CAD/CAM Technology: A Boon to Apparel Industry

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Abstract

Globalization, availability of information and advanced communications systems have changed profoundly the face of Apparel industry and have simultaneously stimulated competition. Though manufacturers offer unlimited designs but the basic problem remains as to how to bring such designed products to market quickly and release market updates. This problem has been rectified by Computer Aided Designing and Computer Aided manufacturing systems which are now the essential tools required to integrate and achieve success taking the role of the Designer. The objective of this paper is to spread awareness regarding the use of different CAD and CAM systems and how they help in giving suppliers and exporter's edge over to get recurrent orders and to enhance production in Apparel fashion industry. Different CAD systems available in India are body measurement, body scanning, digitizing, grading, marker making, pattern design and generation, texture and embroidery, design specifications, cost, data management and 3D visual merchandising systems using software's like Gerber, Tukatech, Lectra, Adobe Photoshop, CorelDraw, Illustrator, Digital Fashion Pro, Wilcom etc. Some of them are being used in various departments i.e. Design, Production and Sales in Ludhiana readymade garment manufacturing units. New Technology is being integrated with traditional methods as manufacturers are still hesitant to totally depend on it. Punjab Government has taken initiative for technological up gradation by offering different schemes but still lot needs to be done. Some more efforts are required for smooth infusion and diffusion of CAD/CAM technology in Ludhiana Apparel industry which had revolutionized the whole garment manufacturing process.

Key Words: *SWOT Analysis, Challenges, CAD systems, Digital Fashion, Body Scanning, 3D Fit.*

Introduction

The Apparel industry has been a pioneer industry contributing 14% of Industrial output, 27 to 30% of the country's total exports and providing direct employment to 38 million people (Robyn, Dutta, Tait, 2005). The structure of this Industry is as varied and deep rooted as is its reforms are challenging and daunting. The onset of Globalization of trade and economic liberalization within the country has posed new challenges and opportunities (figure1).

These challenges can be met by combining the solutions of CAD/CAM technologies along with internet tools. CAD and CAM are industry specific design & manufacturing systems using computer as a tool. CAD

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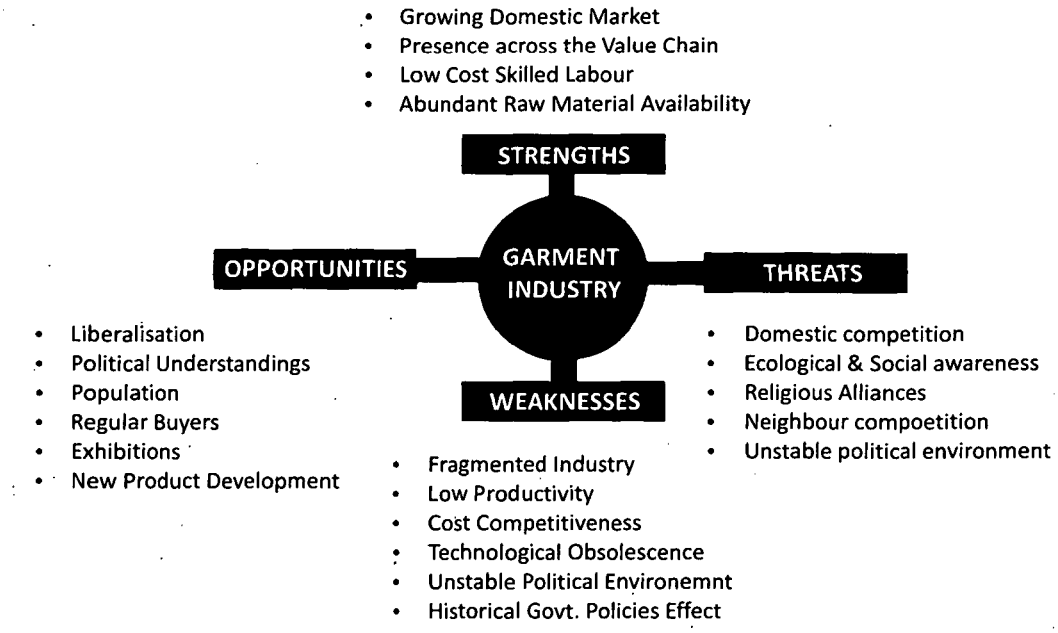
Figure 1: SWOT Analysis



technology was first used in the Indian garment industry in the 1980s. It was originally developed simply to aid draftsman but now it has been upgraded to a powerful man machine interface which has evolved since long from luxury to a necessity. Traditional working methods are being phased out in favor of futuristic and globally prevalent methods of working. The evolution in technology has been influenced by the proposition to reduce cost and lead time, to increase interactivity between what is real and virtual and to enhance one's creative abilities. Prices are not what they used to be due to the competition between CAD suppliers. Technology has grown over the ages in diverse fields, and has influenced the advancement of each field in a combined and integrated manner.

'CAD' - Computer Aided Design. It is also called Computer aided drafting or Computer aided drawing. As the name suggests it is designing textile or fabric garments with the help of computer. It is computerized version of hand drafting process that used to be done with pencil and ruler on the drafting table (Calasibetta and Tortora, 2005). It is extensively used in all technical fields such as Architecture, mechanical, electrical & industrial engineering along with textile & clothing sector.

'CAM' - Computer Aided Manufacturing. It includes Computer hardware & software systems that grade and make markers electronically and has a capacity to do computer controlled cutting and use lasers for specialized cutting (Rao, 2008).

OBJECTIVES OF THE STUDY:

1. To spread awareness regarding use of CAD and CAM technology in Readymade garment manufacturing units.
2. To study present status of CAD and CAM technology adoption in readymade garment manufacturing units in

Ludhiana as it is leading garment production centre in north.

3. To investigate Key CAD Soft ware's available in market and how they are employed to create innovations in production and manufacturing processes.
4. To find out different institutes providing CAD training in Ludhiana.
5. To examine the hindrances in the way to integrate CAD/CAM in practical scenario and give suggestions for improving its smooth adoption in Apparel Industry.

METHODOLOGY:

As the whole study is based on primary as well as secondary data, Informal interviews were also Conducted with Enlightened and experienced entrepreneurs i.e. 50 readymade garment manufacturing units owners, 10 CAD software suppliers, 5 CAD training Institutes owners, 5 CAD operators in Ludhiana who have long stint in the readymade Garment manufacturing business and technical experience. Random sampling technique was used to select the sample. The raw data collected was classified on the basis of respondents; coded (in the form of frequencies) and tabulated (in percentage). Various issues of Newspapers, Textile magazines like Textile Trends, Indian Textile Journal, Clothesline, Book reports, statistics from various departments, associations has been read and Material related been sorted out for reference. Google has been used to visit various websites - www.emerald.com, www.fibre2fashion.com, etc.

DISCUSSIONS:

Today's CAD systems offer a variety of tools and solutions, not only for design, but also for solving a variety of production and management. Although there are fewer companies providing proprietary software today, CAD software continues to be quite expensive but now comes with enhanced technical support and training, industry expertise, and in some instances production interfaces. CAD using garment manufacturing units shows reduction in pattern designing, grading, and pattern alteration time by around 90%, Greater flexibility in pattern designing, grading and marking, reduction in waste upto 10%, increasing quality of cutting room by around 50%, reduction in sample making time by 60% (Parthasarathi, 2010). But technology adoption is not easy to this industry. At least an investment of Rs 2 crore is required for automating a 100 machine garment unit. Not only has the cost of technology been deterrent, this has also paced India in a position much below other countries such as China, Sri Lanka and Korea in terms of production efficiency. However, post 2005, it is "do or die" situation for manufacturing units to survive and be competitive ,they would have to incorporate latest garment manufacturing technology and advanced management technology combined with the manufacturing model and systems to personalized clothing and globalization for the markets. The technology that has given a real facelift to these units is CAD/CAM.

There are different types of CAD/CAM systems that are available in the market for the use in the Apparel industry.

- Design CAD system
- Body Scanning & Measurement
- Digitizing
- Pattern design & Generation

- Grading
- Marker Making
- 3D Fit
- Texture Mapping
- Embroidery
- Design Specification
- Data management
- 3D visual Merchandising

1. Design CAD system: It enables the designers to play with the shapes, figure, motives, colour schemes, layouts taking into consideration the fashion trend for colour and design. Fashion illustrations, Accessories & story board can be created. CorelDraw13, Photoshop CS3 & Illustrator are being used by almost 80% of the apparel industry in the India as their main design software. Digital fashion pro is a true fashion design system that comes with fashion templates, training, graphics program and more wrapped in one and it's easy to learn. Lectra Kaledo (Module of Lectra), Shima Seiki USA are also used.

2. Digitizing CAD systems: It enters the handmade paper pattern into the computer with the help of digitizing tablet which is embedded with sensors that related to X horizontal and Y vertical coordinates of a grids and with Digi pen or Crosshair cursor, paper pattern is translated into a series of codes that input the shapes into the computer. OptiTex Digitize, Digitizer apparel (Module of Gerber) and Audaces Digiflash (Brazil) are mainly used.

3. Body Scanning CAD system: It helps in designing personalized garments and allow higher level of customization in clothing .There are 3D scanning booths where the system records the body shape and posture 2 or 3 dimensionally and calculate the body measurements (Beaziey and Bond,2004). It is linked to the computer pattern alteration system and either it finds nearest pattern to the individual or creates a new pattern and transfer to automatic marker. The scanned data and other information are stored in the computer for future orders. SymCad Flash 3D is the software available.

4. Body Measurement Cad System enables to manufacture single garments at mass production speeds and avoid high costs.MTM (Made to Measure) softwares are integrated with existing CAD module, allowing quick and easy entry of customer details, body measurement and customer orders. Information is further linked to pattern making, marker planning, plotters and single ply cutters. Like Optitex Modulate, WebMTM-Made-to-measure(Module of Lectra), AccuMark MTM (Module of Gerber), etc.

5. Pattern making & Grading CAD system: It enables to create basic as well as complicated patterns & then upgrade & down grade it to S, XS, L, XL & XXL sizes. Style summery & pattern card reports in Excel can be easily made by just one click which gives all information regarding number of pieces, code, placement, trimmings, special instructions, notches, area used, etc. REDTREE (Apparel CAD Software from Astor Technologies), Modaris (Pattern Design module of Lectra), OptitexPDS and Grade modules, ReachCad, AcuMark Silhoutte (module of Gerber), Action Technologies PatternCad, Tanya Geometrik and TUKACAD (module of Tukatech) allows the pattern maker to drape patterns pieces on screen. Gerber Acuplot700, AcuMark Scan 100, TUKAjet family of High Speed Ink Jet Plotters are output and input devices attached to the system. Educational as well as Commercial versions are also available.

6. Marker making CAD Systems: It enables

to plan for cutting the pattern for a specific garment style by laying out the pieces on marker along with Summary report of marker giving information regarding pieces placed, total pieces efficiency, length & width of the marker. Stripe, checks matching and placement of pieces for border design can be easily done. SMARTmark (module of Tukatech), REACH Cut Planner, MGS-Marker-making (module of Lectra), AcuMark Silhouette (module of Gerber) allows the Automatic Nesting providing layout in record time of 3-5 minutes as compared to manual layout of 8 minutes.

7. 3D Fit CAD System: Using waist, hem and bust parameters and a framework of dots or intermediate points can be generated using folds, bumps and curves. Garment can be viewed from every angle with fabric designs/textures and drape characteristics for realistic representation on 3-Dimensional Virtual mannequin (Chatterjee, Kaur, Khanna, Chaudhary, 2010) with the assistance of a trained sales person, which allows one to select the style, design, fabrics and fitting styles. Hence the customer gets perfect e-fit garments 3D software which not only gives 3D simulated view, but changes can be translated into a two dimensional pattern and vice-versa.

Modaris 3D Fit - 3D Virtual Prototyping and Visualization (module of Lectra), OptiTex 3D Garment Draping and 3D Visualization, e-fit Simulator (module of Tukatech), AccuMark Vstitcher (module of Gerber), REACH Fashion Studio software are mainly used in India.

8. Texture Mapping CAD System: It enables the designers to easily create different textures on the garment design. REACH Fashion Studio, Digital Fashion Pro, Adobe Photoshop CS3 consists of numerous tools and menu items which help in creating repeats, rendering prints, textures and making logos. Images can be manipulated, cropped, resized, shift colors, alter focus and create many special effects (Figure-2).

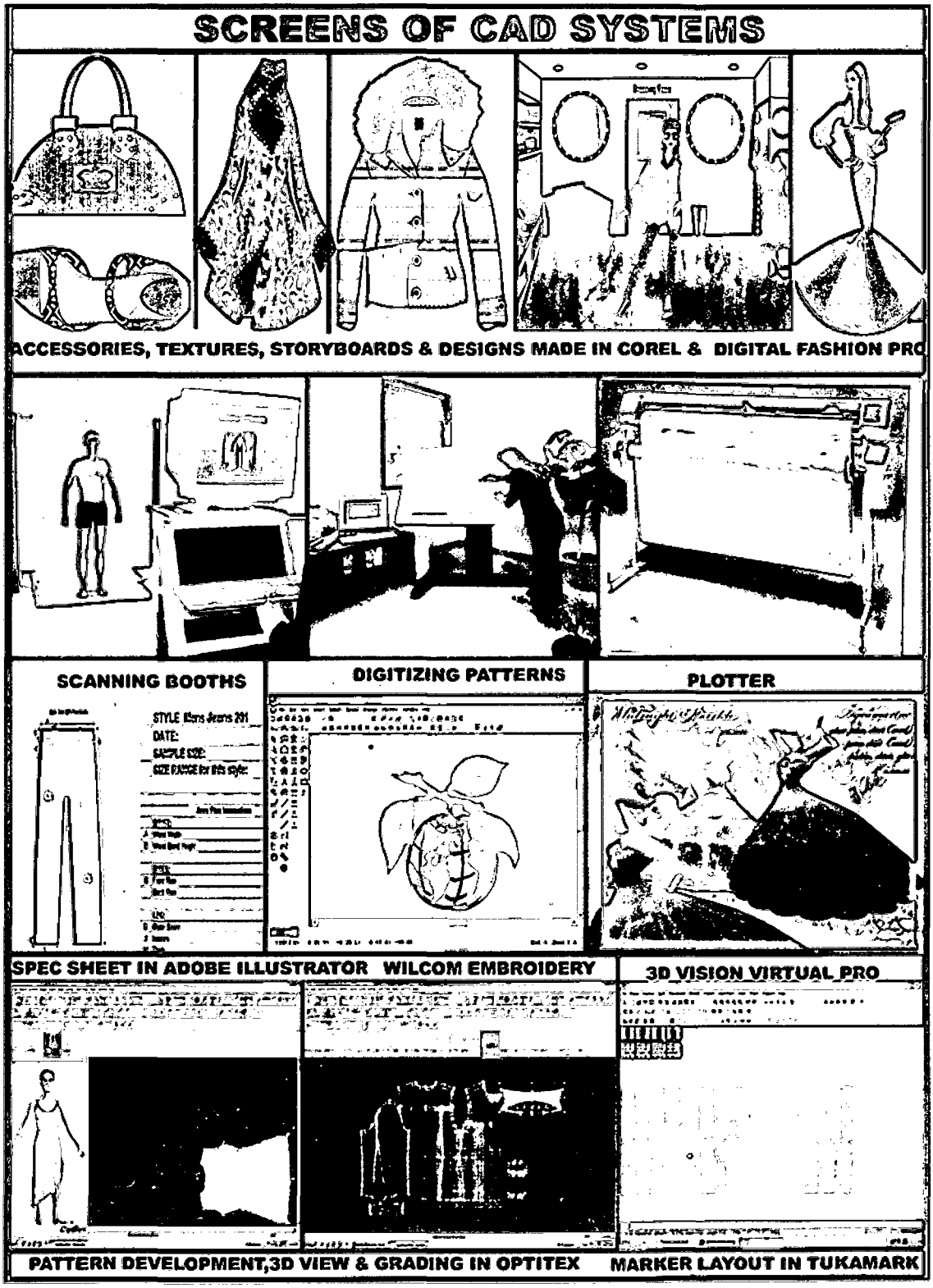
9. Embroidery CAD System: It is known for its renowned stitching quality, creating, visualizing and producing multi decorative designs using innovative design tools. It also enables to estimate the cost of the design by counting the number of stitches used. Different stitches like satin, cross, fly, feather can be used.

Wilcom ES and WINGS Experience 5 are easy to use and fast softwares which helps to create embroidery designs with the best possible quality.

10. Design Specification System: It enables to create technical sketch i.e. SPEC sheets, Cost sheet etc. A fashion drawing that are really true to the design, and has the best possible fit and silhouette along with storyboards displayed with product description are created using PGS - Pattern Design (module of Lectra), C-DESIGN Fashion (module of Optitex), Adobe Illustrator and Digital Fashion Pro.

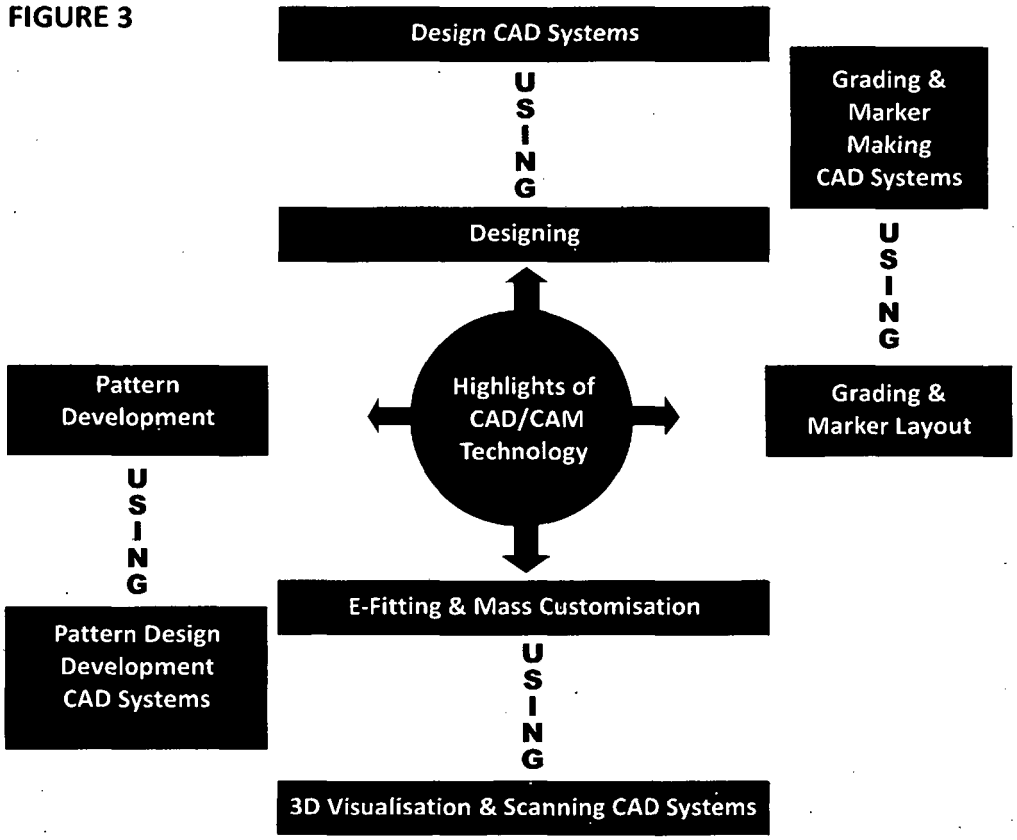
11. Data Management System: It helps the manufacture to manage every step of the design, merchandising, purchasing , sewing, warehousing & shopping process with direct links to the factory floor and retailer. Product data management system, Lectra Fashion PLM, TUKAtrack Information Tracking System, Tukaplan-n41 Apparel ERP Software Suite, REACH Merchandising Manager, Apparel Track and Business to Business are used to give complete solution for the Apparel industry: Sales, production, inventory, EDI, bar code, picking, shipping, invoicing, commission, accounting and runs over the Internet or on your hardware (Figure-3).

FIGURE 2


SCREENS OF CAD SYSTEMS
ACCESSORIES, TEXTURES, STORYBOARDS & DESIGNS MADE IN COREL & DIGITAL FASHION PRO
SCANNING BOOTHS
DIGITIZING PATTERNS
PLOTTER
SPEC SHEET IN ADOBE ILLUSTRATOR
WILCOM EMBROIDERY
3D VISION VIRTUAL PRO
PATTERN DEVELOPMENT,3D VIEW & GRADING IN OPTITEX
MARKER LAYOUT IN TUKAMARK

12. 3D Visual Merchandising CAD system is a new media promoted by major CAD vendors offering the ability to quickly simulate apparel collection in any virtual 3D retail environment. 3D Runway Optitex Designer 10 has new customizable features and options, allowing designers the freedom to change textures, materials, colors and stitches or add logos on screen without using a single piece of fabric. The garment can then be seen "in action" on OptiTex's 3D models, all of which are fully adjustable to reflect any body type.

FIGURE 3



USE OF CAD/CAM TECHNOLOGY BY DIFFERENT DEPARTMENTS:

1. Design Department (e-design)- Most (80%) of the designers in Ludhiana ready-made garment manufacturing units are already using CAD to illustrate and visualize their designs after developing storyboards that fits customers requirement both two and three dimensionally by filling chosen textures and saves time by requiring fewer adjustments of prototypes and samples later. CoralDraw, Digital Fashion Pro, Fukuhara, Universal, Stoll, Shima Seiki, Illustrator and Photoshop are mainly used to create different styles, its modification and grading, for design detailing & storing, colour matching, Spec sheets by almost all units like Payal Exports, Duke and Jay Kay Knitwears. Wilcom embroidery software is used along with computerized machine for making embroidered patches in Blue Mount in Ludhiana.

2. Production Departments (e-manufacturing) – Most (85%) of the Apparel units in Ludhiana are following the traditional method for construction while (15%) are combining traditional garment making techniques with CAD/CAM Technology. But Master pattern makers are still making a base pattern out of cardboard in the "the old traditional way" and then place it on a digitizing table, and its coordinates traced out to obtain a digital image of each pattern piece. Later, the pattern is graded to all sizes, marker layout is done and it is sent to specialized plotter for full scale print and production pattern is cut, sewn and fitted. Similarly in some units, Grading is still done manually and then fed into computer through digitizing. Gerber (AccuMark Version-7.6) is being used in Nahar Fabrics and Sobhagia Sales Pvt Ltd for digitizing, grading and marker layout. Indian made MD CAD software is also used in Sobhagia Sales Pvt Ltd & Astor Technologies in Bhandhari Hoisery Exports Limited. Modaris and Diamino Fashion Lectra software is used in April Cornell, Superfine Knitters Ltd and Cotton County Retail Ltd. (Table-1).

3. Sales Department (e-sales) - Use of CAD helps in reducing the gap between customer and designer by offering the ability to quickly simulate apparel collection in any virtual 3D retail environment-mail based sales which are cost effective and gives high response.

TABLE 1: CAD/CAM Technology Usage

CAD Technology		CAM Technology	
USAGE	**ADVANTAGES**	**USAGE**	**ADVANTAGES**
• Draw accurately. • Simulate fabrics, stitches, texture and prints and manipulate them in size and proportion. • Visualise the product in three dimensions. • Rotate designs to see them from different angles. • Make changes and modification easily and quickly. • Digitalise the design which can then be saved or reproduced on the image of a garment. • Test the design/ component parts before proceeding to the next stage. • Presentation tool • Produce story Boards • For marketing, Advertising & Merchandising.	• Improves quality of presentation. • Maximises creativity. • Increases productivity. • Allows for quick and easy changes/ modifications. • Reduces sample costs. • Reduces development time. • Direct link to customers • Helpful for people with no drawing skills • Repetiveness in a design • Develop Personalized product	• Spread fabric, ready to be cut. • Work out the most economical lay plan. • Produce a cutting marker. • Cut fabric. • Control garment-handling systems. • Provide technical specifications, size charts and construction details. • Programme knitting and sewing machines to produce a range of stitches and control the movement of small pattern pieces during stitching. • Control ordering and stock.	• Ensures accuracy throughout manufacture. • Allows a single person to control many operations at one time. • Reduces human error. • Reduces labour costs. • Reduces development time. • Increases productivity. • Speeds up response time. • Direct downloading process • More logical patterns • Easy modification of design • Streamlines the manufacturing process • Direct link to customers • Reduce maintenance • 3D visualization • Voice capabilities and communication in several languages

Simulated Fashion show can be presented where models can be seen walking on the ramp giving front side & back view hence can be used in sales promotion and shown to actual customers. In Ludhiana, 3D simulation is not being used but sketches made in Corel, Illustrator and Digital fashion pro where real look of fabric and style can be created are used on sales brochure. Hence, it was observed that CAD/CAM technology is not fully utilized in certain traditional manufacturing sectors in Ludhiana.

CAD Training Institutes

1. APPAREL TRAINING AND DESIGN CENTRE, Ludhiana, Punjab, India
   - Apparel CAD Course (1½ months)
   - Diploma in Advance Pattern Making and CAD (1 year)

   (Training in Reach Cad, Fashion Studio and Merchandising Manager)
2. SPORTKING INSTITUTE OF FASHION TECHNOOGY, Ludhiana
   - Apparel production and merchandising (3years) (Training in Lectra CAD software.)
3. GOVERNMENT POLYTECHNIC FOR GIRLS, Ludhiana
   - Garment manufacturing technology fashion design (3 years)-Training in Tukatech CAD
4. DEPARTMENT OF CLOTHING AND TEXTILES

   College of Home Science, Punjab Agricultural university, Ludhiana
   - M.sc clothing and textiles(2 years)
   - Training in Tukatech CAD software

	CAD SOFTWARE	REACH SEWN TECHNOLOGIES PVT. LTD. INDIA
APPAREL CAD SOFTWARES	COREL DRAW (US)	TANYA GEOMETRIX (INDIA)
	ADOBE PHOTOSHOP (US)	ACTION TECHNOLOGIES (INDIA)
	GERBER TECHNOLOGY (US)	ASTOR TECHNOLOGIES .(INDIA)
	DIGITAL FASHION PRO(USA)	LECTRA(USA)
	TUKATECH (USA)	WILCOM ES AUSTRALIA
	OPTITEX (USA)	

Hindrances:

1. Expensive as CAD hardware and software are quite costly for start-up companies and requires not only huge initial investment but also continuous import of technology.
2. Designers are reluctant to use CAD as they find hand sketching motivational.
3. Lack of uninterrupted supply of electricity.
4. Dearth of CAD professionals.
5. Increase boredom of the work as there is less opportunity to move around.
6. Resentment among traditional workers as they are being replaced by CAD/CAM technology.
7. Pressure to switches to CAD system is less intense as compared to other technical fields as Architecture.
8. No Government Industrial training institute is offering CAD diploma in Punjab at reasonable fees.

Government Efforts:

1. Punjab Small Industries and Export Corporation Limited was set up to assist small scale Garment Industries in the State. The Corporation has signed a joint Collaboration Agreement with APPEAL, Ludhiana for setting up Apparel Export Park in joint sector at Ludhiana with an estimated cost of Rs. 40 crore. A new company named Punjab Apparel Park Limited has been set up for implementation of the Project for export promotion.
2. Apparel Training and Design Centre (ATDC) is in Ludhiana Sponsored by Apparel Export Promotion Council, Ministry of Textiles, Government of India runs various Apparel CAD courses.

Suggestions for smooth diffusion and infusion of CAD in Garment Industry:

1. Employ Professionals who can bridge the gap between CAD and traditional manual design. They will educate, support and assist in integration of digital data and creative imagery.
2. The government should develop infrastructure for massive training programs which should be on a public-private partnership module so that it can run on a sustainable basis. In this regard the government should also consult the industry associations of both large as well as small units.
3. Support and acceptance at all levels within a company among strategic upper management.
4. Human resource development: The industry needs a trained workforce to handle these efficiently and effectively. There is no training centre to impart training on computer-aided designing and manufacturing systems .Exploit strong human resources as their knowledge, skills and creativity are the keys to harness the new technologies.
5. Start CAD diploma in Government Industrial training institute with minimum fees for Garment industry workers providing Training/Workshop on technology up gradation.
6. Visits of foreign experts: Experts from developed countries should be invited on designing and manufacturing of garments using CAD/CAM technology to enlighten small-scale entrepreneurs about appropriate technologies and processes, on the basis of study of the existing set-up of the units during their stay. This will help in creating confidence among the entrepreneurs in making their units sustainable and competitive in the international market.
7. Development of economical models of modern CAD software
8. Research and development centre: An exclusive Centre for Research & Development for CAD/CAM technology in northern India having modern facilities backed by well known CAD specialists and experts in the field, with a separate wing for imparting training to workers and intermediate-level management personnel and Demonstrations for adoption of technology.
9. Progressive reduction of import duty on garment machinery and CAD Hardware and software products.
10. To provide more incentives, including interest subsidy by the Government.

11. Good infrastructure ,uninterrupted electricity and skilled manpower
12. Encourage private sector to establish and operate demand-driven technical training centers through financial and other incentives, under carefully designed industry initiatives, supported and coordinated by government, for quality control and accreditation systems.
13. A fully fledged Institute of Fashion Technology, on the pattern of such Institutes at New Delhi, Hyderabad, Tirupur, Kolkata and Mumbai, should be established at Ludhiana to train professionals in use of CAD for designing, marketing, quality control and manufacturing of garments.
14. Financial assistance: For modernization and technology up gradation of the units, it is essential in this era of stiff competition to provide finance at rates of interest comparable with internationally prevailing interest rates. This will help the small-scale units to purchase CAD software and hardware components required for production of acceptable quality.

FUTURE OF CAD/CAM TECHNOLOGY:

As Government is also making effort to promote technology diffusion in garment industry, it is believed that in the near future it will be common for people to go to body scanning boutiques to have their measurements taken, receive an electronic copy of their measurements, and then download this information to a virtual store to purchase custom-made clothing online. Body scanning technology is the perfect complement for electronic clothing boutiques. An individual can use his or her data to either order custom-made clothes online or determine whether a particular ready-made style fits their own body properly.Using CAD systems is like having a better pencil, or a better paint brush. Instead of being an enemy, computer technology is really a friend As CAD companies anticipate the direction the apparel industry is going, they are looking for ways to be more innovative and responsive to their customers' needs. CAD software companies show the willingness to respond to these changes by stepping outside the box, looking at the big picture, and using innovation to provide their customers with the best possible solutions for competing in a global economy. So slowly CAD/CAM Technology is diffusing in the Indian Apparel Industry. 'Cheap' CAD software's are being developed in Eastern Europe, North Africa, India and China like Astor technologies Pattern CAD software and their licenses are available permanent as well as temporary or on rent as CAD/CAM has become a commodity. Due to the changing needs of the industry, along with globalization, more flexibility within CAD systems is seen. CAD Distributers are giving more and more discounts ,Free service and support system ,free upgrades And today's versions have the ability to communicate in a variety of ways and to interface with a variety of systems.

Conclusion:

Computer aided designing is an innovative approach to Garment designing, Pattern & Marker making as well as Fashion simulation which enables Fabric & Garment producers to be dynamically adaptable to the fast and even changing needs of the fashion oriented 'Global Market 'which used is getting

competitive.

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