, access to European Community R&D programs.

Citera, which is a computer- aided workstation for the design of knitwear was developed in conjunction with ENEA (the Italian Commission for Nuclear and alternative Energy Sources). It enables fashion designers to gain rapid reviews of thousands of images and colors, which speeds up the turnaround time from design to the finished product. The knitwear industry is able to maintain a competitive edge over low cost competitors by speeding up the process. SMEs in the region achieve external economies of scale through co-operation. The cost of using this new technology is not within the reach of the individual firms. The service center provides the facilities of a computer-aided workstation, for a small fee. Innovative techniques such as Citera, has radically reduced the process of design to production to a finished product in terms of time, from months to days. The measures have assisted in the development of the concept of *ready fashion* (Danson and Whittam 2000:1-5).

The successful models cited above clearly indicate that, given the technology support, small firms/SMEs entrepreneurs can prosper and perform as efficiently as larger firms that use CAD technology. The international

examples provide the collective body of evidence that has given the impetus for similar support projects to be introduced locally by government and educational institutions.

#### 2.4.4.4 Significance of Incubators in Industrialized Countries

According to an assessment by Lalkaka and Bishop (1996:4) incubators in seven industrializing countries demonstrated that technology and business incubators are beginning to make a significant impact on economic development. The incubator characteristics in the countries studied by them are summarized in the Table below:

Table 1 Industrializing Country Incubators

Country	Incubators Total	Sample	Average Investment US\$000	Building Net M2	Tenants Firms	Employees
<i>Brazil</i>	42	16	n/a	810	10	55
<i>China</i>	73	31	454	4,702	36	727
<i>Czech R.</i>	27	17	N/a	5,757	26	105
<i>Mexico</i>	10	6	529	676	6	n/a
<i>Nigeria</i>	2	2	N/a	1,871	7	38
<i>Poland</i>	19	19	N/a	1,813	15	88
<i>Turkey</i>	5	2	568	951	16	72
<b>OVERALL</b>	143	93	496	3169	24	359

Lalkaka 1999:4

Research shows that among industrializing countries, the largest incubator program is in China, with over 2,000 enterprises, producing a sales turnover of almost US\$ 200 million (in 1993). From a modest beginning in the 80s with assistance from the United Nations, the Chinese incubators have graduated over 200 enterprises. Incubators work on a system of non-profit basis and are state-owned corporations. The table shows that the incubator programs are well established in Brazil and China with a total of forty two and seventy three respectively. By comparison in South Africa, Egypt and Korea, incubator programs are in their early stages. Lalkaka indicated in his

study that South African Breweries had set up incubators for retrenched employees to create alternate employment the former Technikon Natal was cited as developing the incubators for empowering the previously disadvantaged communities. Participation by educational institutions in providing support mechanisms, skills training and business support for previously disadvantaged SMEs is imperative.

## 2.5 SMEs Constraints in South Africa

SMEs entrepreneurs face many obstacles of which education and training have been identified in the Gem survey as the most inhibiting factors for entrepreneurial activity. The survey also revealed that one in every four adults had no education and that only 6% of all adults in South Africa had a tertiary education.

These staggering figures around education and training indicate the need expressed by entrepreneurs in education as being the most pressing. Key issues other than education are highlighted in Figure 6 below:

**Problems that inhibit entrepreneurial activity in South Africa, according to expert informants**

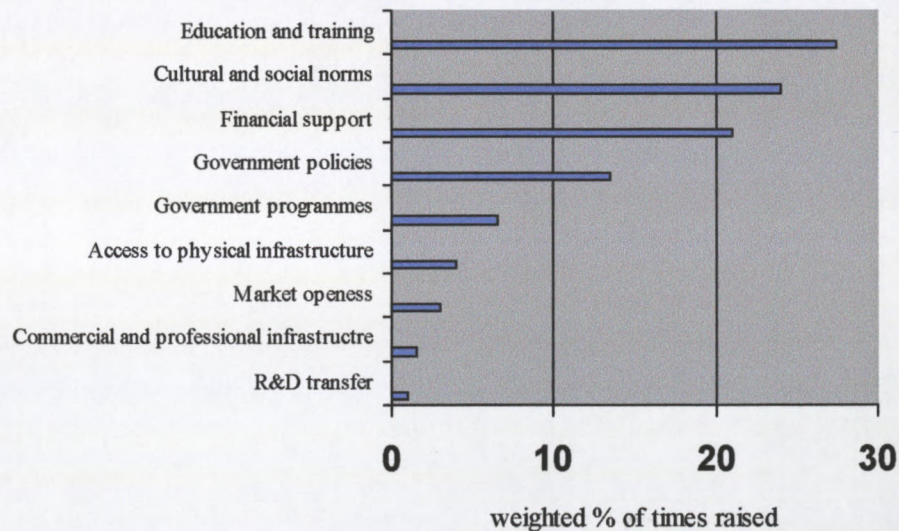


Figure 6 Source: Gem Survey (2001:39)

The last four items on the bar graph were regarded as the least important, thus showing the extent to which education and training hinder entrepreneurial activity. Past policies and barriers to education have perpetuated a backlog, which is difficult to overcome. Therefore the basic skills level, and adult education are a priority and are being addressed at a national level in order to assist the SMEs in their contribution to the economy.

### **2.5.1 National Education**

The National Plan for Higher Education (2001:7-49) in South Africa, in its broad context is said to provide opportunities that are unique, in meeting challenges to produce graduates of high quality skills and competency in all fields. The provision is believed to address the shortage of high-level skilled workers. The Sector Education and Training Authority (SETA) is responsible for identifying the delivery and development of the required programmes through appropriate higher education providers. The skills gaps and shortages are to be addressed through access and various learnership programmes coordinated by skills facilitators. The development approach is said to guide institutions and industry towards meeting the goals as a whole.

Development programmes such as the Human Resources Development for Industry Programme takes into account the development of technology and appropriately skilled people in its effort to improve South Africa's global competitiveness. The Technology and Human Resource for Industry Program (THRIP) was established in 1991 as a joint venture between industry, research and education institutions and government. The THRIP programme supports the accessing of resources and support mechanisms that develop technology, and the improvement of appropriate skills that lead to successful commercialization of products and services.

The South African higher education system is faced with key challenges, and the role of higher education is seen as three-fold in a world that is knowledge-driven. These include human resource development, high level skills training and the production, acquisition and application of new knowledge.

### **2.5.2 The Role of Higher Education and New Technology Opportunities**

There is growing pressure on higher education to be more responsive to the needs of the economy, the broader society and particular communities, and to move away from an elite, to a mass education system. The change required is to engage the help of societies in determining their needs and actions, and not for academics to forecast what is good for society (NCHE 1996:6). Further to this, the demands for increasing technological literacy and innovation have become additionally challenging to education. High levels of skills that are appropriate and market-orientated are required in the information-driven economy. This would require new skills that relate to the 'world of work' and skills that can be applied in the work situation.

### **2.5.3 New Requirements in Education and Technology**

Other policy documents also address transformation goals that affect human resource development e.g. (RPL) Recognition of Prior Learning and lifelong learning and the needs of the economy. These goals are being addressed especially in view of the current trends in unemployment records. However, it is for Higher Education to provide curricula to meet the challenges of upgrading technological capabilities and literacy. According to Carl (1997:25) South Africa has a need for dynamic curriculum development so that relevant education may prepare pupils for a world of work. He stresses that there must be purposeful curriculum to supply manpower and their requirements. In the fashion design course, consideration has been given to the technological needs of students, and to the clothing industry they will serve in the future.

In Porter's (1990:629) view the appropriate policies towards education and training must reflect each nation's particular circumstances. Applicable characteristics of sound educational policy emerge from his research that apply to the fashion course which relates to:

1. Students must be equipped with skills necessary for them to be meaningful participants in the economy. Also mentioned is the fact that the minimum standard necessary have been rising continuously as technology advances; and

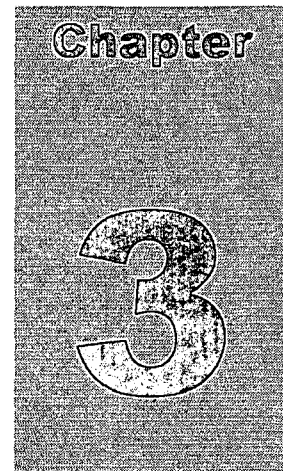
2. Technical universities and vocational schools are respected alternatives to universities. The economy cannot upgrade rapidly unless students gain the skills needed in particular industries.

At an institutional level the former ML Sultan Technikon (which merged in April 2002 with Technikon Natal to form the Durban Institute of Technology), was committed to meet the new challenges of higher education, as well as the demographic, economic and cultural requirements of the country. As the institution realigned itself, it was essential to formulate goals and objectives for teaching and learning, research and development, innovation and entrepreneurship, community service, internationalisation, technology, quality and leadership. One of the objectives pertinent to the study, of which the department takes cognisance, is 'to produce graduates who value and practice the pursuit and application of knowledge, and who are equipped for careers and employment.' Departmentally, the envisaged support strategy would be of great value to our future entrepreneurs/graduates and SMEs, in improving their technological development.

## **2.6 Conclusion**

The literature survey has provided evidence that SMEs entrepreneurs in the clothing sector require upgrading and enhancing of technological capabilities. Technological change that is required in the country is dependent not only on the research and development but also on the ways in which resources, including skills are organized for companies and firms. The upgrading of SMEs is seen as an important challenge for economic growth of South Africa. The different avenues that are identified to address the problems are: education, specialized support mechanisms and skills training programmes. The main aim of the present research study is to promote and support graduates and SME entrepreneurs by providing them with the use of CAD as a resource to gain competitiveness and productivity.

In Chapter Three the research methodology is discussed with reference to the collection of data, the selection of the sample, the questionnaire design for the 2 groups of respondents, the distribution/collection of the questionnaire and the reliability and the validity of the data to be employed.



## **RESEARCH METHODOLOGY**

### **3.1 INTRODUCTION**

The literature was reviewed in Chapter 2 and several key issues and problems were identified. Chapter 3 describes the methodology that was used to ascertain and investigate the data. The chapter also verifies the appropriate research steps and procedures that were followed for these purposes. The administration, the collection procedure, and the treatment of the data are outlined.

### **3.2 THE DATA**

#### **Primary Data**

The results of responses from small and large firms using CAD systems, academics, experts in the field, consultants and graduates formed the primary data.

#### **Secondary Data**

Secondary data included current and historical sources and was obtained by a review of the following:

- Literature on SMEs, computer technology in the clothing industry and the provision of support services;
- The types of incubator and business service centers (both national and international examples);
- Business magazines, newspaper reports and articles;
- On-line sourcing using Internet articles related to SMEs (entrepreneurs);
- Academic Journals; and

- Trade Magazine reports related to technology (CAD) in the clothing industry.

### **3.3 DATA COLLECTION**

The data was gathered using an empirical investigation using questionnaires. The following respondents made up the sample:

- Large, medium and small companies using the CAD system were drawn from a user base list of eThekweni (Durban);
- Academics with CAD experience at Technikons in South Africa;
- Consultants, trainers and experts in the field; and
- Graduates and students from the former M L Sultan Technikon (2000 – 2002).

### **3.4 QUESTIONNAIRE DESIGN**

A structured questionnaire using the Likert scale was developed and administered to the various respondents. Since they are widely used for their built-in subtlety of response and the rating scales are particularly useful for soliciting attitudes, perceptions and opinions of respondents, the instrument was regarded as most appropriate for the survey. The main feature being that it is an attitude-scaling instrument (Cohen et al. 2000:253).

According to Neuman (2000) the Likert, the Stapel, and the Semantic Differential are Semantic scales that are used for constructing most instruments used in business research. The precision (reliability) and the accuracy (validity) of verbal instruments are mostly determined by the design and construction of the scales (Thurstone [1928] as cited by Newman [2000]). Likert scale considers three characteristics of semantic

scales with respect to scale quality. The characteristics fall into three major classes of meaning: evaluation (good-bad), potency (strong-weak) and activity (active-passive). Evaluation is the most significant of all three classes of meaning. Results from Semantic Differentials indicate to the researcher how one person perceives different concepts or how different people view the same concept (Neuman 2000:189).

As cited by Munshi, Likert (1932) himself, in his original paper, did not consider the number of choices to be an important issue stating only "If five alternatives are used, it is necessary to assign values from one to five with the third option assigned to the undecided position". It is implied that the actual number of choices may be left to the individual researchers. In practice, researchers often do assign the number of choices arbitrarily according to personal taste or past convention (Munshi 1990:1,2). The middle option of undecided was used as it allows a neutral answer unlike four-point scale that forces a decision (Melville and Goddard 1996:4).

### **3.4.1 The Questionnaire**

Questionnaires are the most commonly used instruments consisting of a printed list of questions, which respondents are requested to answer. Although questionnaires are easy to compile, their effectiveness lies in forward planning for ensuring that, the data can be analyzed objectively (Melville and Goddard 1996:43). The advantages of using questionnaires are:

- It allows the researcher to collect the data easily;
- The information is easily coded;
- If the measures are valid and reliable, the scientific community benefits from the research; and
- The positive measures carry some weight for the respondents (Tabeisa 2001:11).

The questionnaire used in the survey, as prescribed by Neuman (1999:270) included a covering letter requesting the respondent's co-operation and explaining the purpose of the survey (Appendix A). A guarantee of confidentiality and full details of the researcher were provided. Accompanied in the letter was a self-addressed envelope with a postage stamp for the convenience of the respondent and in expectation of a prompt response. A mailing list was compiled to keep track of the replies.

### **3.4.2 Description of Questionnaires**

Two sets of questionnaires were compiled in order to ascertain the required data from the two groups of respondents i.e. students/graduates group and the 'other' group consisting of industry, experts and lecturers. Part 1 of the questionnaire was identical for both these groups, the differences in Part 2 distinguished them from each other. (See Appendices A and B ).

**Questionnaire A.** The questionnaire for the industry, experts and lecturers consisted of 26 questions in total.

**Questionnaire B.** The questionnaire for students/graduates consisted of 13 questions, which were drawn from Questionnaire A and to which no changes were made. The questions that were eliminated were beyond the scope of these respondents. The distinction had to be drawn as students/graduates were not in a position to give opinions on statements like, efficiency of production, training for staff and the recommendation of CAD for small and large firms. This sample included respondents that had the CAD training but did not have access to the resources. The analysis was conducted taking these factors into account.

#### **3.4.2.1 Questionnaire A**

**Part 1** of the questionnaire consisted of factual questions relating to biographical details of the respondents and demographic variation of the firms. Structured dichotomous questions pertaining to age and experience were used. Relevant workplace and computer details that were important to the study were also utilized. Seven questions were included in this section.

**Part 2** of the questionnaire was based on a qualitative study and therefore addressed broad areas related to the use of Computer Aided Design. Key areas identified included the disadvantages/advantages through the lack of computers, the needs that would impact on the productivity and competitiveness of SME and CAD as a resource for entrepreneurs. A total of twenty-five questions were posed, of which the final one was open ended. This was to invite an honest and personal input other than the Likert type responses. If respondents deemed it necessary the opportunity was provided.

The questionnaire was formulated in a logical sequence and dealt with the following three areas:

**General** – This section identified the aspects on the familiarity and operation of the CAD system and its use in the clothing industry.

**Disadvantages** – The questions addressed the various elements that contribute towards the competitiveness and productivity through the use of computers.

**Benefits and Support** – These questions related to the improvement in competitiveness and a consensus/opinion towards the use of CAD at a support centre.

### **3.5 Reliability and Validity**

According to Neuman, (2000:164-168) reliability and validity are central issues in all measurements. The main significance of both the measures is the connection between the concrete to constructs. Although reliability and validity are ideals that researchers strive for, these are difficult to attain. In establishing the findings to be truthful, credible and believable both the measures are important.

### **3.5.1 Reliability**

Reliability means dependability or consistency. It implies that if measurements are conducted under very similar and identical conditions, it is likely that there will be recurrence and repetition of the results. The process proves the opposite to reliability in the event that the measurements produce erratic, unstable or inconsistent results.

Reliability can be improved, although as mentioned, it is rare to have perfect reliability.

There are four methods by which reliability measures can be improved:

1. The construct can be clearly conceptualized;
2. The use of a precise level of measurements;
3. Multiple indicator usage of variables; and
4. The use of pilot tests.

### **3.5.2 Validity**

Validity refers to truthfulness and how well the conceptualized idea the researcher is attempting to research 'fits' with the actual reality. Poor fit takes place when no validity is reflected between the constructs a researcher utilizes in describing, theorizing and analyzing the social reality that is being measured. However, the specifics of reliability and validity may be viewed differently in the research process. Quantitative and qualitative researchers require reliability and validity measurements.

#### **3.5.2.1 Statistical Validity**

Statistical validity is important to the study as it indicates that the correct procedures were selected. It further implies that the assumptions were fully met in relation to the conditions appropriate to the study. In order to retain the validity of the statistics, its major assumptions should not be violated. The misuse of statistical procedures should be avoided. Although the results may be calculated correctly, the results will be invalid. This can occur when computing information at a nominal level to find the average or mean (Neuman 2000:172).

There are four types of validity i.e. face validity, content validity, criterion validity and predictive validity. The most basic kind is face validity and it is the easiest to achieve (Neuman 2000:168).

### **3.6 Pilot Study**

The pilot test was done to improve the reliability of the measures. A preliminary version was drafted, followed by a final version using the input from the survey sample. Previous research (Vawda 1997) in the same area was used to build on the measures or new indicators were added by using previous measures.

A pilot study was conducted by selecting a small sample from the different groups that made up the survey sample. Various input was required in order to attain clarity of instructions, avoid any ambiguities and vagueness in the questions and to ascertain that the terminology is commonly understood (Beach 1992: 57).

The pilot study was useful in that some changes were required to facilitate the process as well as simplify some of the questions. The length of the questionnaire did not pose a problem.

### **3.7 Administration of Questionnaire**

The lists compiled for the different groupings were used for follow up purposes and to ascertain the response rate. A selection of methods was used to deliver the questionnaires to the respondents.

- Questionnaires were mailed if correct addresses were known;
- Hand delivered by field worker in case of SMEs (graduates); and
- E-mailed or facsimile used for Technikons and CAD experts/consultants.

### **3.8 Sample Selection**

Purposive sampling was used, based on the fact that this is an acceptable kind of sampling, which is applied to special situations (Neuman 2000:198). Cases in the study were selected for special reasons as indicated below.

The sample selection was based on the familiarity of CAD and its use in the clothing industry as the most important prerogative in the research survey. Hence the groups selected represented large and small clothing companies with experience on various systems.

Academics from other institutions who have had past experience and impart the CAD skills to their students were selected for an institutional exposition to the study.

Experts in the field were clothing industry trainers for the various CAD system packages. Their experience over the years would provide the necessary view points/input, first hand experience related to the pros and cons of training and use of the systems and their benefits to small industry (entrepreneurs).

As the feasibility of such a project being undertaken relies on support from experts, hence the criteria for inclusion in the sample was based on them being considered specialists in the eThekweni industry that they serve. Particular types of respondents were required as the research was exploratory (Neuman 2000:198).

#### **3.8.1 Response Rate**

The response rate was slow although calls were made to remind respondents of the urgency of the questionnaire. The response rate increased when the questionnaire was faxed to respective companies. Many of the firms ignored the initial questionnaire and were not aware of having received it. A few of the respondents communicated their lack of knowledge of the new Durban Institute of Technology. The researcher is under the impression that respondents were unfamiliar with the name *Durban Institute of Technology* and therefore did not particularly take an interest. The response rate was 80%, which is a good sample to work with.

The distribution ratio of the questionnaire was as follows:

- Fifty-three (n = 53) Clothing industry, CAD consultants, Technikon Lecturers.
- Forty-five (n = 45) Students/ Graduates (2000-2002).

### **3.9 Data Analysis**

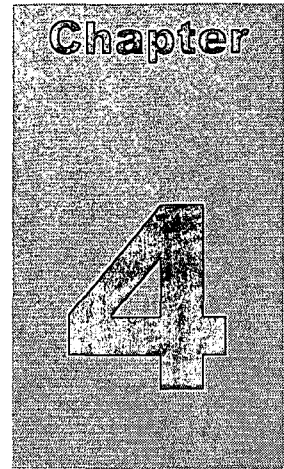
The questionnaires received were edited and checked. A thorough check was conducted to detect any inconsistencies and incompleteness. Checking with respondents rectified the missing data.

The statistical section of the report is to ascertain the use of CAD in relation to industry, CAD consultants, lecturers, and students towards computer systems. In addition, a group of variables were used as multiple indicators for key concepts to the responses when making inferences for the final analysis. According to Neuman (2000:322) statistical relationships can be based on co-variation and independence. In the present study, certain variables go together or are associated together. Independence occurs when no association can be found and no particular value can be found influencing the other.

The raw data from the questionnaires was captured and collated. The data was analyzed using the software package SPSS/PC (Statistical Package for Social Scientist) by a statistician. The data was analyzed by calculating frequencies and percentages and compound frequency distribution of: General Attitude; Advantages / Disadvantages through lack of access to computers; and the quality, Support and Competitiveness factors.

### **3.10 Conclusion**

This chapter has covered the research methodology stages in this qualitative study. The stages have been discussed in terms of the procedures followed, the sample selection, pilot testing and the data analysis. The findings of the study are discussed in the following chapter.



## **INTERPRETATION OF RESEARCH DATA**

### **4.1 Introduction**

This chapter presents and reports on the patterns of results from the empirical study and provides analysis of their relevance to the study. Cross-tabulations and graphs are utilized to show how SMEs/students are influenced through the lack of CAD resources and the specific training that is required in the use of CAD.

#### **Description of variables**

##### **Part A**

This section established company size, number of years of experience and opinions on most utilized applications (CAD) in the industry. Information from the findings were used to cross-reference with multiple variables in Part B. These were used to find relationships for the transfer of technology and the specific needs of training.

##### **Part B**

To provide a description of variables in the research, frequency tables, cross tabulations and mean-scores were used. The descriptions of the variables are under 3 different sections of the questionnaire. Section B in the questionnaire included:

- General questions aimed at attitudes on training and computer use;
- Disadvantages through lack of computers; and
- Improvement of competitiveness through quality, support and other factors related to CAD for SMEs.

The analysis with respondents from industry and experts was based on a Likert scale questionnaire with 24 statements/variables. (Questionnaire-A)

The analysis for respondents from tertiary institutions (students/graduates) was based on 13 of the 24 variables selected from Questionnaire A, as students were not in a position to respond to certain statements.

#### **4.2 General Questions**

The various items under general were primarily to ascertain the attitude towards CAD technology and training/technology transfer. In addition to this, a statement on employment opportunities was included:

A total of 4 out of 5 questions in this section covered variables related to training and the attitude towards computers in terms of: ease of operation, traditional methods for using CAD and the transition from manual operations to computer systems.

The statement regarding an increase in one's job opportunities received a high level of agreement from respondents. An overall agreement of 89.7% (Fig. 7) was yielded thus suggesting that training in CAD is essential in the clothing industry and at technicians. Students, industry and experts convey a degree of positiveness in that job opportunities are created in the field of clothing with experience in CAD training. Kalcharyan (1988:66) highlights that future students must be prepared for high tech fashion. In considering the importance of technology to industry, colleges have kept pace by introducing computer systems. The implication that job opportunities increase with the knowledge of computer technology is apparent. In an open response a student's statement: 'CAD is essential for a better future,' is in recognition of its importance to 'new' requirements for the workplace. On the contrary, another respondent felt that computers were the result of job losses in the industry. The recent findings of Yan and Fiorito (2001:140) reveal that efficient training will provide opportunities to graduates as the industry regards CAD/CAM as their future tools for competitiveness.

Beije (1998:28) expresses a viewpoint that innovation not only has a significant impact on economic growth but also on employment. He describes the effect of innovation on employment as being positive and negative depending on the age of the industry. Process innovations (as in CAD used in this study) tend to reduce employment. His illustration is in keeping with the concerns raised by some of the researchers and respondents.

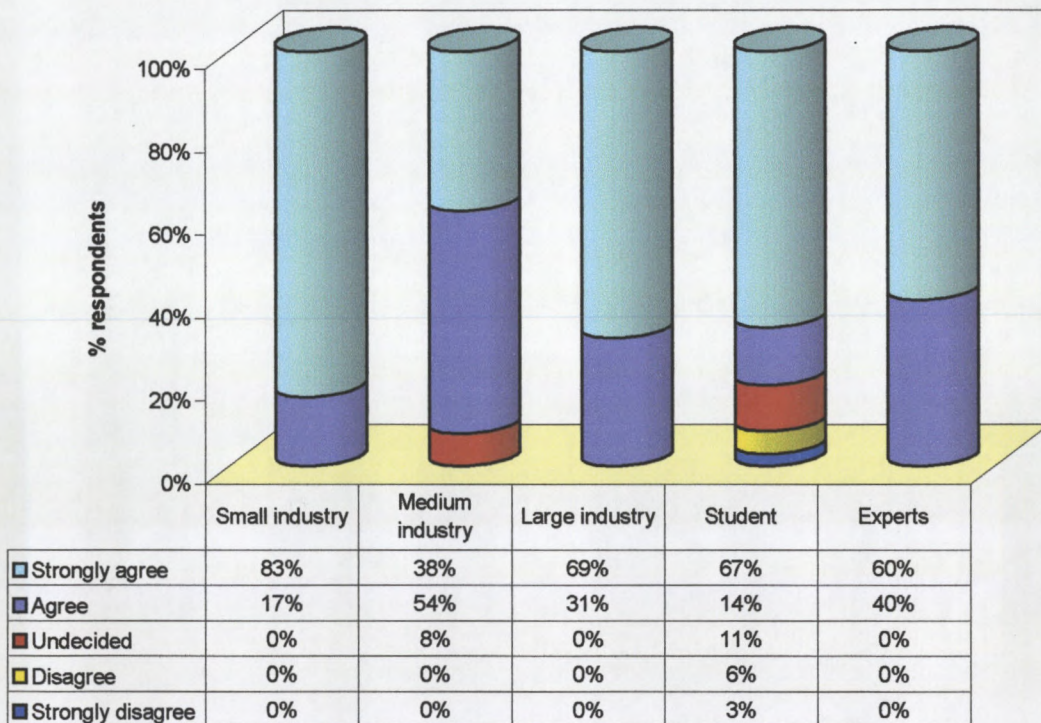


Fig. 7 Knowledge & skills in computers increases one's job opportunities

The high level of agreement for 'provision of service enhances skills' (100% from small industry and 97% from students) and 'training is essential' (100% from industry) provides further evidence that CAD systems are fast becoming the tools of the future in the clothing industry. CAD training is significant to all SMEs entrepreneurs as outlined in Joffe et al. (1995:197) and Altman (1994:143-144) who identified problems among South Africa's manufacturing sector. They reported that the under-developed skills and weak technology base as a major inhibiting factor for high productivity. Further to this Altman's viewpoint is that, 'the educational and skills potential of employees is underestimated' by employers, with this stance,

workers are denied upward mobility. Industry training programmes are not being used, as smaller firms claim that training is not affordable; larger firms regard industry programmes to be unsuitable and theoretically based. Fear of poaching was also quoted as an additional drawback to training by Salinger (1999:14).

Huria (2000:99) argues that, in developing competencies that can manage world-class technology, it requires human resources that are ready to absorb new skills and show a high level of motivation. The small industries have reflected this in their 100% (Fig. 9) support of training. The implications are important for industry, as in keeping up with the skill levels, production efficiency will improve to the extent that higher value added, and higher quality products will be produced (Altman1994:143).

Further advantages include the introduction of life-long learning can be nurtured among former graduates who were denied the opportunities of the new curriculum.

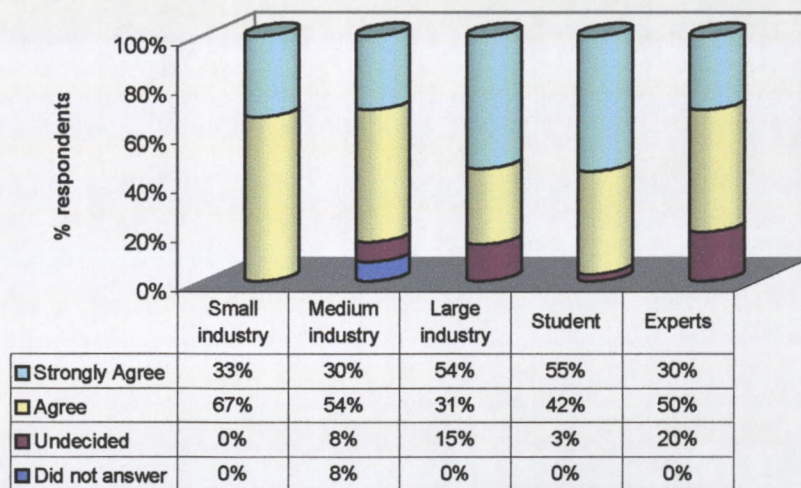


Fig. 8 Provision of service will enhance the skills of SMEs

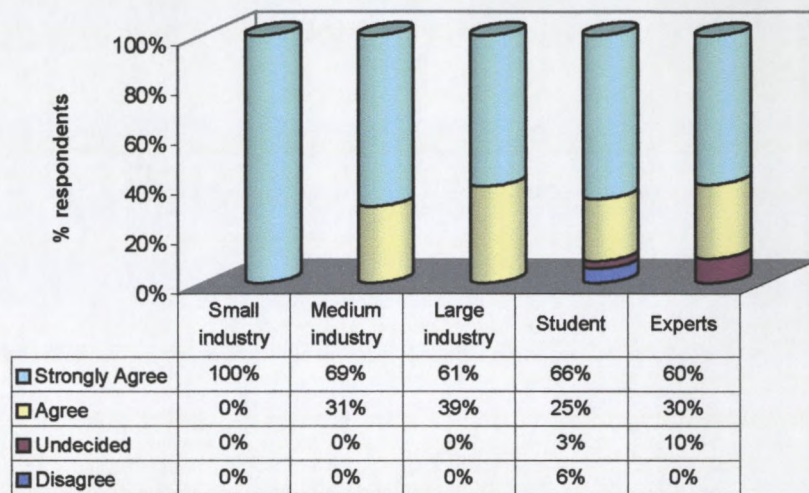


Fig. 9 Training in CAD is essential

The three statements related to the attitude (CAD is easy to use and operate, traditional methods are required to use CAD, transition from manual to computers is difficult) towards the actual applications received varying results. A high level of agreement was received from students and industry for the statements 'easy to use', with an overall 84.6% (Fig. 10). With respect to the statement 'transition from manual to computers is difficult', 50% of respondents showed a level of disagreement and 25.6% were undecided (Fig. 11). There is a conflict of opinions as the previous statement of 'easy to use' received an 84.6% overall agreement level. Taylor (1990:91) concedes that, CAD is difficult to use at first since it takes an enormous amount of time and struggle to grasp. Older software is now discarded, as former employees managed new companies. 'Operator friendly' systems with the latest innovations in technology are being produced.

The level of agreement (23.1%) and the indecision expressed indicates that companies are experiencing problems in training or alternately older, experienced workers may lack mathematical skills as indicated by a respondent. An interview conducted by Chase (1997:62) with a markermaking and grading specialist reveals that the initial adjustment from using manual to computers processes was difficult and that one had to apply many steps in order to perform one task. Accepting the computer was also an issue and that the real value is appreciated after the training is over.

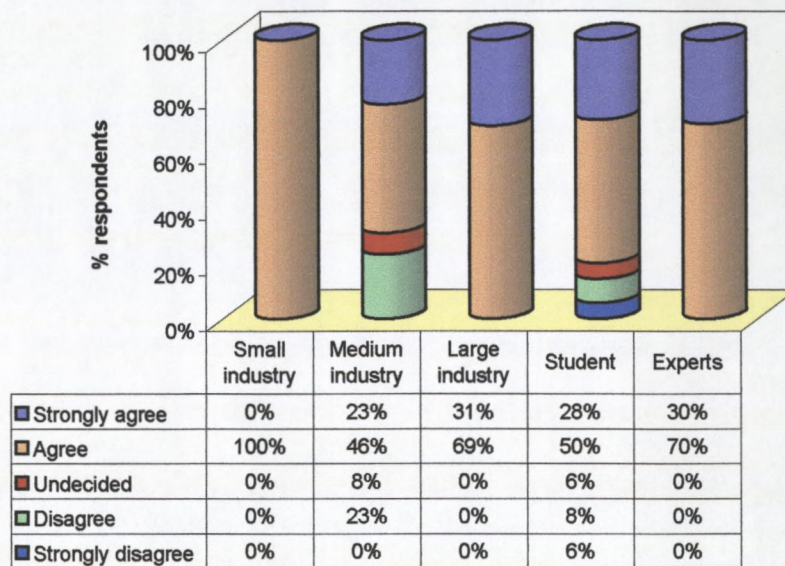


Fig. 10 CAD is easy to use and operate

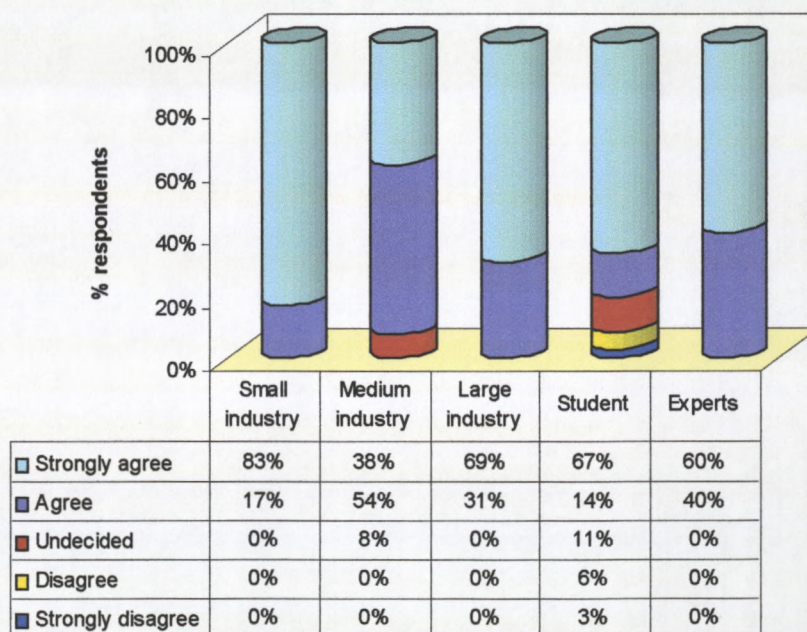


Fig. 11 The transition from manual patterns to computers is difficult

Further, the responses may also be attributed to the fact that there is a general attitude of an unwillingness to adopt technology through many years of using traditional methods. With regards to 'traditional methods' there was an overall agreement of 31% from students and 33% from others, making the level of agreement 57% (Fig. 12). The use of traditional methods can be correlated to the relevant years of experience of respondents in the sample. This relationship is discussed in 4.5 of the analysis. Chase (1997:51-63) illustrates the different attitudes and opinions towards CAD/CAM in her interviews with various designers /patternmakers. In some way this confirms that a generalization cannot be drawn on this issue. One can agree with Taylor (1990:8) in his strong viewpoint that, large companies do not employ designers who lack pattern-cutting skills. The preference for 'knowledge in traditional methods' is favoured since the background provides an understanding of the complexities of pattern development.

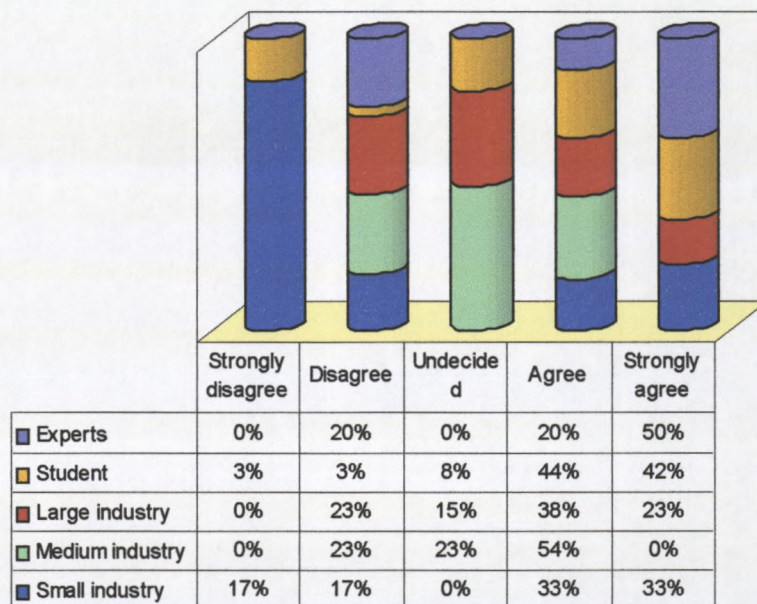


Fig. 12 Traditional methods of pattern-making a required to use CAD

#### 4.2.1 Comparative study

The comparative score in Fig. 13 show the responses discussed in this section. The highest score of 98% for CAD increases job opportunities is very significant for: the curriculum needs of the fashion design course, for industry re-training and training needs and for the provision of life-long learning. The lowest scores revealed that students/graduates and industry have experienced problems during the transition stage.

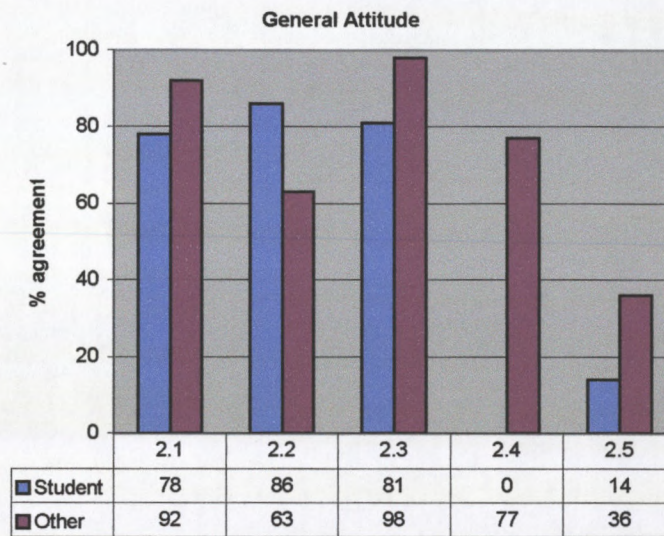


Fig. 13 Comparative results for question 2-General attitude

#### 4.3 DISADVANTAGES THROUGH THE LACK OF ACCESS TO COMPUTERS

This section covered all the factors that were related to the processes that improved efficiency of production hence impacting on efficiency of production and competitiveness.

This statement on 'saves time compared to manual operations' (Fig. 14) received an overall agreement, yielding a result of 95.3%. Timesaving on operations is one of the factors that leads to 'quick response strategies' and 'speed' in the supply chain. As product life cycles become shorter, the industry is expected to work according to the demands of the consumer. The tasks involved in grading and marker making are performed much more quickly and efficiently with the computing system of CAD than the manual techniques used previously (Hoffman and Rush 1988:72). It is clearly evident that CAD offers a wide scope of benefits through the adoption of new technology.

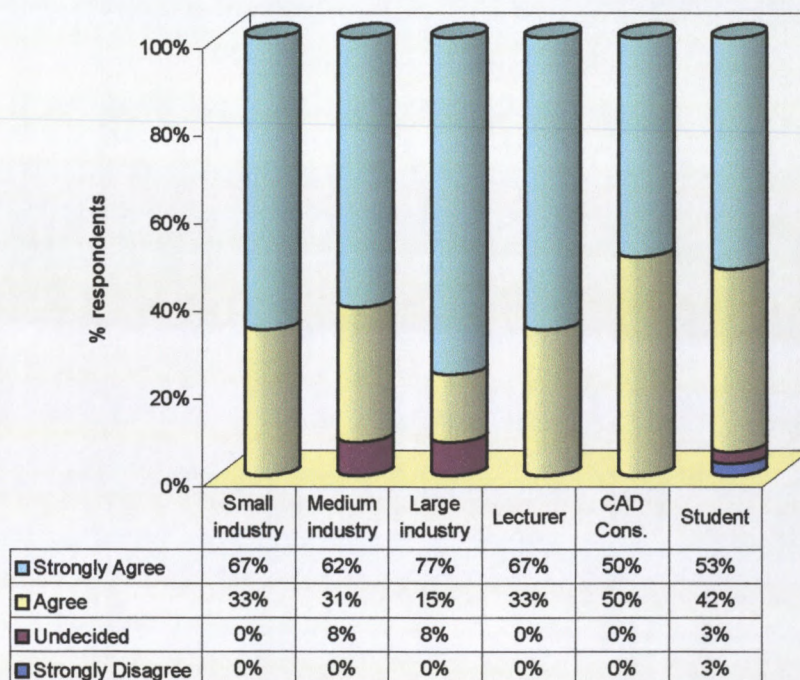


Fig. 14 Saves time compared to manual operations

The statistics on timesaving processes (Fig. 15 and 16) collectively yielded between 90-100% agreement from large industry and experts. Student's response was positive with 88.7% and 72.2% respectively. The congruency indicates that CAD

provides the advantages that speed up processes involved in the pattern development. Hoffman and Rush (1988:72-73) mention that computer systems in the market have their own set of operating and functional characteristics. Therefore they are distinguished in terms of ease of operation, memory capacity and storage facilities (Gray 1998:11). It is likely that the experiences of individual firms may have been expressed through these varied responses.

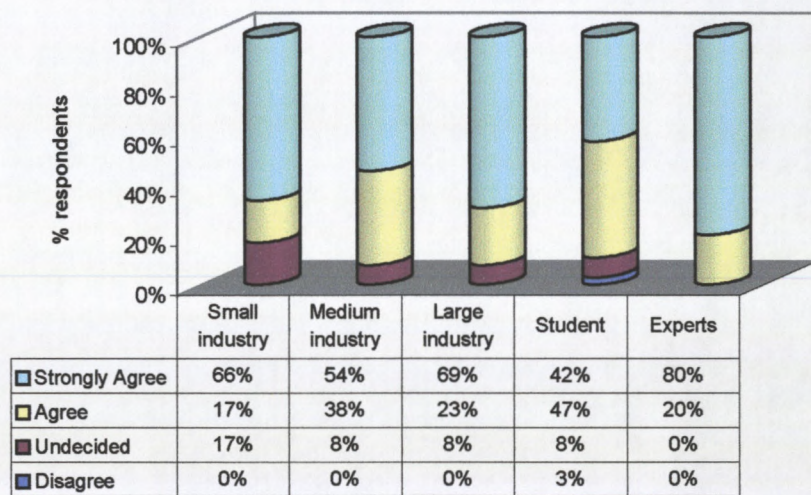


Fig. 15 Avoids repetition of certain tasks

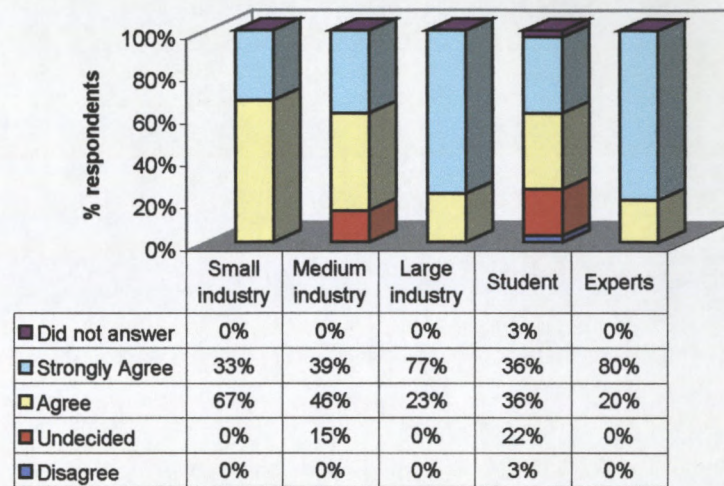


Fig. 16 Blocks captured successfully onto database

The opinions of students for ‘on-line libraries are accessible for review of designs’ received a 50% agreement reflecting either a lack of experience or that students were not acquainted with the statement (Fig. 17). Small and medium industries also yielded similar results. An overall agreement level of 66.6% from small industry and 69.3% from medium industry shows that these firms may not be utilizing the process. Sub-contracting (CMT) work for larger firms is a common practice among SMEs (Salinger et al. 1999:32), thus eliminating functions like review of designs. However, 50% of past fashion graduates have most likely recognized the need for ‘review’ through their own experiences. They supply small innovative ranges for which they often have to commence the whole process from the beginning. Fashion works in cycles and as products reach a saturation point, the demand declines until such time that the trend is reinterpreted (Easey 2002:129). A few adjustments can save a considerable amount of time in streamlining the functions for efficiency of production.

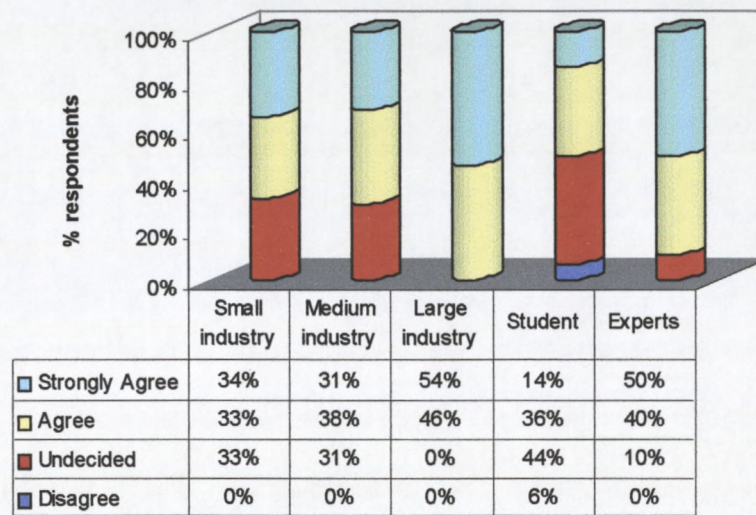


Fig. 17 On-line libraries are accessible for review of designs

The statement pertaining to the 'planning time' received 100% agreement from large industry and 80% from experts (Fig.18). The respondents showed a high level of agreement, which reflects that the advantages gained in terms of time and thereby reducing cost is being recognized. By gaining on planning time, lead times required for production can be reduced (Gray 1998:2,3). Although additional 'planning time' is gained through the benefits of using the 'storage capacity' respondents have failed to recognize the link. Hence, based on this example, it is not possible to achieve total reliability.

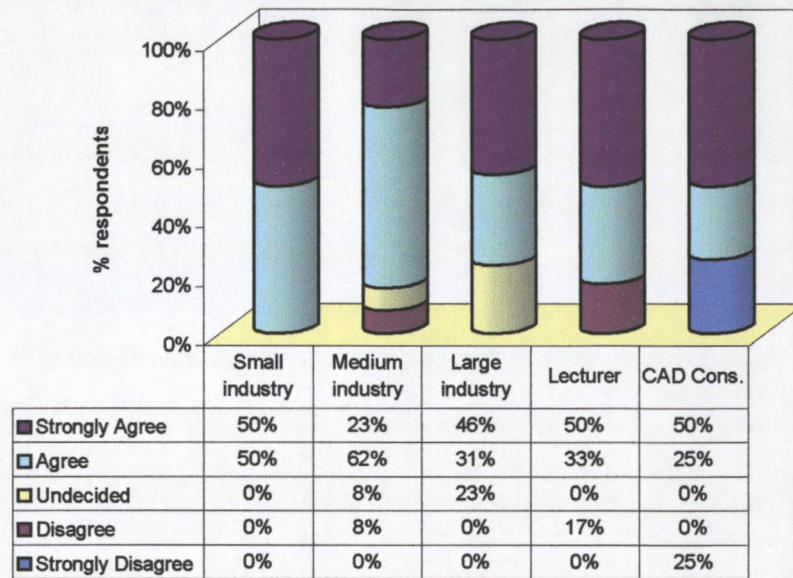


Fig. 18 Planning time increases

The findings for the results of 'pre-production processes are being cut down by CAD' indicated 100% from small industry and between 69-75% from other respondents (Fig.19). The level of agreement indicates some inconsistency in the results obtained or that the statement was misinterpreted. All manual operations handled by computers reduce the amount of time it takes to perform the tasks prior to the production stage (Altman 1994:54). The significance of CAD is that the various processes combine to effectively increase productivity and throughput, respondents have failed to recognize the benefits individually. Furthermore, when inspecting the results of the next statement, 'CAD improves time management' an overall agreement level of 95% was recorded.

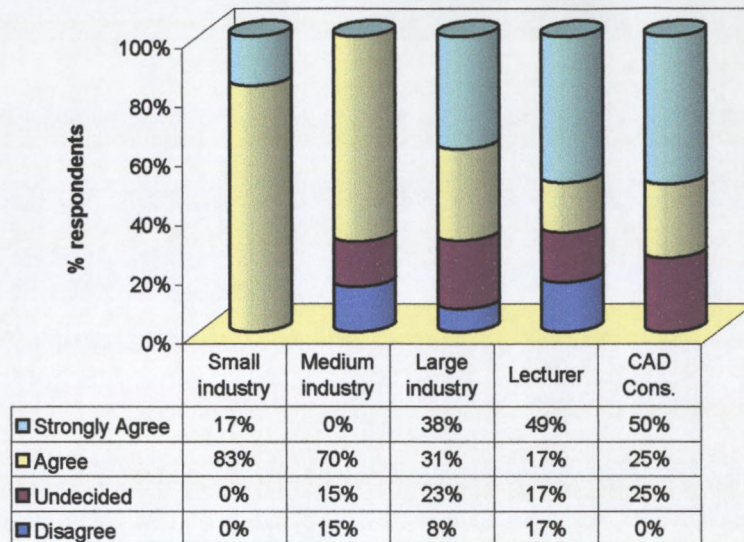


Fig. 19 CAD cuts down number of pre-production processes

The statements in 3.7, 3.8, and 3.9 (CAD improves time management in pattern room, stored blocks are modified to develop production patterns for style variation, CAD reduces overhead costs in pattern department) which were time and cost related yielded results of 100%, 92.3% and 91.3% respectively from large companies, indicating the importance of CAD for productivity levels to be achieved (Fig.20,21,22).

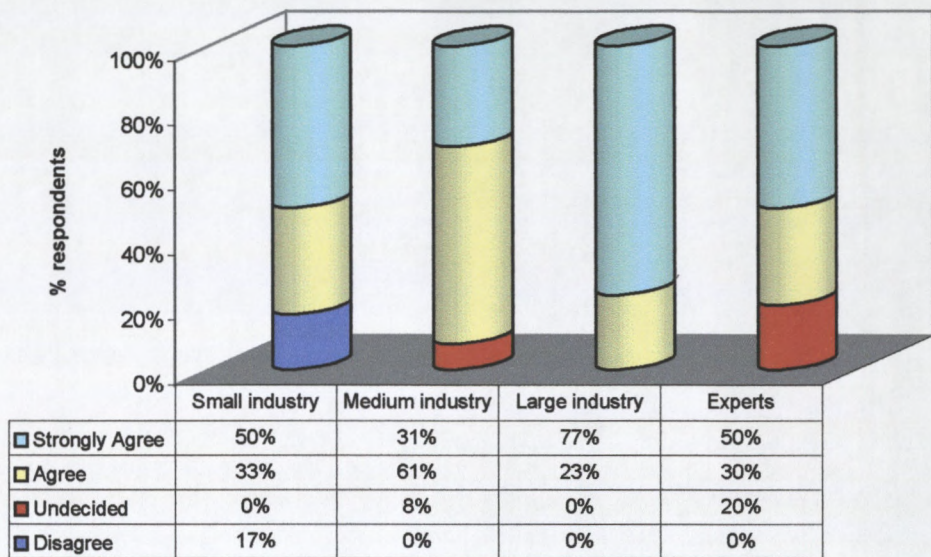


Fig. 20 Improves time management

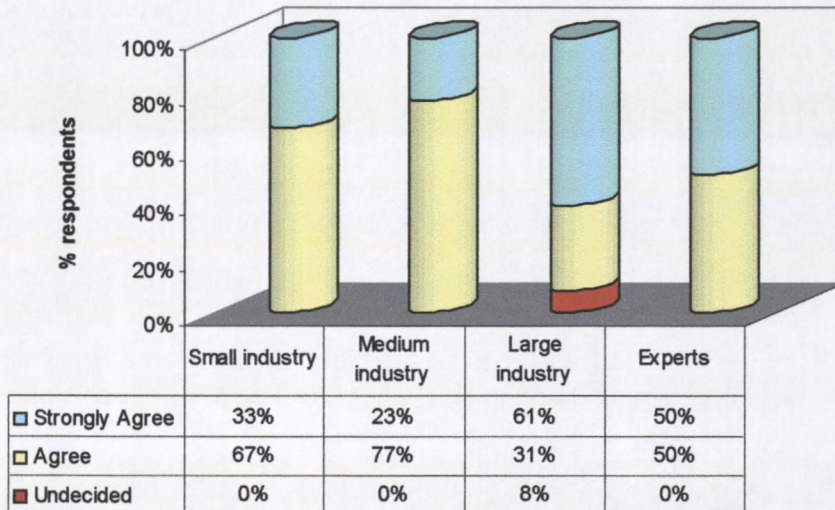
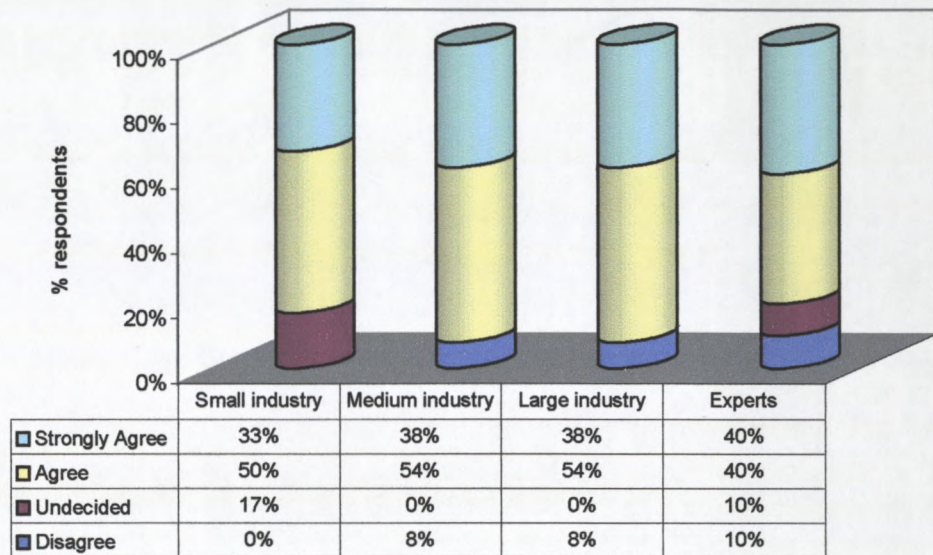


Fig. 21 Patterns can be modified to develop style variation



**Fig.22 CAD reduces overhead costs**

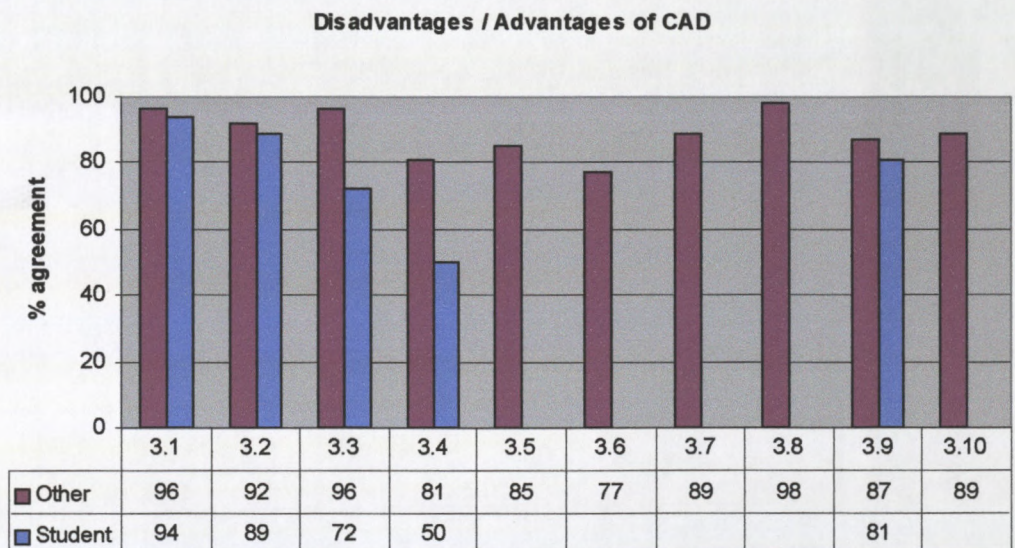
For the statement 'CAD reduces overheads in the pattern room' there were the odd disagreements. Better utilization of time in the pattern room can cut down on unnecessary and manual processes. The whole process of developing a product range is streamlined. 'Stored blocks' are easily adjusted allowing the whole process to be completed in quick time for new style changes that are required constantly. Cost effectiveness in the pattern room can be achieved by saving on time, labour and raw materials usage (marker making). Greater variety and improved styling are achieved in smaller volumes to satisfy customers who are easily influenced by the media (Gray 1998:8). Libraries covering various categories of clothing and linking them with different markets can be created and easily accessed (Taylor 1990:95). The benefits gained are through lowering of direct costs through optimum use of the various functions available on the CAD systems. SMEs are evidently disadvantaged by the lack of technological resources. The overall results were very positive, 95.5% (Fig. 20), 96.7% (Fig. 21) and 88% (Fig. 22) respectively were achieved.

The efficiency of production is achieved by all the contributing factors mentioned for which both experts and large industry have yielded a strong level of agreement, 90% and 92.4% respectively. Small and medium industry has also indicated a positive attitude towards the statement. Efficiency of production relates to, as mentioned in

the literature review, the increasing of profits, reducing costs and maintaining quality. The entire workforce has to work towards customer/market satisfaction.

### 4.3.1 Comparative Study

The highest score among students of 94% for 'saves time' compared to manual tasks is most significant in terms of their experience. Industry confirms the statement with a 96% agreement level. Among all the advantages the storage of blocks for editing and review for style changes received the highest rating. The benefits of CAD are highlighted in these 2 areas. However, the lowest score of 77% reveals that industry focuses on individual benefits compared to overall / collective advantages (Fig. 23).



**Fig. 23 Comparative Results of Disadvantages and Advantages of CAD**

#### 4.4 Quality, Support and Competitiveness

The statements regarding 'improvement to quality of patterns' have yielded the following results: Quality related statements received an agreement level of: 92.4% from large industry; 100% from small industries; and an overall agreement of 89.8% was yielded (Fig 24). It is significant that goods produced by using CAD systems demonstrate the consistency of quality levels, providing better value for money (Gray 1998:4,7). Consumers and markets drive the industry to manufacture efficiently, quickly and with more flexibility hence quick response is essential at all stages in the manufacturing cycle (Byrne 2001:3).

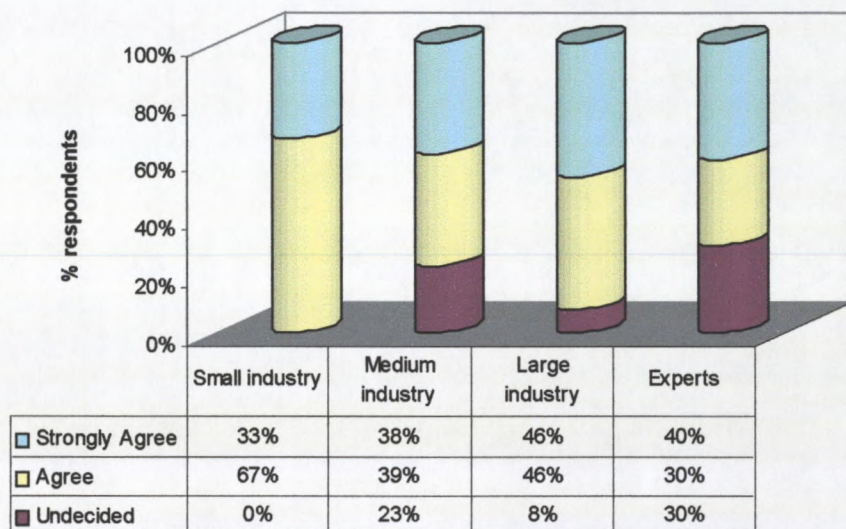


Fig. 24 Improvement to quality of patterns

The variable concerning the 'consistency in manufacturing' yielded an agreement result of 97.5%. The large and small industries showed a 100% agreement, which can be interpreted as, CAD allows for accuracy, consistency and quality (Fig. 25). The tasks related to accuracy and consistency i.e. specifications for pattern measurements are difficult to achieve manually. Other factors include the achievement of consistency in the capturing of data (garment specifications) for reference purposes, quality adherence for SABS approval and benchmarking standards. The study of Joffe et al. (1995:244) has identified the quality aspects of manufactured goods. They recommend strongly that since the export market applies very stringent control over quality, SMEs need to be aware of the procedures required to expand their shares and increase their opportunities in exports. Conversely, CAD does not perform

work automatically, the technology is there to assist but not to solve quality problems (Gray 1998:11).

The two previous statements combined would achieve the competitiveness through the adoption of CAD. Competitiveness in manufacture requires reliable tools, which are efficient, free of human error and assist in achieving economies of scales for both the large and small companies.

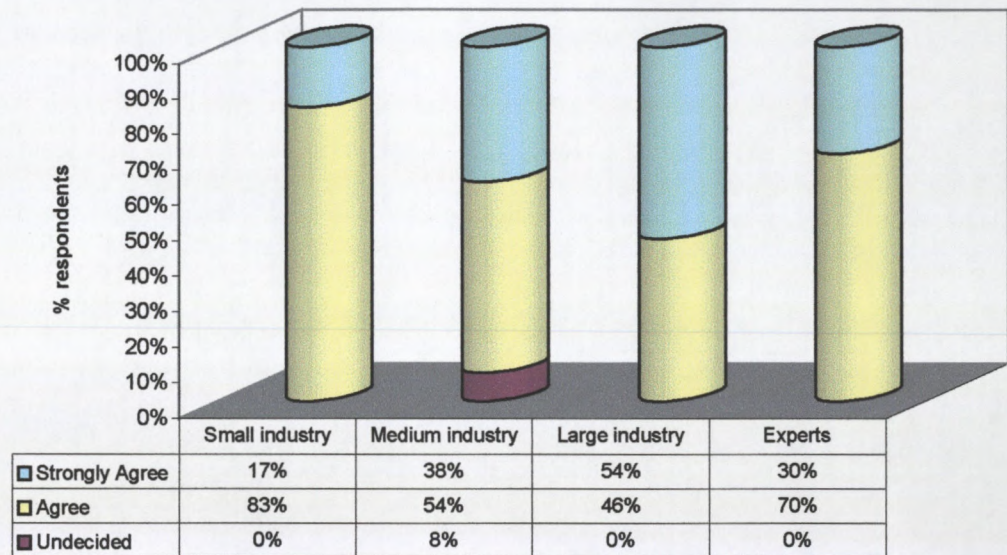
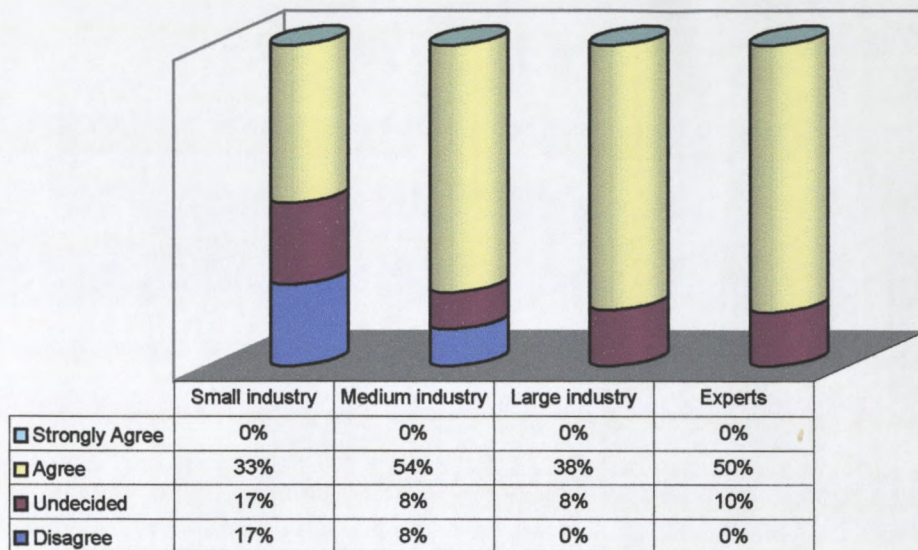


Fig. 25 CAD allows consistency of manufacturing

Further, the results yielded for 'competitive advantage' shows that there is about 90% agreement among respondents. However, it seems that the small industry group show lack of confidence in their agreement level of 66% (Fig.26). There is a possibility that despite the fact that some small companies may be CAD users, they do not realize their full potential and the benefits derived from computer systems (Gray 1998:55). Alternatively, with the larger industries dominating (vertical integration) the clothing industry, smaller industries may be intimidated by their competition. Vertical integration along production chains is common among the large firms in South Africa (Joffe et al. 1995:72,73).



**Fig. 26 CAD improves competitive advantage of companies**

The implications of the findings with respect to a 'support service' are very positive. The agreement level of 91.1% (including students) for enhancing skills of SMEs proves that the service would firstly benefit entrepreneurs (Fig. 27).

This has also been demonstrated by international models discussed in 2.4.4 of Chapter 2. Secondly, networking among SMEs as the results indicate would be encouraged. The agreement level among the small industry is 100% with an overall agreement of 83.4% for 'enhancement of skills' (Fig.28). The benefits of networking for the purposes of achieving best practice, creating contacts with suppliers and markets are important for SME entrepreneur's sustainability and growth (Carson et al.,1995:205). The response indicating that a service does exist refers to the establishment of CAD bureaus (open ended response). Internationally the service of bureaus have been in existence for many years offering various service facilities. The services have proved to be very costly and beyond the means of smaller firms who lack the in-house skills or resources (Carson et al. 1995:144)

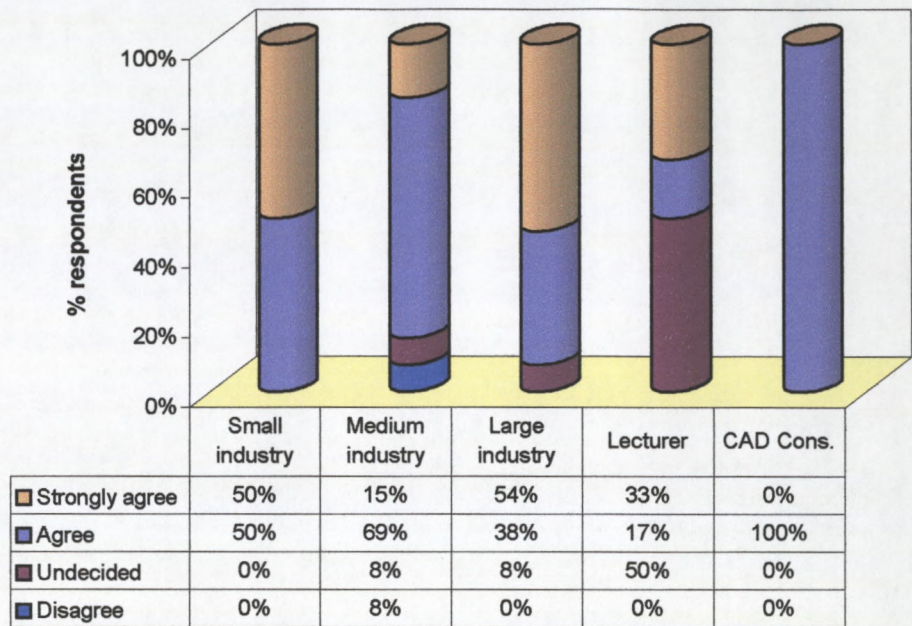


Fig. 27 Support centre will encourage networking.

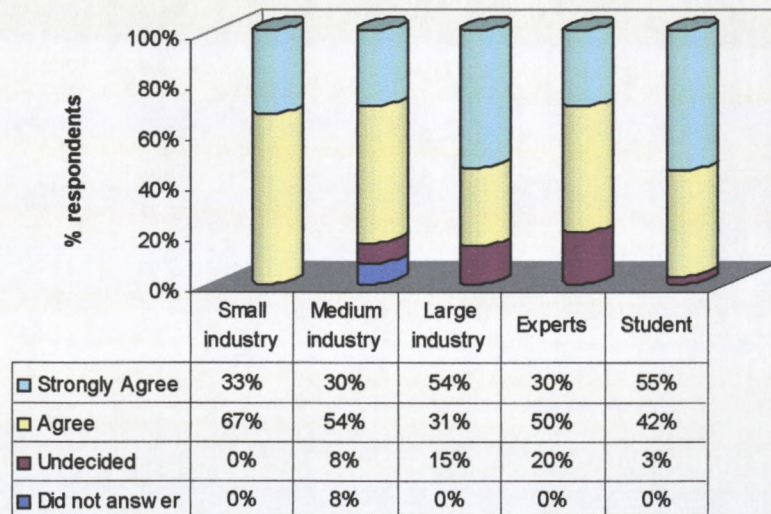


Fig. 28 Provision of service for enhancement of skills

The statement 'training in CAD is essential' received 100% agreement from industry, confirming the importance of computer systems in the manufacture of clothing (Fig. 29). A further interpretation could be that insufficient training is taking place among CAD users. Constantly upgrading of skills is also required to keep abreast with new processes that are introduced. Among experts and students the agreement level was around 90%. The lack of 100% support from all groups might have been through the subjective interpretation of the variable. On close inspection, lecturers and students were undecided while two students disagreed. However, 100% agreement by CAD consultants prove that training and re-skilling in CAD is essential to enhance the capacity of SMEs. Hunter (1993:149) believes that new skills are required to fully utilize computers and the computer systems. One of the objectives of the study is to identify the specific areas of training, which is discussed in 4.6 of this chapter.

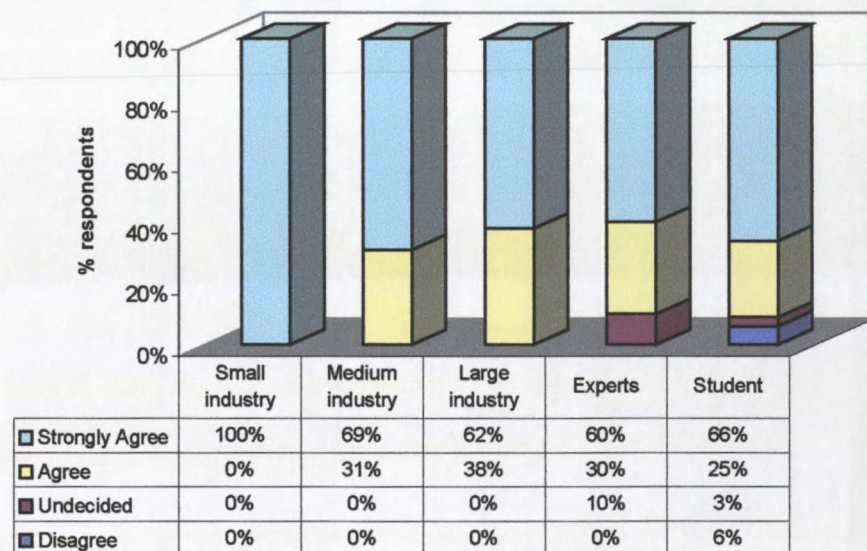


Fig. 29 Training in CAD is essential

With regards to the recommendation for 'CAD for all sizes of companies', it was observed that there was a significant level of agreement, irrespective of company size. Small companies and CAD consultants supported the statement with 100% overall agreement, while for medium to large companies, the result was 84.6% (Fig. 30). A total of three companies disagreed which is negligible. Given the fact that all of the trainers agreed (100%), shows that through their vast experience, CAD is valuable irrespective of company size. International experience in the literature

reviewed, has also reflected that, the use of CAD is meaningful in improving the competitive advantage of companies/entrepreneurs (USAID project in Poland 2000:1-8).

The results of the statistics on competitive advantage yielded an 85.7% agreement, which further signifies that CAD is suitable for all sizes of industries. Emerging entrepreneurs would thus be included among these groups.

At this point it is important to mention Porter's (1980:15,16) view as he highlights why smaller firms should not invest in technology. In his estimation, smaller firms are unable to spread fixed costs over the small number of goods produced as in the case of larger firms. Even if they are technologically efficient, their demand does not make the investment cost effective. The technology in fact would be under-utilized. This argument supports the view that, essentially technology hubs/ incubators are the most suitable option for SMES to benefit from economies of scales. Randeree (2001:1-2) refers to economies of scales for SMEs to become globally competitive and this is one way of achieving the benefits similar to those of larger firms.

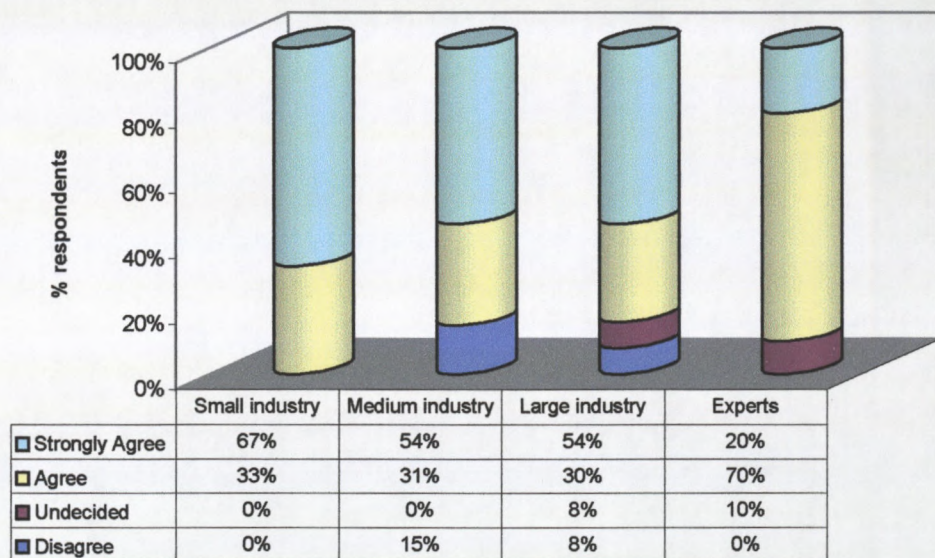


Fig. 30 Recommended to small, medium and large companies

In responding to the statement ‘CAD as a means of survival and success,’ the larger industries all agreed (100%). One small industry disagreed and three respondents were undecided. The overall agreement of 88% outweighs the negative results by these respondents (Fig. 31). Investing in new technology has ensured the survival and growth of developing countries, benefiting both by improving their production levels and sustaining low labour costs (Timpson 1998:11). The results prove that, South African manufacturers of all sizes require new technology, for their survival and success.

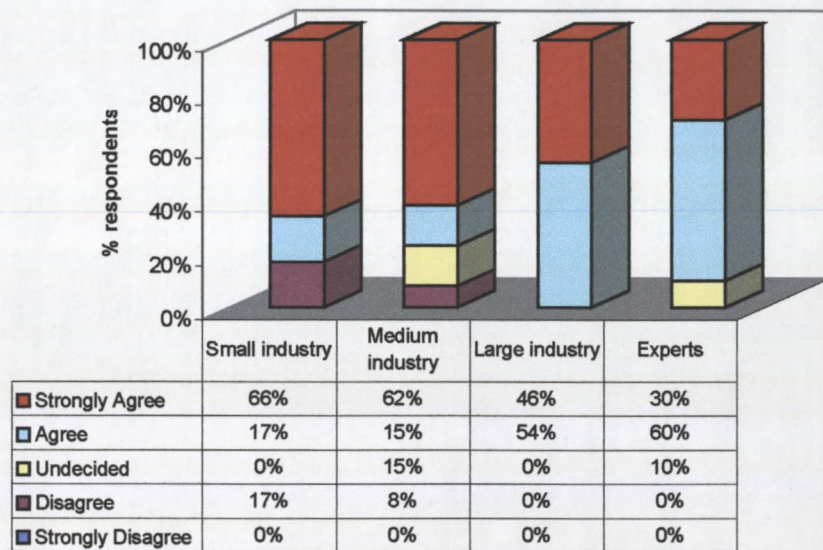
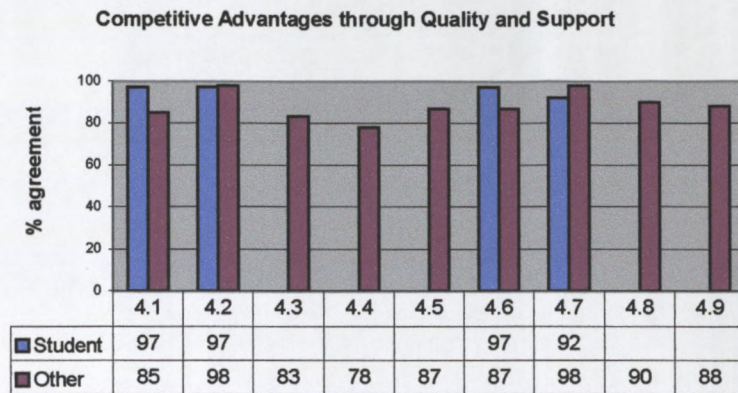


Fig. 31 CAD is significant for survival and success

#### 4.4.1 Comparative Study for Quality, Support and Competitive Advantage

The composite results show that training is essential and highly favoured together with consistency of manufacturing (4.7 - 98%, 4.2 - 98%) taking the first position in positive responses (Fig. 32). The seventh position is that of best practice (78%) reveals that the concept may be misunderstood, or not recognized. Important to the study are the scores of 97% from students for ‘quality’, ‘consistency of manufacturer’ and ‘the enhancing of skills for SME entrepreneurs’. In the light of the findings, providing the service for graduates to enhance and commercialize their skills becomes important.



**Fig. 32 Comparative Results of Competitive Advantages through quality and support**

#### **4.5 Statements related to Training /Skills (Transfer of Technology)**

The general statement in Part 2 concerning the use of CAD were cross-referenced with the number of years of experience of the respondents. The responses were used to establish whether the transfer of skills are possible within the industry and if the skills were valuable in increasing the job opportunities of SMEs and entrepreneurs. The experiences of respondents were utilized to obtain a more informed view to make further assumptions.

The statements 'CAD is easy to use and operate' in relation to the experience of the respondents proved that irrespective of the experience, there was a level of overall agreement from all groups. This suggests that the majority of employees/workers (pattern room personnel) should be able to train and operate on CAD systems without much difficulty (Fig.33). In the literature surveyed there was no evidence indicating that computer skills cannot be acquired.

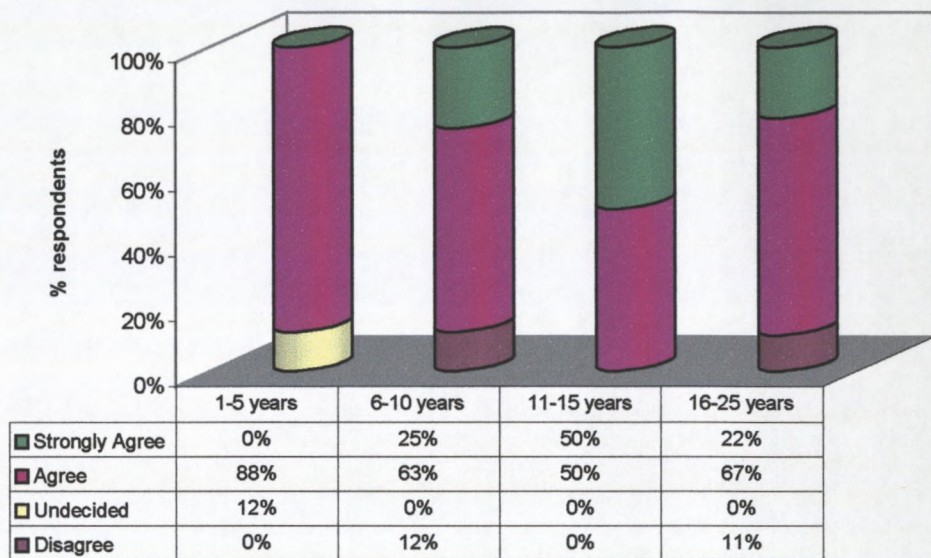


Fig. 33 CAD is easy to use and operate' in relation to the experience

For the statement 'traditional methods are required' there was no definite trend established. This is contrary to the opinions found in the literature review. The highest number of disagreements were from the experienced group (16 - 25). On the whole 23.8% of respondents disagreed with the statement and 11.9% were undecided, making the level of agreement substantially low. Considering that some competency skills have to be exhibited for carrying out the procedures on the computers, these results are relatively difficult to accept (Fig. 34). However, current research reveals that a larger percentage of IT specialists are employed in the European garment industry (Majewski 2000:37-39). Thus the results prove that there are varied opinions on this important aspect. Kalcharyan (1988:65) believes that manual methods provide a back up system arising out of a technical hitch; this can be seen as a logical and practical viewpoint in dealing with technology.

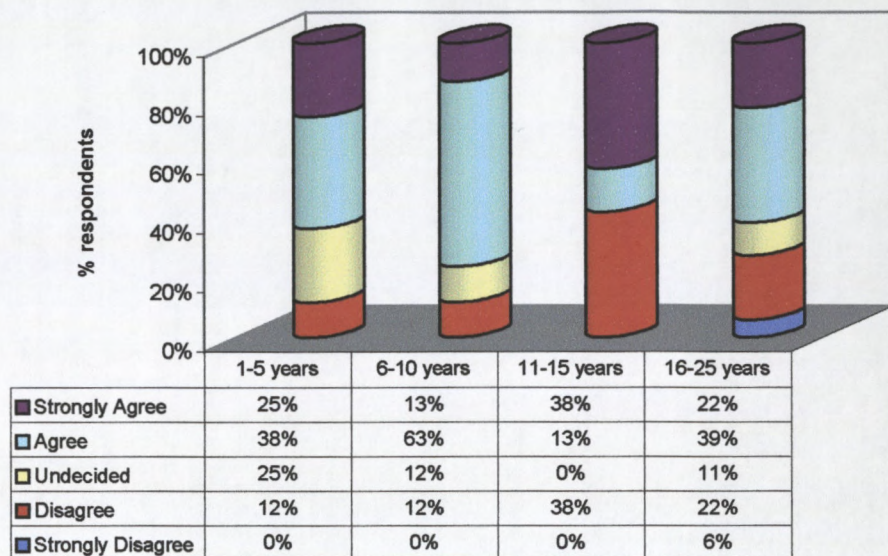
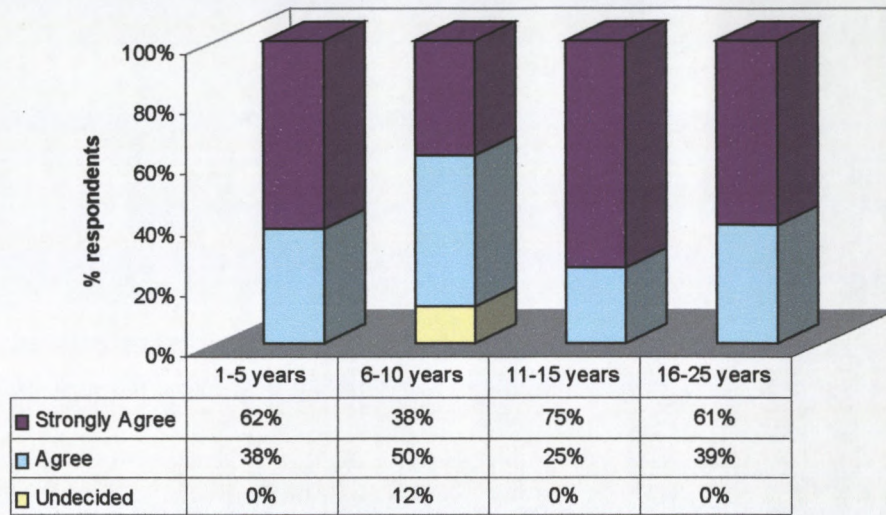


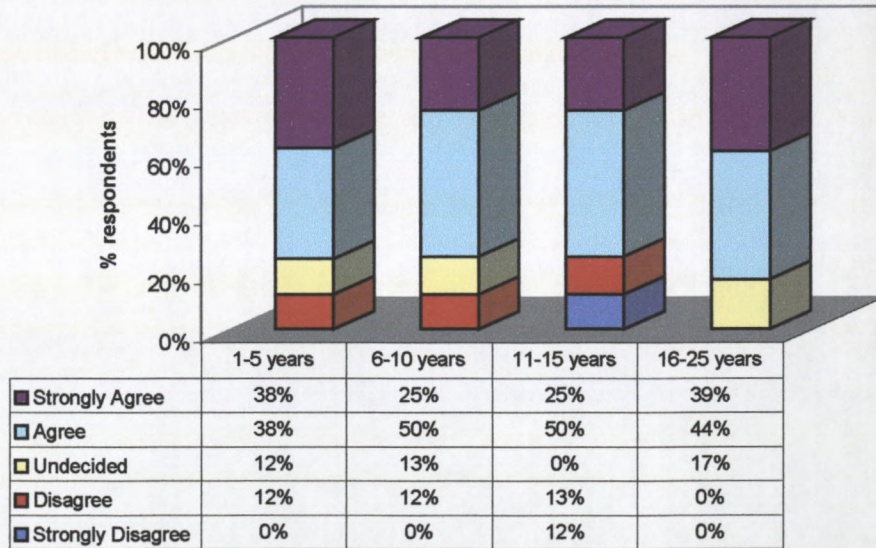
Fig. 34 Traditional methods are required in relation to the experience

A very high level of agreement was yielded for the statement 'increasing job opportunities'. As reflected by the results (97.6%), it can be assumed that all groups believe that CAD is important for highly skilled jobs in the clothing industry. Among the more experienced (16 - 25years) 11 out of the 18 respondents strongly agreed to the statement and 7 agreed (Fig. 35). It further verifies that CAD should be part of the Fashion Design curriculum for students to succeed in the clothing industry and to commercialize their acquired skills. For employees in the clothing industry, the opportunities for upward mobility can be created by re-skilling (Salinger et al. 1999:27).



**Fig. 35 Relationship of experiences to- increase in job opportunities**

With regards to 'CAD can be taught to all design staff' the agreement of 78.5% indicates that there is inconsistency in the opinions of the respondents. If 90.5% believe that, 'CAD is easy to operate' one should be able to acquire the skills (Fig. 36). It can only be assumed that an element of subjectivity prevailed or that the respondents felt threatened especially in the groups below 16 years of experience.



**Fig.36 Relationship of experiences to CAD can be taught to all design staff.**

#### 4.6 Specific Needs In CAD Training

The position regarding specific training needs were determined by utilizing the different responses for the three processes listed.

Related to the specific areas of CAD most utilized, marker making received a strong level of agreement. Overall agreement figures of 76% for marker making, followed closely by 69% for grading and 38% for pattern making. The savings achieved through material costs (fabric) is related to the marker making process. The lack of computers places the SMEs entrepreneurs in a cost, quality and 'quick response' disadvantages. Material costs are at least 50-60% of the total cost of the garment. Savings on fabric consumption is essential if a firm is striving towards cost effectiveness for frequent style changes (Hunter 1993:153).

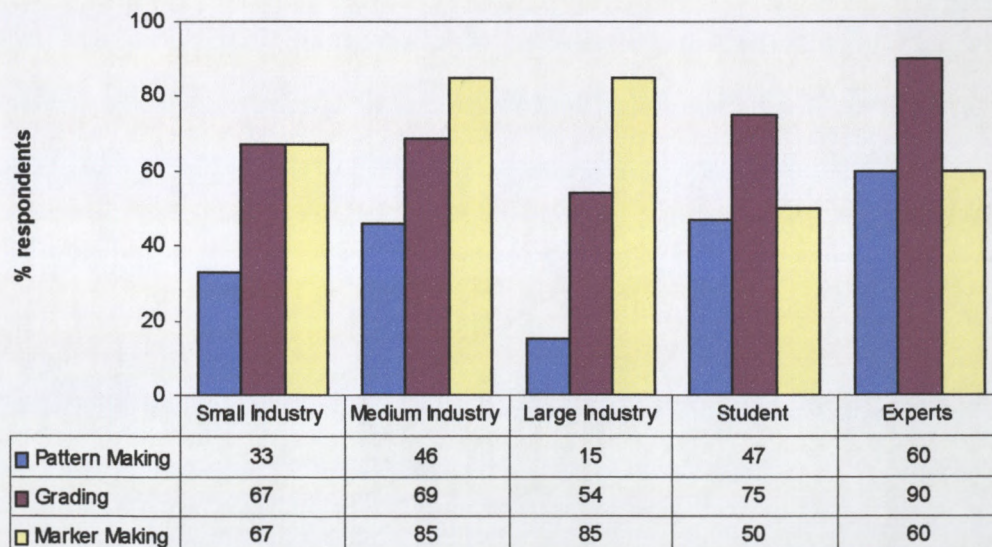


Fig. 37 Composite results of preferences for the three processes

The composite analysis in Fig. 37 shows that marker making and grading have been the most popular of the three processes. Large and medium firms both indicate 84.6% for marker making. This can suggest that these firms concentrate on a standard range of goods to satisfy the needs of the market in the minimum amount of time. The larger firms gain competitive advantage by using effective technology. According to Taylor (1990:34), investments are undertaken by firms that produce high volumes of goods with few style changes and therefore their preference for marker making.

The results from students indicated grading to be most utilized, with (75%), marker making at 50% and pattern making at 47%. The individual results show the highest scores from large industry and experts. The following figures are important:

- Large industry - 84% for marker making.
- Experts - 90% for grading.
- Experts - 60% for pattern making

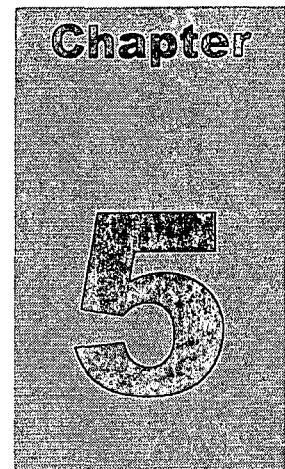
The results are significant in that they provide important findings regarding the training needs in the clothing industry in the eThekweni area in Durban. Although the pattern making scores were substantially lower than those of grading and marker making, the opinion of experts would be based on the requests for pattern making from clients.

It can be further concluded that, although all three processes are vital in the pre-production stages, respondents probably only considered immediate needs as opposed to long term needs of the industry. The opinion of the experts and the larger firms should serve as a guide since they have the experience.

## 4.7 CONCLUSION

The findings in this chapter have served to form assumptions in the various areas of the study. In order to make the recommendations that, support in CAD is essential for competitiveness and productivity, the responses both negative and positive have contributed significantly.

The concluding chapter sets out to discuss the conceptual, the theoretical and empirical contribution and recommendations of the study. It finally discusses the opportunities for future research and draws conclusions by giving a synopsis of the study.



## **Conclusion**

### **5.1 Introduction**

This chapter identifies the extent to which the research conducted has achieved the objectives outlined in Chapter One. The review of the study will be discussed in terms of its conceptual/theoretical contribution, empirical findings, the implication for future research, support model for the future and conclusion.

### **5.2 Conceptual/Theoretical Contribution**

The present study related to CAD support for SMEs has provided additional information to the existing literature that was reviewed. A local study undertaken previously covered designers' attitudes towards CAD with reference to the design process (Vawda 1997). A study undertaken by Yan and Fiorito (2001:133) in the UK investigated the internal and external pressures in adopting CAD/CAM and adoption related to sales volume. This study places emphasis on the pattern design aspects of CAD that cover the pre-production stage, ultimately improving the competitive advantage of companies.

The recommendations and suggestion that have emanated from this study could contribute significantly towards the sustainability and economic development of SMEs. The goals of the National System of Innovation can also be realized at a regional level.

In its wider context the Innovation Policy seeks to empower all South Africans in meeting the demands of global economic competitiveness. A number of programmes are being initiated and nurtured to build the technological capacity in the province. The research study has explored the successful international models of the support mechanisms and the information gleaned is of strategic importance for supporting the SMEs and the clothing sector in the eThekweni area.

### **5.3 Empirical Contribution**

The aim of the research was to identify how SMEs in the clothing/fashion industry are influenced by the lack of access to resources i.e. CAD to improve their productivity and competitiveness. A support strategy to access computer technology was investigated.

In order to undertake this investigation five objectives were postulated:

- To determine the extent to which SMEs are disadvantaged through the lack of access to Computer Aided Design (CAD) compared to larger companies;
- To assess the specific needs that would increase their productivity and competitiveness through the use of CAD;
- To ascertain the possibilities of networking and hence achieving best practice;
- To evaluate the benefits the envisaged support service would have on the SMEs; and
- To provide transfer of technology skills and create opportunities for life-long learning.

The study established that access to computer technology impacts on performance levels. Firms utilizing Computer Aided Design systems compared to manual methods have improved their efficiency and productivity levels. The specific disadvantages gained by larger firms were evident in the pre-production processes. The number of tasks required are drastically reduced when accomplishing the processes of marker making, grading and pattern making. In the final analysis the factors that accounted for gaining competitive advantage were quick response, consistent quality standards, time and cost savings and reduction in labour.

With respect to specific needs of SMEs, no definite pattern could be recognised. Hence, it can be assumed that the responses were based on the most immediate needs and not on long term needs and benefits derived through the use of all three processes (marker making, grading and pattern making). The pre-production processes contribute directly towards the efficiency and speed of production. In the light of these findings the highest scores received from industry and experts were considered to be of utmost importance. The rating was presumably based on the needs of the clients/ customers that consultants serve.

The findings of the study illustrate that training for re-skilling as well as updating existing skills is necessary to improve the technological capacities of the SMEs. New technology requires skills to operate, manage and maintain the computer systems.

The implications and benefits of networking and best practice have not been particularly of interest to the local industry. The study established that internationally these factors play a major role in sustaining and empowering SMEs. Networking among SMEs would lead to accessing information on trends in the fashion industry, market indicators, suppliers, financial management advice, and access to resources and the clothing industry.

The positive effects of a support service/technology hub are highlighted by the research study. The findings indicate that there is a strong preference for such a service. Over and above the benefits outlined, cost disadvantages are eliminated and economics of scale can be achieved through support.

In terms of the last objective the positive views projected in the responses are convincing and show that there was a strong preference for training in CAD. Hence, opportunities can be created for transfer of skills among those that were deprived by past policies and education or through lack of provision in the old curriculum. Lifelong learning can be introduced to experienced employees/entrepreneurs with little or no computer skills.

## **5.4 Recommendations/Suggestions for Future Studies**

### **5.4.1 Suggestions for Future Studies**

Research conducted for this study was to investigate the use of CAD to support SMEs. Therefore the literature reviewed attempted not to exceed these limits. For the purposes of implementing a service for SMEs, further research will have to undertaken. The areas that limited this study are:

- Due to the nature and confined field of study, samples need to be drawn from all CAD users in South Africa for the study to be more effective;
- The non-availability of a comprehensive database of CAD users placed constraints on the researcher for sampling purposes;
- The respondents in some instances were employees with technical skills only and hence there was a reluctance to respond. This can be attributed to unfamiliarity with wider implications of using new technology in the clothing industry by some of the design personnel; and
- An updated database of SMEs in the eThekweni area is also essential for facilitating any new research.

### **5.4.2 Recommendation for Future Research**

In South Africa institutional support services/incubators are in their infancy stage. There are no local proven examples of such services (for the clothing industry) implemented in the country. Incubator support centers in KZN outlined by Davies (2002:6) include the eThekweni Business Development Centre (TBDC), Siemens /Telkom Business Initiative and the Cape IT Initiative (CITI) Bandwidth Barn. All four provide different services, but official documentation is required to capture the impact of incubation. Some of the services include the enhancement of technological innovation, transfer of technology, business advice, 'Tender Awareness' and assistance and the needs of the ICT community (Davies 2002:6). For future research the successes and weaknesses of the newly implemented support mechanisms need to be documented.

#### **5.4.2.1 Support Model For The Future**

The existing study that was conducted can be taken further, by proposing a support model/technology hub. According to consultant, Greenwood (2002:2-2), the feasibility and implementation (business incubators) should entail:

- Identifying potential clients and the businesses they operate. To determine the size and the scope of the programme, a study should be undertaken;
- The approach that one applies to incubators should be considered, an incubator must work as economic development tool. A realistic and creative approach should be applied in order to satisfy the needs of clients more effectively; and
- A solid and well-developed plan would be required as incubator programmes are expensive. A variety of sources of funding must be explored to ensure long-term success (National Business Incubation Association 2002:1- 2).

Other aspects to be included are:

- Devising a business plan that contains the structure for financial sustainability;
- Identifying and recruiting management/coordinators who will fulfill the needs of the project successfully; and
- Create incubator facilities, resources, methods and tools that address the special needs of the SMEs. Effective delivery of specific CAD training and use of computer technology for clothing/ fashion needs.

In addition to the above, in the proposed model one should examine the possible contracts and agreements related to international property rights, a marketing strategy to draw SMEs, selection criteria for incubates, and general service contracts for the period of incubation.

Further research areas related to the topic are in the field of the export market. It has been proved that new technology has strengthened the competitiveness of larger firms by participating at an international level. Smaller and medium size firms require know-how of exporting and an awareness of the opportunities that are available for niche market products and the quality standards related to exporting (Laing 2001/2:22). SMEs are unacquainted with the adherence to specific standards for a target market. The suggested study could be relevant for the skills training programmes.

The present study can be extended to include other provinces of South Africa. This will give a better perspective and a wider scope in estimating the use of computer technology in the clothing industry. It will also highlight the new skill levels required for a technically empowered work force in the different regions.

From the international example surveyed, industrial districts have become very important for SME sustainability and development. An investigation into similar support mechanisms for SMEs in rural areas can bring about new employment / job opportunities. The formation of such an industrial district sharing resources, inter-firm co-operation expertise and networking is likely to raise the levels of entrepreneurial activity. In a knowledge-based economy, technology resources should be available and accessible to all entrepreneurs.

## **5.5 Conclusion**

The greatest challenge that South Africa is currently facing is that of employment generation. Statistics revealed in the area of unemployment are escalating on a daily basis. The slump experienced in the clothing industry since the 1980s, which was considered to be a 'lost decade', has made slow recovery in creating jobs. As import penetration increased, job losses grew at an alarming rate. Although exports increased, there were no corresponding jobs created, through the displacement (Altman 1994:i). The effects of the past continue to perpetuate in the form of legal/illegal imports and remain as the main cause of unemployment.

The clothing industry has undergone many organizational changes since the advances in computer and IT, changing the requirements for technical skills. According to Chantaranakaracha (2002:36,37) the decade of 2002 and beyond will be considered as one of speeding up the old structure of quotas, to that of free movement of goods and thus integrating into the global economy will be crucial. The success however, will depend on how manufacturers are able to administer the changeover that was once governed by export control and quotas to that of competition market based forces. Adaptation to the increasingly rapid changes generated by the Internet and commerce and competition from countries with low labour rates, will require efficient management. He believes that to stay ahead of the rising competition, Thai garment

exporters will need to adopt new technology and commit to human resources development increasingly, improve technological capability and invest in research and development for the future.

In South Africa, we are aiming to foster and engage in the same commitments and are also susceptible to the international norms of globalization. The areas identified by various researchers through the Industrial Strategies of Altman (1994) and Joffe et al. (1995), The Clothing and Textile Industry Summit 2000, the White Paper on Science and Technology (1995) and research on 'Eager Projects' (Salinger et al. 1999 and Flaherty et al., 1998) have repeatedly emphasized similar areas if not the same. These include training and support, access to information and resources, extended opportunities for export projects, human resource development and financial and business development programmes. In the Clothing sector one of the major obstacles has been technology and according to Anson (1996:6) the industry needs to reform additionally in: change in attitude and practices; a decrease in production costs; a need to satisfy domestic demand, a strong commitment to training; and investment in new technology.

Competitiveness will depend on the ability of firms to learn and acquire the new skills required in the clothing industry. Although technology is now affordable, cost still remains as 'the' factor against adoption among smaller firms. As larger firms continue to benefit from vertical integration and the benefits of technology, smaller firms face many challenges and constraints e.g. restrictive labour laws and competition policies, resources and lack of skills.

While industry justifies its contribution to training as being a loss through the high rate of labour turnover among the new employees, the work force skills-levels have not been upgraded in keeping with technology requirements. Furthermore, there has been much criticism of government and the NGO sector spending a vast amount of money in small business development, with little being done to improve the range of skills (Terrablance cited by Rossouw 2003:5)

The shortages of skills and the appropriateness of skills are a central issue in a modern and knowledge driven economy facing Higher Education in South Africa. The majority of students are not trained to function in these environments. At tertiary level it has become incumbent to provide skills relevant to the industries the students will serve.

The function of tertiary institutions extend beyond this point, as has been illustrated by the newly initiated IT Centre, by the Durban Institute of Technology. The importance of IT cannot be over-emphasized especially in view of the fact that a survey is now being conducted among SMEs on 'the impressions of the effect of IT on productivity and competitiveness' (SME Survey:2003).

The 'techno-hub' in the heart of Durban affirms that Kwa-Zulu Natal is a region of opportunity for SME entrepreneurs and therefore fulfilling it's aim at becoming a "smart city" is inevitable. The project worth R22 million was funded by different sources including the city itself and is an excellent example of an institutional support mechanism providing for the local needs of the city. The post-training will allow networking and access to IT resources. The support envisaged for entrepreneurs in the clothing sector, although intended to be institutionally based is aimed at offering a similar service. The commercializing of skills acquired in the clothing/ fashion field is significantly important to SMEs of the future. The country needs innovative entrepreneurs who can stimulate the economy and also improve their sustainability through empowerment in the various aspects of entrepreneurship skills.

The clothing industry is the most labour intensive and female dominated of all the manufacturing sectors. In the new democracy, as the economic policies are trying to address employment equity and black economic empowerment, there has been a growing concern by government to elevate the position of SMEs and in particular the position of women. The development of SMEs is seen worldwide as the driving force of the economy, more so in South Africa where small business contributes 42 % of the GDP (GOVZA:Economy 2002:19).

As a consequence, government has come under enormous pressure to provide an enabling and a supportive environment for the SMEs. Support programmes on a national level are indicative of the need for technological support for SMEs in South Africa through the National Innovation Policy. Participating higher education institutions are used as the 'transfer vehicles' for the support interventions. The programmes are focussed on human resource development in an environment conducive for the transfer of technology. The national and local initiatives are encouraging. It has been proven by international examples that interventions for supporting SMEs in specific areas of need have had far reaching effects. Inter-firm cooperation, networking and the establishment of best practice have been mentioned as

the benefits of support mechanisms (general incubators, business incubators and support centres). For productivity enhancement and economic empowerment, the need for new skills and technology through support are imperative.

According to Porter (1990:610) the main role of government towards the economic policy is to ensure the deployment of labour and capital for increasing levels of productivity. He believes that productivity levels determine a nation's standard of living. To sustain the growth of productivity, continuous upgrading, improvement, innovation and capacity building for competitiveness is required. The study has also established that productivity includes a combination of factors to work simultaneously, at workforce level and at organizational level in order to be competitive.

Policies of competitiveness need benchmarking against economic performances of other nations. According to the World Competitiveness Yearbook, South Africa has improved its position to 38<sup>th</sup> moving four places through currency stabilization, privatization and reform of state sector and liberalization of trade and tariffs. Countries contributing significantly in their technological infrastructure are the world's leading nations in terms of Internet connections, telecommunication and computer usage. The USA being the most competitive followed by Singapore and Finland (Siddique 2000:1-5).

Garelli (1996:15,16) maintains that, 'nations do not compete with products and services alone, but also with education and value systems'. The research undertaken has provided sufficient evidence that competitiveness is a culmination of prerequisite factors, of which 'process innovation' through new technology is distinctively important. The importance of CAD as a tool in the clothing industry and in education has many exciting possibilities in stimulating and challenging the enquiring mind. Hence, entrepreneurs given the access to physical resources together with their enhanced creativity would be equipped to increase productivity and assist in becoming more competitive.

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# APPENDIX A

30 July 2002

Dear Respondent

**Re : Questionnaire on Computer Aided Design (CAD) : Clothing**

Presently I am studying towards a Masters Degree in Entrepreneurship and my topic investigates setting up a CAD Support Centre for SMEs in the clothing sector.

I would be most grateful if you could complete the attached questionnaire. You have been selected as I believe your knowledge and experience on CAD will contribute towards the survey.

*The questionnaire consists of 2 parts :*

**Part 1** has 6 questions and deals with descriptive demographic details. **Part 2** has 25 questions on Computer Aided Design-focusing only on the *pattern making, marker making and grading processes*. Your response will be treated as confidential. Please use the self-addressed envelope to return your questionnaire by the 26 August 2002, alternatively it can be collected if you so desire.

Your sacrifice and participation would be most appreciated.

Thanking you in anticipation of a response.

Supervisor : Dr R Chetty  
Associate Director : Research

Yours sincerely

Fathima Patel (Mrs)  
Department of Fashion Design (M L Sultan)  
Durban Institute of Technology

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Address : 96 Brickfield Road, Overport, Durban

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# APPENDIX B

**Part 1 :**

**Demographic Details**

*Please tick (✓) relevant blocks*

1. Position held in company.

\_\_\_\_\_

2. Age of Respondent.

20-30	31-40	41-55	56-70
-------	-------	-------	-------

3. No. of years of experience.

1-5	6-10	11-15	16-25
-----	------	-------	-------

4. Number of employees in the workplace.

1-9	10-49	50-100	over 100
-----	-------	--------	----------

5. Number of computer (CAD) work stations in the workplace.

None	1-2	3 or more
------	-----	-----------

6. What is the legal form of the business?

Company	Partnership	Close Corporation	Sole Proprietorship	Other
---------	-------------	-------------------	---------------------	-------

6.1 If other, please specify.

\_\_\_\_\_

7. Which is the most utilized of the CAD software?

Marker Making	Grading	Pattern Making
---------------	---------	----------------

## Part 2 : Questionnaire

Please indicate the extent to which you agree or disagree with the following statements using the example below.

### Example

CAD has been in existence for at least 20 years.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
			✓	

2.	General	1	2	3	4	5
2.1	CAD is easy to use and operate.					
2.2	Traditional methods of pattern making are required to use CAD.					
2.3	Knowledge and skills in computers increases one's job opportunities.					
2.4	The transition from manual patterns to computer patterns is difficult.					
<b>3. Disadvantages through lack of computers</b>						
3.1	CAD saves time compared to manual operations.					
3.2	CAD avoids repetition of certain tasks.					
3.3	CAD allows to capture basic blocks onto data base successfully.					
3.4	On-line libraries are accessible for review of designs.					
3.5	CAD reduces overhead costs in the pattern department.					

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

4.	<i>Improve competitiveness through quality and support.</i>	1	2	3	4	5
4.1	CAD improves overall quality of patterns.					
4.2	CAD allows consistency in the manufacturing of garments.					
4.3	The provision of this service will enhance the skills of SMEs.					
4.4	Training in CAD is essential.					

---

4.5 Are there any comments you would like to make?

---

Thank you once again for your time and co-operation.

---

# APPENDIX C

**Part 1 :**

**Demographic Details**

*Please tick (✓) relevant blocks*

1. Position held in company.

\_\_\_\_\_

2. Age of Respondent.

20-30	31-40	41-55	56-70
-------	-------	-------	-------

3. No. of years of experience.

1-5	6-10	11-15	16-25
-----	------	-------	-------

4. Number of employees in the workplace.

1-9	10-49	50-100	over 100
-----	-------	--------	----------

5. Number of computer (CAD) work stations in the workplace.

None	1-2	3 or more
------	-----	-----------

6. What is the legal form of the business?

Company	Partnership	Close Corporation	Sole Proprietorship	Other
---------	-------------	-------------------	---------------------	-------

6.1 If other, please specify.

\_\_\_\_\_

7. Which is the most utilized of the CAD software?

Marker Making	Grading	Pattern Making
---------------	---------	----------------

## Part 2 : Questionnaire

Please indicate the extent to which you agree or disagree with the following statements using the example below.

### Example

CAD has been in existence for at least 20 years.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
			✓	

2.	General	1	2	3	4	5
2.1	CAD is easy to use and operate.					
2.2	Traditional methods of pattern making are required to use CAD.					
2.3	Knowledge and skills in computers increases one's job opportunities.					
2.4	Skills and use of CAD can be taught to the majority of the design staff.					
2.5	The transition from manual patterns to computer patterns is difficult.					
3.	<b>Disadvantages through lack of computers</b>					
3.1	CAD saves time compared to manual operations.					
3.2	CAD avoids repetition of certain tasks.					
3.3	CAD allows to capture basic blocks onto data base successfully.					
3.4	On-line libraries are accessible for review of designs.					
3.5	CAD increases planning time for upcoming orders.					
3.6	CAD cuts down number of pre-production processes.					
3.7	CAD improves time management in the pattern room.					
3.8	Existing/stored blocks are modified to develop production patterns for style variations.					
3.9	CAD reduces overhead costs in the pattern department.					
3.10	CAD improves efficiency of production.					

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

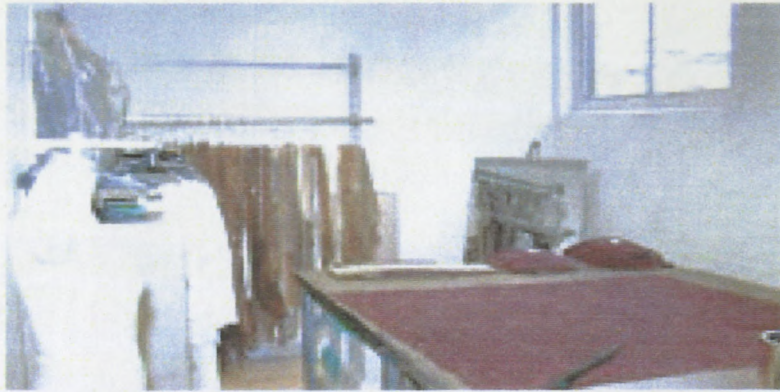
4.	<i>Improve competitiveness through quality and support.</i>	1	2	3	4	5
4.1	CAD improves overall quality of patterns.					
4.2	CAD allows consistency in the manufacturing of garments.					
4.3	CAD improves the competitive advantage of clothing companies in South Africa.					
4.4	Through the use of CAD best practise in the pattern area is established easily.					
4.5	A support centre for CAD will encourage networking amongst SMEs.					
4.6	The provision of this service will enhance the skills of SMEs.					
4.7	Training in CAD is essential.					
4.8	CAD is recommended to small, medium and large companies.					
4.9	CAD system is significant for survival and success in the clothing industry.					

4.10 Are there any comments you would like to make?

---

Thank you once again for your time and co-operation.

# APPENDIX D



*A studio at the Toronto Fashion Incubator*



*The TFI production facility*



*The Eveleen Dollery Showroom*

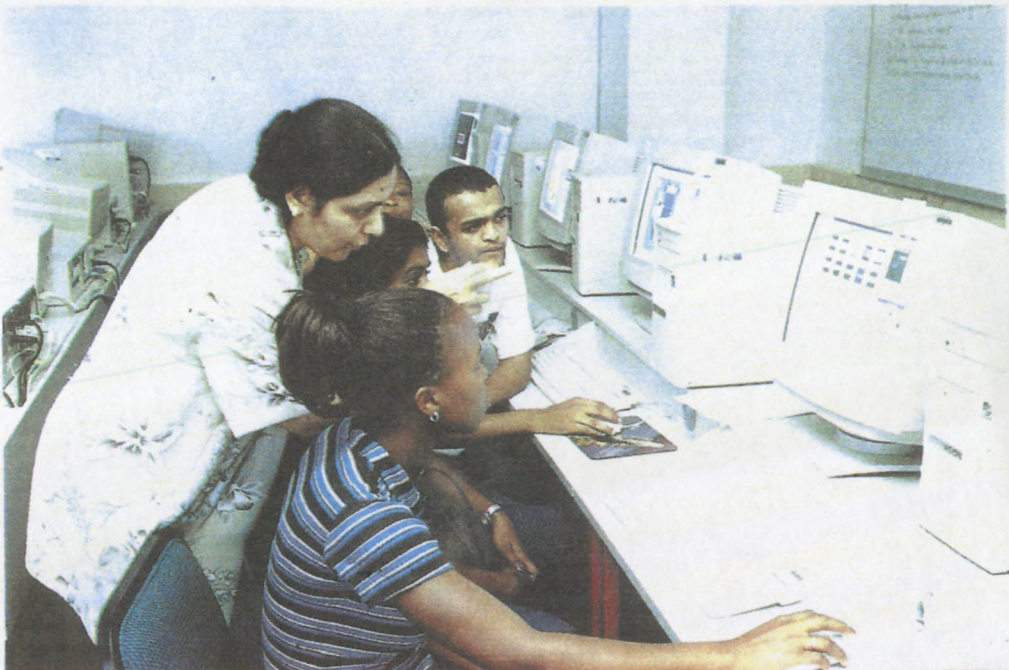
FASHION INCUBATORS



### Technology Station at Peninsula Technikon



CAD workstations



Fashion design students get into the swing of things using Computer Aided Graphics for designing

ML SULTAN ANNUAL REVIEW 2000