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Digital Tools for Product Development and Organizational Management

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Abstract:

The report illustrates about the digital tools those are used for product development and organizational management (apparel sector). We went to Lectra Sweden AB, DTS solutions AB to search our planned information about those tools. We got some additional information from them as well. We were interested to learn about much software for this but we studied about Lectra Fashion PLM, PISA PDM, and ERP Garp system (CRM, SRM, MRM) as we could manage opportunity to know about them only.

For Lectra, we focused on general idea about this software, its different divisions, its working procedure, its advantage to use, its possibility to use for every company. On the other hand, we concentrated on almost similar way of Lectra for PDM, PLM, ERP (CRM, SRM, and MRM).

We got different divisions of Lectra, namely- Kaledo, Modaris, Diamino, Optiplan are using for various purposes, like - design, pattern making, marker making, spreading and cutting. On the opposite side of the coin, if companies implement PDM, PLM and ERP system, they can assist to manage the whole business chain very easily for instance- product development, order, purchase, manufacturing, stock/distribution, economy, logistics etcetera. We also knew that it is expensive to buy those software’s and require special skill to operate so it is not prolific to all company.
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Chapter-1

1. Introduction:

Major brands, manufacturers and retailers in the Fashion and Apparel business are working in a competitive situation where everybody focusing on quality and price. The fulfillment of customer demand is the key rule of company by deliver the product at right place at right time. So the designer, merchandiser, suppliers in the fashion world have to be innovative, efficient, quick-reacting and productive. At the same time business is being global but no matter to look at distance and time. Companies are deliberate their energy to build brand, running with current market trend, new and diversity of product assortment, cost minimization, quick time-to-market. Towards this ends, companies are developing next-generation digital design initiative to reduce costs, improve product quality and speed time to market, digital design technologies and techniques can help design engineers fully exploit investments in knowledge assets and integrate key suppliers into the product development process-essential in today’s hyper-competitive marketplace.

In order to boost up product development and product quality, it is crucial for the company to implement digital product development tools and use skilled manpower. To manage entire supply chain properly, it is also essential to maintain good collaboration within the retailer and supplier or manufacturer like retailer have to send or share present and update data to the manufacturer and on the other side retailer have to know the current status of production. By extending access to the product data management environment, firm can share design and cost information across business unit, and collaborate with strategic suppliers to accelerate design and sourcing processes across and beyond the enterprise.

2. Research Purpose:

We tried to focus on the digital tools are used to enhance the product development and organizational management of apparel sector including their individual identity, working principles and working relationship with each other. On the other hand, we aimed to investigate software’s availability, suitability for every company around the world. In addition, we wanted to know how they are helping with communication of different departments of an organization.
3. Research Questions:

1. Which digital tools are used to enhance the product development and organizational management of apparel sector?
2. What are the relationships among those tools?
3. How these tools are working for the organizational management? Such as- working mechanisms, their relationships with each other, etc.
4. Is it good to use these software’s for every company around the world?
5. How we can maintain the communication within different departments of an organization by this software?

4. Research methodology:

The method of this thesis paper is an inductive approach to identify and finding the present digital tools for product development and organizational management, we have gone through one of the top most design tools company “Lectra in Sweden, Borås, Sweden” and one ERP system developer and supplier “DTS Systeam AB, Borås, Sweden” and also reviewing literature regarding fashion art and design, Supply and demand chain management, garment manufacturing systems and other manufacturing system design techniques and system design tools and their applications in different areas of product development and organizational management process from the library of Högskolan i Borås and searching books, journal, website through internet.

To get more information about the acceptance and uses of digital product development tools in the garment manufacturing country we have had a telephonic conversation with Sample and technical manager of Esquire knit composite Ltd, Bangladesh. In addition, to get clear knowledge about the optiplan of Lectra system we have had an online conference with Optiplan pre-saler/Trainer of Lectra in Belgium.

After having company lectures, interview and reviewing the literature, the digital tools for product development and organizational management were determined, and also benefit and importance of tools for retailer or manufacturer were analyzed.

5. Abbreviations:

CAD-Computer Aided Design
CAM-Computer Aided Manufacturing
PDM-Product Data Management
PLM-Product Life Cycle Management
ERP-Enterprise Resource Planning
CRM-Customer Relationship Management
SRM-Supplier Relationship Management
MRM-Manufacturer Relationship Management
Chapter-2
Product Development

1. The Process of Product Development:

The Origin of Styles

- Market research
- Design concept
- Market screening

The Development of samples

- Prototype pattern
- Sample
- Range meeting
- Pattern adaption
- Testing
- Production pattern
- Grading
- Markers
- Production templates

The refinement of business objectives

- Specification

The attainment of commercial products

- Feedback from manufacturing
- Feedback from the marketplace

Figure-1: The process of design and product development (1)

Source: Harold Carr and John Pomeroy (1992), Fashion Design and Product Development
This figure shows in diagram form of the process of product development. The process of design and product development is very complex to meet the final goal. After passing various stages where influenced by a variety of aesthetic, technological and financial factors then reach the final product stage.

The first stage is fully innovative: Idea generation and design concept are coming after market research. Market research may be fundamental or it may be no more than a reaction to existing sales figures. Research can be performed by analyzing world-wide series of show, from fashion journals, from style and color forecasting services; from the garments competitors; from the buyers in retail stores. The idea is then developed by the production of prototype pattern and the making samples. The creation of a prototype pattern is based on the technology of block patterns of modeling. The first samples are constructed in accurate fitting and adjusting with all correct measurement. Range meeting examines the looking of garments with compared to first idea and estimate the material and other cost. Is there any further development need for the particular garment, range meeting also gives decision for this.

Pattern adaption, following the range meeting, makes alternations to the pattern to correct any fitting problems, to find out of cost reduction, and to resample in alternative fabrics. After finalize the decision then the order is going for bulk production and garments is tested in different manner like comfort, resistance to attack by fluids and sunlight, resistance to wear and behavior in washing and dry-cleaning.

Then produce production pattern where include seams, inlays, and turnips, grain lines and pattern identification. Grading is done by analyzing the sizing survey, increase or decreases the dimensions of pattern. Marker making is carried out from all of pattern where important thing is to minimize the space between patterns for saving the fabric waste.

The designer finalizes the specifications of the requirements of the design. Feedback from manufacturing is based initially on a test batch and feedback from marketplace also based on test marketing. (1)

2. Stages and Elements of Apparel Product Development:

In the 1990s, there are different Apparel product models developed. The models identity the functions and elements in the process and provide a context or stage for when each function might be accomplished in relation to the others. One model contains three basic phase: Preadoption, Line adoption, and postadoption (refer to Figure 2)
2.1 Preadoption Stage:
Before garments making all of stages is called preadoption stage where involves creating a new designs, developing design specifications, making the first pattern, sewing the design sample, evaluating the material to be used, and preparing cost estimates. The first step is line concept which includes trend research and concept presentation. All of information then analyzed and make decision for the focus product development process. The line development process is translating the trend to a form of sketch by the designer where designer work with textile specialists to select the textures, colors, fabric design. In this stage making the Idea but it might be modified before go to further line adoption stage.

2.2 Line adoption Stage:
The technical designer will makes the pattern of each style and write the specification for producing of this product. In the Line adoption stage, company select the design of product line, making the sales and catalog samples, and make decision for advancing the selected style for postproduction. The sales and catalog samples are made according to the original sample and those samples are used by the sales people for advertising and publicity.

2.3 Postadoption stage:
The postadoption stage includes the following steps:

- Perfecting the style and fit
- Engineering production pattern
- Making the decision regarding performance standards or quality expectations, style specifications, and assembly methods
- Computing details costs
- Grading the pattern to a range of sizes

In the postadoption stage, company takes final decision that the product should goes to full production. If fulfill above factors then product goes for final production and make a complete line for this. Some of activities are carried out in production planning like production materials which may vary from original samples, marker making in production plant, grading of pattern, cutting of clothes and assembly planning.(2)
Revised Apparel Retail Product Development Model:

Research

Line Conceptualization
(Preadoption)

Product Visualization and Evaluation
(Preadoption/Adoption)

Technical Development
(Postadoption)

Internal Factors Influencing Development Process

Business/Sales Trends
Target Customer Base
Employee Input
Marketplace Research

Testing and Evaluation

Inspirational Search for Trends
Trend Analysis

Structural Fabric Decisions
Palette Development
Theme Development
Silhouette and style Decisions
Fabric surface Design

Prototype Pattern making, Construction, and Analysis
Line Presentation
Line Adoption

Fit & Style Perfecting
Production Pattern Making
Retail Firm Development
Manufacturing Development

Sourcing

Global Market Trends
Competition
Media
Government Regulations
Producer Capabilities

External Factors Influencing Development Process

Figure-2: Expanded product development model from retailer's perspective (2)

Source: Sandra J. Keiser and Myrna B. Garner (2005), Beyond Design, The Synergy of Apparel Product Development
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**Digital Tools working area**

**Source:** Anders Heden and Jane McAndrew (2006), The Fashion Factory, Creative businessmanship from the inside, portfolio Sweden AB
3. Time Scheduling:
The new product development models gives details description of main activities involved in the process and also details performance in the product development process. Time scheduling calendar put in order the activities, working process, working time indicating when should be start and when should stop for the whole development and production process. Here this time schedule calendar shows Inspiration to collection of garments but the product development process is from inspiration to production for salesman sample (Nov-Jun). During this period designer, merchandiser, sample production manager have a hard work to make the sample accurate and cost saving way. (3)

4. Description of digital tools for Apparel Product development:

4.1 Photoshop and Illustration:
Photoshop (Adobe Photoshop) and Illustration (Adobe Illustrator) software uses is limited in Apparel product development. It is not completely making for Fashion design and Apparel product development. It can be use for any design purpose.

Adobe Photoshop and Illustrator give an entire raised area for apparel design. The designer can makes pattern design in effective and efficient way and also he can look the style of pattern or sketch by using different colors and adjusting with different fabric. The Photoshop have bitmap based facilities for editing and manipulate drawing and photographs, and Illustrator has vector-based facilities for accurate graphic drawings and effects where the designer can work on streamlined shapes and sharp geometrics. In Photoshop program the image can be produce of a medley of individual color pixel but the software have no function of recognize the image shape automatically, the user have to separate out in there. If the motifs are elaborate it lose pixel, in that case fine line appear serrated. In Illustrator, sophisticated and high quality artwork, image or sketch can be produce by using a series of points, lines, curves and shapes and wide range of drawing tools. Once the design is produce it can be scaled as the designer chosen in different size without degradation where Photoshop have some problems for this.

Design can be drawing either on Photoshop or Illustrator or to work between two- either way, because this two software have the toolkits for apparel design. Digital style pen have the facility to draw rapid design on computer which look like hand drawing. It has the freedom of drawing pattern, design, paint, and sketch in the computer like as a working with the traditional materials. Drawing can be performed on to the tablet by the style pen, or trace over on to the sketch, or final draw on the screen. The depth of the lines can be adjusted as required by the pressure sensation stylus pen. (16)
4.2 CAD for Apparel:

CAD is Computer-aided design where any type of design can be performed under the CAD umbrella. In Apparel industry it is used for graphics application, visualizing design, technical specifications and functions. CAD systems have the facility to produce realistic figure of different garments, different pattern pieces for design features, sizing, grading, marker making. Most of apparel companies are using CAD system for their design and production processes. Many of companies are using for pattern making and marker making, much in the arena of textile design and production. But the important thing is toward computer integration from design and product development. (8) & (11)

General benefits of CAD’s are:

- Increased productivity
- Reduced product development time
- Increase creativity to conceptual designs
- High product design capability
- Reduce cost of samples and prototypes
- Reduced turnaround time

Design program of CAD, based on two systems one is raster or bitmapped and another is vector. In vector based, line in the image or motif is very clear and printed smoothly but in raster based system line drawing is not as smooth as vector based. More colors are available in raster-based programs and scanning is easier to accomplish. (4) & (6)

![a]  ![a]

(a)  (b)

Figure-4: (a) created by raster-based program; (b) created by vector-based program. (2)

Types of CAD systems:

CAD is manufactured by different company for apparel design, textile design and production. Some of use little in design and some of use for Data management of merchandising and retailing segment that small design of CAD umbrella. Basically
sketching, pattern making and grading area is called Computer-aided design, However, CAD system involved in the development and manufacturing of apparel and textile. There are some different modules of CAD systems: (5)

4.2.1 Textile Design systems:
Designer used CAD for woven textiles design for designing of men’s, women’s and children wear. Yarn dyed, plain weaves, jacquards or dobbies, printed, flocked fabrics, embroideries are designed in CAD workstations.

Some textile design program of weaving need peg plan, determined the yarn types, size and number of the ends and picks can design on the CAD system which can be connected with the weaving machine. (4)

4.2.2 Knitted fabrics systems:
In knitted fabric design CAD have the facilities to view the fabric structure on the screen with indications of all stitch formation. Different knitted fabric like cut and sewing garments or complete garments for fully fashion pieces can graph on CAD and also connected with the knitting machine for production. In CAD knit program, have the facilities to make design with indicating the amount of yarn need according to color for each top. (5)

4.2.3 Printed fabric systems:
Printed woven and knitted fabric can be design with different motif on CAD. The process begins with either for original, scanned or video-input artwork. The motif can be set up on the fabric in different way like resized, recolor, rotated or multiplied as designer wish. The design of the fabric can be look on the computer, can be indicating the weaves structure/texture and color can be increase and decrease as required and finally possible to print out in a fabric or paper to observation. (4)

4.2.4 Embroidery systems:
Embroidery design and motif can be create on the CAD system or can be use scanned image for the design. The image can be modify by using outline section, colors and assigned. (4)

4.2.5 Illustration/Sketchpad systems:
These graphics systems have a pen or stylus on an electronic pad or large table where designer can sketch the design by free hand that automatic store into the computer. Flat line renderings and technical new design can produce. Designer can make a personal library by scanning flat drawing and then operating them. Various knit and weave design and idea for silhouettes can be store for in the library and used as needed. (4)
4.2.6 Texture Mapping: $2\frac{1}{2}$D - 3D Draping systems:

Visualization of fabric on body can be check out by texture mapping process in this system where fabric can be draped over a form of realistic way.

In $2\frac{1}{2}$D draping module, at first designer start work of wearing garments on an image of a model. Individual section of garments is outlined from seam line to seam line. Then the designated fabric is laid over the area and computer automatically fills the area with new pattern. Finally, it is like the original silhouette worn by the new model in a new fabric.

In 3D draping module, designer can see the garment from any angle with the aid of the 3D glasses. Here designer have more flexibility on his work without moving the model he can adjust the sleeve, cuff etc. 2-D flat pattern can be drape for looking fit and visualization in this system.(4)

![Figure-5: 3D Virtual Garment Modeling (28)](image)

4.2.7 Specification and costing systems:

CAD has the function of producing specification sheet of all style information including a flat sketch, size specifications, trim requirements, and size grade charts. Specification and costing systems are communication links between design and production. All information is recorded on a variety of form for use in the overall process. These systems are also referred to as Product Data Management system (PDM). (5)
4.2.8 Digitizing systems:
Digitizer input original pattern to the computer for use and store. The pattern pieces are placed on the digitizing tablet by follows X and Y axes lines. Computer scans the pattern pieces and store on its memory. (4)

![Digitizer for Apparel](image)

Figure-6: Digitizer for Apparel (27)

4.2.9 Grading systems:
After input pattern, it is graded up and down in size. One particular point is considered as a “growth point”. Every pattern are indicate a grade rules on the growth point that the way to know the computer for moves the pattern in X and Y coordinates in order to increase and decrease the size. (4)

4.2.10 Marker making systems:
In this system all of graded pattern appear on the computer screen in small scale so that the operator can easily see the all of different pattern that he working with and he can easily move to arrange an efficient marker for reduce the fabric waste. It is also possible to produce automatic marker on the computer. In automatic marker, operator has allowed changing something of pattern to make more efficient marker such as alignment and rotation of pattern. (5) & (11)

4.2.11 Plotting Systems:
Plotting is the printing system of marker. Marker making system and plotting system are connected each other and allow the marker to be printed in varying scale. Individual pattern and nested pattern in various scales also can be printed by the plotter. (18)
4.2.12 Cutting Operations:
Usually cutting operation is called Computer-aided Manufacturing (CAM). It is also connected with the marker making systems and calculates the number of layers (plies) that have to be cut. During cutting operation fabric layer are laid on the automatic cutting table. The bottom of the layer have the perforated plastic paper and continue air suction in downward for compaction of the layer and upper side of layer have another plastic cover to protect the air for proper compaction for fabric layer. Cutting system can be performed without plotting the marker. The cutting blade operates at high speed into pattern line and cut the fabric layer most efficient and accurate way.(30)

5. Overview of some CAD companies in the market place:

5.1 Gerber Technology:
Gerber Technology introduces a full package of CAD and CAM for designing, product development and manufacturing of apparel. Gerber technology has the facility to sketch the garments component, designing the pattern, developing the product, maker making, grading, and production. This system allow textile printing and texture design, pattern design with grading and marking, texture simulation, and 3D draping. (7)

Features:

- Scan images
- Create vector-based patterns
- Create complex prints with repeat patterns
- Design knits, weaves, and jacquards
- Make storyboards
Libraries:

- storyboard
- Knit & Woven patterns
- Stitch types

Modules:

- Vision® Fashion studio for sketches, line drawings, colorways, fashion illustrations, draping, and woven and knitting design, Print design storyboard and catalog.
- Accumark Vstitcher™: Pattern design by draping or full-scale drafting, grading, realistic draping of fabric.
- Accumark 8.4: Pattern design, marking making and costing.
- AccuNest 8.4: Sample marker, preproduction marker, regular production marker.
- AccuScan: pattern digitizing having auto detect notches, grain lines, internal lines, drill holes and part parameter.
- Pattern Design 2000: pattern design package, incorporating tools from the Accumark, MicroMark, and Silhouette.
- Product Data Management WebPDM V6 system for tracking information on style, costing, fabrics, sketches, manage data of make use of CAD data.
- Calendaring and task manager: Displays planned, calculated starting and ending date of order, link with other task, automatic update key fields. (17)

5.2 Lectra:

Lectra systems makes product to enable the automation of all operations from design, product development, and manufacturing. It has been involved with the world of fashion; the expertise gained gives Lectra solutions a unique business dimension. In designing, industrialization and cutting, Lectra uses can maintain complete control of costs and processes, companies need all information in real time in order to decide quickly and act correctly. This software tools are for the production of apparel specifications, its developed for apparel brands, retailers, distributors and manufacturers, allows technical specification to be produced and adapted quickly and easily into one, apparel specification tool, leveraging the work created for past collections. Specification can then be sent electronically to external partners through a secure web interface.

Features:

- Scan in images
- Create vector-based patterns
- Create complex repeat prints
- Design knits, weaves, and jacquard
- Direct interface with Stoll Sirix knit systems for digital output to Stoll knitting equipment
- Unwrap three dimensional surfaces into 2D flat patterns

Libraries:
- Garments components
- Pantone colors (Color monkey)
- Various stitch
- storyboard

Modules:
- U4ia Graphic: Painting, image-enhancement, recoloring, building custom Pantone palettes. Contains the core tools for the U4ia system, and is required to run the Premier, Prints, Production, Knits and Wovens modules.
- Kaledo knit and weave: Apply fabrics and textures to photographs and line art, for visualization purposes
- Kaledo print: Create print design from original clipboard and motif.
- Kaledo Knits: 3D stitch simulator, floating palettes, combination of color, texture and structure.
- Kaledo weave: weave design, palettes, designers can adjust fiber, twist, density and other parameters.
- Kaledo style: creates sketches, specifications and presentations.
- PGS: Screen creation/modification, digitizing, pattern construction, verification, grading, pre-production, and pattern data organization and archiving.
- Modaris BasicMod: Core module of the Modaris line. Pattern digitizing, design, and modification
- Modaris Modepro: Screen pattern creation/modification, indivizualization, grading, advanced pattern verification.
- Modaris Expertpro V6R1: multi-size pattern making, grading, automatic modification,
- Modaris 3D fit: pattern making, virtual prototyping, fitting on model, draping, realistic simulation and visualization of garments models in three dimentions.
- Diamino BasicMark: protyioing, costing, Create Markers, material consumption.
- Diamino Markpro: faster generation of marker, piece duplication.
- Diamino Markpro: auto markermaking, tight-packing of nested piece.
- Diamino Fashion Expertpro: making automatic and interactive marker and batch processing, auto butt of small piece. (18)
5.3 Assyst:
This is a complete line of computer-aided design and manufacturing tools for the apparel industry. They have design, drafting, pattern design, 3D visualization, draping on the virtual model, Made-to-measure like person-related sizes tables or automated size grading.(12)

Features:

- Woven design including repeat design
- Digitize the pattern
- Sketch silhouettes
- Draping of fabric on image
- Drafts, notches, pleats, seams, mirroring
- Made-to-measure
- Auto grading of modified pattern

Libraries:

- Standard patterns library

Modules:

- CADassyst: Product development, smart pattern design, digitizing, grading.
- MTM.assyst: create individual body dimension.
- Vidya-3D CAD in realtime: create virtual model for sales presentations, fit, fabric behavior and print check.(19)

5.4 PAD System:
PAD System by Infomax gives the apparel industry a new generation CAD system. PAD has a complete design suite, sketching, pattern design, digitizing, and marker making system.

Features:

- Switch easy from a 2D pattern to a 3D model
- 3D draping simulates gravity and fabric tension
- Change the model’s measurements
- Create vector-based patterns
- Digitizing existing patterns
- Garments simulation includes cut, dart, pleat, shirring, collar, lapel, raglan sleeve, appliqué, pocket, button, screen print and embroidery
- Recalculates seam allowances instantly
- Automatically grades pleats and darts

Libraries:

- Garments components and bodies
- Grading rules
- Textile prints

Modules:

- PAD Elite: Create design, automatic grading, garments specification, made-to-measure and clone all in one, master pattern.
- PAD master Digit: digitizing, and grading with simple design and pattern modification facility.
- Master Marker: high quality marker making, calculating fabric consumption.
- Opticut Automarker: automatic and interactive marker making, marker file for production and fabric consumption calculation.
- Opticut Plus v4.8: quick produce of single size, mixed size, or ratio sized marker on any type of plain or matched fabrics. (20)

5.5 OptiTex:
OptiTex have complete module of 2D and 3D CAD software for apparel and Fashion Company. Microsoft Windows™ software of OptiTex is use for digitizing, pattern design, grading, marking and automatic nesting.

Features:

- Digitize and import/convert pattern
- Create vector patterns
- Dart, pleat, notch, draft, seam allowance, special corners, complicated curves, dimension modifications, and facing tools.
- Made-to-measure software
- Manual or automatic marker-making
Libraries:

- Measurements and accompanying pictures

Modules:

- PDS- Pattern Design System: Drafting new pattern and editing existing pattern.
- Digitize: fast digitizing and monitoring of pattern pieces on the screen.
- 3D digitizer: Digitize 2D pattern and see 3D view of this pattern.
- Grade: complicated pattern can be grade easily by helping of special design built-in dialog box.
- 3D Runway Designer: Designer, pattern maker and retailer can see the modification of pattern in 3D view.
- 3D Runway Creator for PDS: Flat pattern can be visualized at finished product in 3D format.
- 3D Runway Creator for Modulate: software having 65 dummy with adjustable body measurement and designer also can create own dummy model.
- 3D Flattening: 3D dimensional object can transform into 2D dimensional pattern.
- Mark: manual, auto, and interactive marker making facilities.
- Modulate: made-to-measure software having parametric style fits.
- Nest++2: Automatic marker nesting.
- Match++: Optimizes pattern layout for matching striped or plaid fabric on marker pieces. (21)

5.6 TUKATECH:
TUKARECH software have pattern design, grading, marker marking, extend of soft body dress forms, 3D virtual apparel prototyping, PLM and PDM facility for clothing industry.

Features:

- Create vector-based patterns
- Scan in fabric images or import them as bitmap files
- dart, pleat, cut, notch, draft, flip, seam allowance tools kits
- Made-to-measure grading
- Match stripes and plaids when marking
Libraries:

- Pantone textiles
- Measurements and accompanying pictures
- Grading rules

Modules:

- TUKAcad™: pattern making, grading and marker making software with dart manipulation, dart fullness, fabric shrinkage, pattern card creation tools.
- SMARTMARK™: marker making software can create many markers at a time automatically.
- eFITSIMULATOR™: 3D virtual prototyping and sample making software can test the 3D fit of garments and share fit comments across the globe. Sample prototypes fitting can look on computer before sewing and share anyone around the world. (22)

5.7 CAD CAM Solutions:

CAD CAM Solutions offer CAD software package name Fashion CAD for fashion and apparel manufacturing company. The software is capable of vector pattern design, grading, and drafting, marker making very easily and efficiently.

Features:

- Scan or digitize old patterns or create new ones
- Scan patterns from an original source and use the scanned image as an underlay to insert real lines and curves
- Automatically scale and grade to any size
- Set up personalized measurements files
- Create any symbols (logos, buttons, zips, diagrams, etc) and insert them onto pattern piece
- Create any surface design to insert onto the pattern piece- “grain” indication to assist with pattern piece matching
- Manual marking
- Export to any Windows-based plotter
Libraries:

- Standard ladies/men/kids pattern blocks
- Garment components

Modules:

- Pattern Design: Pattern creation/import
- Pattern Grading: Grading
- Pattern Detailing: Insert seams, symbols, text
- Mark layout: Marker making. (23)

5.8 NedGraphics:

Nedgraphics is a line of software products for the textile industry. Modules are available for textile design, knits, and weaves. These modules allow print and texture design, but cannot do patterns, marking or grading.

Features:

- Scan in images
- Sketch silhouette
- Make storyboards
- Create complex repeat prints, as well as knits, weaves, and jacquards
- Automatically puts knits in a graph
- Adjust knit gauge and tension
- Weave card generation for most looms
- Texture simulation and 3D draping
- Prints design on fabric with any textile printer

Libraries:

- Pantone colors
- Pantone textiles
- Mona textiles
- Weave
- Dobby weave
- Jacquard weaves
- Textural threads
Modules:

- Fashion Studio: Sketching, textile print design, storyboards, knits, weaves, jacquards, 3D draping
- Printing Studio: Sketching, textile print design
- Storyboard and Cataloguing: Line selection, design collection, color trend, inspiration, storyboard and catalog page.
- Jacquard and Jacquard Pro: Jacquard fabric design, treated, estimated, simulated with color in realistic 3D way.
- Dobby Pro: Wove, dobby fabrics are design, colored, simulated.
- Vision Raschel: Warp knitting multibar function, Semi-automatic lapping movement during sketching. (24)

6. Research Company (Lectra in Sweden):

6.1 About Lectra:

- The production plant of Lectra is at Bordeaux, France. Lectra’s head office is situated in France.
- It earned €198 million revenues in 2008.
- The 89% of these revenues was generated from outside of France.
- It has 2300 customers in more than 100 countries.
- It has 1500 employees that include 220 engineers who are working with R&D.
- It has 31 subsidiaries with sales and service teams, generating 92% of revenues directly.
- It is working with several renowned brands all over the world. Namely: Corneliani, Ashley Furniture, H&M, BMW, Century Furniture, Marks & Spencer, Mango, Park etc.
- Lectra is earning most of its revenues from Europe. For example: Europe- 60%, Americas- 17%, Asia-Pacific- 17%, other countries- 6%.
- It is working mainly with fashion industries. For instance: Fashion (Apparel, accessories, Footwear)- 60%, Automotive 17%, Furniture 17%, other 6%.
- It has several activities in the business mainly software and CAD/CAM equipment. For instance- Software- 30%, CAD/CAM equipment- 28%, spare parts and consumables-18%, Services (training, consulting, hardware, online services): 24%.
• **Target market:**
  ✓ Fashion: Lectra offers a full life cycle management of a garment production. For instance: Designing, Product development, Production etc.
  ✓ Automotive: Car seats and interiors, airbag.
  ✓ Furniture
  ✓ Including: Aeronautics, marine, personal protection equipment, wind energy systems, filtration systems, etc. (31)

6.2 **Lectra’s working procedure:**

![Lectra Complete Apparel Suite](image)

*Figure-8: Lectra, Complete Apparel Suite (31)*
6.2.1 Textile and product design with Kaledo:

**Kaledo collection:**

It consists all of the design tools needed to make fantastic looking boards and combined with database. Storyboards that contain series of pictures of products are shared with all contributing team members and are protected by user rights. The person who knows the correct password can enter there. It uses powerful search and classification tools to organize images. It has Pantone (Textile, Goe and Paper) or other libraries like NCS, Munsell, ISCC-NBS and Color Solutions International’s Color Wall) can be used to develop color stories and color communication with different factors of the business. It has spectral data support for color matching to ensure color consistency. You can share the color palettes throughout the Kaledo Suite.

**Kaledo print:**

It has powerful tool for printed textiles. Design tools and customizable brushes help to control the number of color used. It contains advanced repeat functions and a clipboard of motif. It helps designers to view the overall effect of a pattern and make changes fast. It has commonly used technical report to share the technical details for production. For instance - Color report.

As you can work on repeat, it will help you to make decision quickly that you plan is going right or wrong. You can change the color ways easily and color can be changed by only drag and drop. It saves all of the above mentioned work in one file.

**Kaledo knit:**

It has unlimited combinations of color, texture and structure to make original knit designs. It helps designers to sketch stitches for both visual and structural effect. Floating palettes make options for color, yarns, stitches and technical information. For instance- count, diameter etc. as technical report. It has a powerful 3D stitch simulator. In addition, it has different extensive options, like cables, jerseys, laces, misses, tucks and arans is available. It contains a special tools error-check before production as well. We can get automatically detail report about technical and color information. We can also make color ways directly.

**Kaledo weave:**

It offers a very easy to understand tools for designer to take control over colors, yarns, weave pattern and surface design. It has dockable floating palettes for all Kaledo modules that help users to customize their design. It has tools to create check, plaids,
stripes and more by copying, mirroring and repeating sequences from warp-to-weft or vice versa. Report of yarn details, weave type, density etc. and color can be prepared by a click of mouse. An unlimited color ways can be created.

**Kaledo Knit and weave:**

It has extensive yarn library so designers can adjust fiber, twist, density and other parameters. It helps to create multicolor effect for both knitted and woven fabric. It also helps to make fancy effect.

**Kaledo style:**

It has a simple desktop solution of toolset for especially fashion. It contains appropriate drawing tools for saving time and short learning curve. It creates sketches, specifications and presentations quickly. It reads all Kaledo textile files as well as Lectra pattern and marker files.

Important notes from Lectra:

- It is possible to use iPhone to take photo of an object. Then we can send it to Kaledo design.
- We can create and modify designs very easily. It has more tools than abode illustrator.

**6.2.2 Pattern Design in Modaris:**

Modaris software is used for the pattern making purposes. The apparel industry is now facing increasing demand for new collection and it is difficult to organize all of the things accurately to keep intact customers loyalty. So it is required to make new productivity, quality, and innovation constraints. Many brands are also extending their product ranges. These developments as well as the increasing competition are forcing apparel industry to be adaptable and responsive to change.

Modaris can do the following tasks-

- It can design more patterns in less time.
- It can reduce the number of physical prototype created.
- Generate initial products run faster and with lower costs.
- It ensures the quality and fit of the products in all sizes. Because you can wear this prototype to a dummy’s body to see the fitness. It means you can go from 3D to 2D.
- It optimizes the development of new collections and styles.
Important performance in model development:

**Modaris Mode:**

It provides the importation of pattern files and the digitization of paper patterns. It also ensures users to do basic modifications, industrialization tasks, high quality grading in all sizes, and pre production preparation.

**Modaris Mode Pro:**

It integrates on screen management of pattern design and modification. It also facilitates industrialization tasks, advanced verification of pattern pieces, high quality grading in all sizes and pre production preparation.

It can exchange information with CAD systems. It has made the Modaris essential tools for networked companies.

**Modaris ExpertPro:**

It enables fashion industries to get more facilities in terms of innovation, product quality and innovation. It helps to create more models and increase development office productivity by up to 50%. It is unique in pattern grading of all-size. It enables users to organize patterns and product ranges and also keep a record of the designs and pattern pieces created.

Figure 9: The creation of a correct prototype by fitting it with a model
**Modaris 3D Fit:**

- It is a virtual prototyping solution that means you can check the fitness of your 2D design to 3D Dummy's body. It offers to cover the entire product development process. It is reducing prototyping costs and time by up to 50%. For instance, earlier we needed to produce 6 prototypes per garment. But it has reduced this number to 1.5 prototypes per garments on average. Lectra is trying to ensure 1 prototype per garment.

![Diagram](image)

**Figure-10: Comparisons of continuous development of Modaris software (31)**

**6.2.3 Marker making with Diamino:**

It saves material and increase productivity during marker making process. It is solution for interactive and automatic marker making on plain and matched fabrics, represents a high-technology tool that allows:

- Easy, fast and effective interactive creation and nesting of markers for prototyping, costing and production.
- Fully automatic nesting based on current technologies.
- It has some functions to increase the marker making performance.

It has following advantages to use:

1. Confirmed experience in marker making
2. Productivity gains
3. Materials gains
4. Powerful, ergonomic and user friendly.
5. Complete integration with Lectra product range
6. A flexible range to suit every need.
There is different version of Diamino:

i. Diamino MarkPack V5
ii. Diamino MarkPro V5
iii. Diamino BasicMark V5
iv. Diamino Expert V5

6.2.4 Line planning, Product data management, workflow:
In the line planning work with Lectra, we can select a collection for the production. We can take help from the previous design/collection. We can make a change in the collection according to our forecast demand. We can select the sizes also and we can also choose the different color options for the collection. We can keep the specification of the collection with their images. (31)

6.2.5 Lectra cutting solution:
There are different brands for cutting of fabric by Lectra brand. For instance:

Vector FX:
It can cut 2.5 cm width fabric. It has versatile and precise working style. It brings the most advanced response to the needs of fashion and apparel companies specialized in short deadlines and small production runs. It is helping with following areas in fashion industry:

- Faster production for enhanced flexibility
- Unrivaled quality
- Constant optimization of process

If the width of the fabric increases, the revolution of the motor also increases. Vector FX has a maximum set up of 6000 r.p.m.

Vector MH:
It can cut 5 cm width fabric. It came directly from Lectra’s MP technology; the vector fashion MH carries on the high performance tradition which has made the Vector range an international success. It is helping with following areas in the fashion industry:

- The fashion markets new quality reference
- Enhanced productivity
- Process reliability ensure, no matter who the operator is
- A complete line dedicated to large-scale production.

It has a set up of maximum 3500 r.p.m
**Vector MH8:**

It can cut compressed knit spreads up to 8 centimeters thick and compressed woven spreads up to 5 centimeters thick. So it is a multiple purposes cutter able to handle a diverse range of orders.

It has a set-up of maximum 3500 r.p.m.

**Vector MX:**

It can cut up to 6 cm width of fabric. It is the most powerful solution on the market. It helps with production flexibility, exceptional output and high-volume cutting capacity.

It has a set-up of maximum 6000 r.p.m.

**Vector MX9:**

It can cut up to 9 cm width of fabric. It especially provides knitwear producers with the market’s most productive cutting system, combining impressive cutting speed and ability to cut thick spreads with exceptional quality.

It has a set-up of maximum 6000 r.p.m. Lectra brand sells this cutter machine more.

**Important notes about cutting:**

- It has XY movement of cutting blades.
- We need to paper under the fabric and plastic over the fabric to stress the fabric.
- Vacuum:
  - It has vacuum cleaner to exhaust the hairs that are produced during cutting.
  - Automatic bristle cleaning. It reduces downtime.
- New cutting heads: It can cut the fabric without interruption. It can cut the fabric when the conveyor belt advances to pass the cut part. This is called Eclipse function.
- There is camera on the machine to detect the skewness of yarn in the fabric.
- It has digital deflection control blades.
- New sharpening devices:
  - It has a three belts system to sharpen the blades.
- Drill:
  - It can drill 1-22mm. For instance, where pocket will be attached, there will be a hole.
- Pilot software:
  - Cut path management.
Reduced gaps.
Multi-level user groups.
We will get whole production data.
Always visible the total production system on the screen.

- Smart maintenance system:
  - 120 signals monitor constantly.
    - Predictive maintenance.

- Data communication:
  - Internet is used to share information’s.

- Spreader and cutting machine is different. But they are integrated.

6.2.6 Optiplan:

- Calculation of order and it can work with different orders at a time.
- It optimizes the spreading and cutting room. Optiplan can integrate the cutting room into one unique process including ERP, plotting, CAD and CAM system for planning, costing and cutting process rapidly.
- It can save material up to 5% or more.
- The software tests different sizes, model and marker combinations according to the material and cutting room parameter, like fabric width, table length, production equipment, labor quantity and costs. (It can work with different sizes, orders at a time).
- We can do marker planning within minutes by Optiplan automatically. It leaves a big time to better marker efficiency.
- We can see the stock of our material for an order and how much materials we need to prepare new. So we can avoid extra production, purchase for an order.
- Data exchange is secure and easier.

6.3 Service:

1. Lectra has 480 consultants, trainers and technicians.

They help the users:

- To optimize the reliability of systems and the quality of production.
- To improve the efficiency of resources and organizations
- To accelerate return on investment and control maintenance budget.

2. Five infrastructures entirely dedicated to customers:

- It has International Advanced Technology & Conference Center in Bordeaux-Cestas, Atlanta, Istanbul, Mexico city, Shanghai.
3. Five international call centers: Bordeaux-cestas, Atlanta, Madrid, Milan, Shanghai:

- 80 Lectra experts capable of taking remote care of software and equipment in real time.
- They receive 50,000 calls per month.

4. Software Evolution:

- You will get access to the latest version of the Lectra software by paying a subscription annually.

5. Lectra helps to the training and preparation of students for careers:

- They have partnership with 660 schools and universities in 30 countries.

6. Lectra has partnership program with several institution:

- Fashion and design schools and universities.
- Engineering schools, especially in the field of textiles and IT.
- Professional associations. (31)

7. Industry experience with Lectra:

Esquire is the one company of Bangladeshi Apparel Company is using Lectra software. They are fashion industry producing knitted garments- mainly tops for children, and women and men’s wear. They were facing the under mentioned problem before using Lectra:

I. The time for developing samples was high and inaccurate costing.
II. As they did the spreading work manually, they faced shrinkage of fabric for this.
III. No consistency of cutting. So time wasted on sewing departments for incorrect shapes and notches.

So they installed following Lectra software at their manufacturing plant in between 2004 and 2008:

- Modaris
- Diamino Fashion
- Optiplan V3
4 Brio100 spreaders
2 Vector automated cutting system.
Esquire has a capacity to cut 70000 pieces per day.

Now we will submit the interview of company’s managing director Ehsanul Habib about Lectra.

- “Lectra CAD solutions and cutting room equipment integrated quickly into our planning and cutting process. Our team was equipped with the solution and operating comfortably very swiftly”.
- “We were really impressed with Modaris, for the development of patterns, and the Vector has been instrumental in helping us to overcome certain challenges by increasing our productivity and reducing cost without compromising the quality”.
- “By developing Lectra’s Modaris solution for pattern making, we have achieved faster product development by creating patterns ‘on screen’ from buyer’s technical specs, without the need for paper patterns, and by modifying existing styles”.
- About Diamino: “Even with different width and size combinations, this system is extremely effective and enables us to make huge fabric savings through greater material consumption efficiency”.
- “The speed of the vector machine is extraordinary, especially with the latest model VectorFashionMX, which leaves practically no cutting gap between pieces”.
- About Eclipse function (It can cut continuously even the conveyor belt advances): “I am always particularly impressed when I see Eclipse feature used”.
- About spreader: “We have been able to direct labor hours elsewhere, and our costs have been drastically reduced. What’s more, tension-free spreaders are really helping to save time and fabric, mainly with longer marker”.
- About service: “The service and support we have received from Lectra have been excellent”. (31)

In telephone interview, Mr. Shahidullah, sample and technical manager of Esquire told that, they don’t make sample pattern on CAD software during the time of sample development. Pattern master are responsible to produce sample pattern by manually,
then cut fabric according to sample pattern. After sewing they delivered the proto
sample to buyer for approval. According to buyer comments they make fit sample by
original fabric and including all of accessories and then send it again to buyer for
approval. If the sample is perfect that means after approval they go to produce
salesman sample according to buyer requirement otherwise they arrange for final
product. When order is confirm they input sample pattern into modaris software by
digitizer and correct it with accurate drawing, seam allowance and store the pattern into
their collection. Then they use diamino for marker making, for automatic marker it takes
only few minute and they then try to rearrange some pattern to get better
performance. By using Diamino they get 85%-90% marker efficiency. Before using
lectra, many fabrics are dapping into store but now they can easily check the stock
condition and reuse the leftover fabric. Before using Lectra they spend 1-2 hrs for
marker making but sometimes the drawing line was not perfect, so they had needed to
erase the line and drawing again. Now markers are making within few minutes and store
in the computer and can print how much they need. Auto cutting also gives the accurate
garments pieces within very short time. (36)
1. Enterprise Resource Planning (ERP):
Now a day ERP is familiar of business organization in all over the world. It is helping to manage the different departments (Product, order, purchase, production, stock, economy) of a business organization. In the ERP system, there will be a common/central database. This database will collect, process the information from the different parts of a company and then it will distribute information within a company as well. The information is updated continuously and is collected in one system and it is easy to access. It is not mandatory to have PDM and ERP system together in an organization. Some companies are doing the work of PDM software with their official technique (also ERP). Then they are sending it to the ERP software. PDM software works until a collection is finalized in common. After that, data will be processed in the ERP system. In the PDM software you can save the picture of a collection as well as data but in ERP system you can only deal with data.

Figure-11: Schematic presentation of an ERP system
1.1 Research Company (DTS Solutions AB):

1.1.1 About DTS Solutions AB:

✓ It is helping business grow with IT support for efficient business flow.
✓ It has started from 1997.
✓ It consists of 33 employees. They are helping 250 businesses and company has a turnover of 42 million
✓ Among all IT firms in western Sweden, it is standing on second place.
✓ It is helping companies with IT solutions in the following areas:
  ● Effective operational flows of article arrangements, orders, purchases, logistics and economics.
  ● They are helping companies to maintain e-commerce, store checkout, CRM, WMS, decision support, TA etc.
  ● It is providing secure and stable IT operations and is effective.
  ● It is helping client by maintenance and development.
  ● A dependable infrastructure.
  ● In Sweden Micro craft AB is working as regional Garp Center.
  ● Garp is an ERP software manufacturer.
  ● Examples of companies are working with Garp system:
    - Cult Design, Eton, Nudie Jeans, Galvin Green, Gents & Femmes Apparel, Cross, Acne Jeans etc. (25) &(33)
1.1.2 PISA PDM system:

PDM, Product Data Management is very essential for organization but some company is running without PDM system. But they may have ERP software. It is not obligatory to have PDM and ERP system together. In Sweden DTS solutions AB is supplying PISA PDM system to their clients and it has the following workflow: We will have a common data base PISA. There-

- We can save the information about supplier.
- We can upload the materials data.
- We can save the design tools. For instance- Components, color palette materials, fabric color settings.
- We can upload the size charts/grading of components.
- We can make description of sewing.
We can save photo of the marker and thus we can forecast the actual fabric required.
We can save the calculations of costs, total balance etc.
We can transfer the all of the above mentioned items, materials and structures to the ERP system from our common database PISA. It is mentionable that there will be a close communication interchange among material, suppliers, Garp throughout the flow chart of the PISA PDM system. So material, supplier’s data will be always uploaded to the ERP system and PISA simultaneously.

1.1.3 Flow description of Garp (ERP) System:

1. Product: At first we need to forecast the consumption rate of a material by primary calculation. Then we have to make a decision for the price set up of the material.
2. Order: In this case, organization will get to know about the demand of the material by POS data, EDI, Internet web shop. When something will be sold in the shop, it will be updated automatically in the total organization by ERP system. Company will have a salesman in the business area to collect order from shops. Shop will get customer demand then he will order it to salesman. Then salesman will give this order to the manufacturing plant. This is called B2S business. If shop gives the order directly to the manufacturing plant by internet web shop to the ERP system of the manufacturing plant, it is called B2B system. If the customer orders directly by e-mail, it is called B2C business system. Companies can maintain the CRM (customer relationship management) by this. You can see your current stock of a material by Garp. So if a material stock is finished, you will go to the following steps:
   - Product requirements, customer order, forecast order items.
   - Manufacturing order then
   - Purchase of raw materials

   But if the supplier has the backup materials, then he will not go to the manufacturing, purchase steps. He will get the order and supply it for the customer again. In this way we can Maintain SRM (Supplier Relationship Management).
3. Purchase: We have to make a material planning by ERP system and it is easy for us as we can know shortage of material easily by Garp system. We can make an Automatic/Manual purchase order for material. Then transport it to the stock. We will transfer the material for production then.
4. Production: We will set up a time plan for the production. After production it will move to the stock.
5. Stock/Distribution: The stock will transfer to the customer for selling.
6. Economy: We will have the information about our article. We will have all of the documents of transaction with customer, supplier, stock, production side by Garp. It will save to the accounting system. On the other hand, we will have the time of working of individual person of a worker in a company. So we can set the wage payment by this and it will also save by Garp system. Then it will pass to the corporate accounting system. We can keep the VAT information by the Garp software as well

➢ In this way we can maintain the SCM (Supply Chain Management). (34)

Figure-13: Schematic presentation of a working procedure of a GARP ERP system (34)
2. Product Data Management (PDM):
Connect multiple and different system in distributed environments is most priorities today’s business, and product data Management(PDM) become the 1st most important and fastest growing segment for computer integrated company. Communicating product data with the marketing data and entire business system to revise time scheduling calendars for line development and process planning and to calculate volume, stock materials, production cost and margins is important to meet the deadlines, quality and profit for an organization. (8)

According to Ed Millar, “Product data management (PDM) system deals product the data and organizes work flow processes. By the use of PDM, related data like Product, order, purchase, Manufacture, Economy, Logistics, stock/distribution information in an organization are integrated with one other; PDM manages product data throughout the organization, ensuring the right information is available to the right person at the right time and in the right form. By this way, improves communications within entire organization. (9)
PDM appears can help according to John Stark.

- Reduce data related costs by at least 10%
- Reduce product development cycle by at least 20%
- Reduce data handling time by least 30%
- Reduce the number of data change by at least 40%. (14)

2.1 Nine Basic Components in PDM systems:

1. Information warehouse- Product information store unit
2. Information management unit- it control and manage all of data information in the warehouse.
3. Infrastructure- basic infrastructure required for networked computer environment.
4. Interface module- User and programs like CAD and ERP data to access the system through the interface module.
5. Information structure definition module- necessary structures of information for the PDM system is defined in this module.
6. Workflow structure definition module- defines the structure of workflow.
7. Information Structure Management Module- exact structure of all information is maintain in this module.
8. Workflow control module- Control and organize the data.
9. System administration module- proper system for all of configuration. (15)

PDM systems help the organization to manage in product development, distribution and use of product data. Any apparel and fashion companies are working various types of data like text data (measurement, time table, production panning, operation data, project data), numeric data (equation, calculation, digit data), design data (Sketch, pattern, marker, drawing), and voice data. Different department in an organization have the responsibility to do their task, PDM defined this person to complete his task in a regular manner, and then data can be work on other person in due time. No need to input data again, second person can get latest data without any working notice. So PDM helps to create, store and re-use product information in an effective way. Every product information are input in the system and its links with different department for example design sketch, product specification and measurement lists are input in the system and product manager, production manager, Designer, planning manager can work with the same latest data.(29)
There are different PDM systems, using different small, medium and large size company. Now a day traditional PDM system are replacing by Web-based PDM in some cases because it is very easy for an organization to use data everywhere in the world. Placing data in a common centralized data base, and it can be view in everywhere in the apparel supply chain of organization. So it is great saving of time and work for the designer, product developers and merchandisers to find the right information and files. Gerber Technology continue developing WebPDM, they continue upgrade their version for greater benefit for their customer. They released of WebPDM version 6.4. A key component of WebPDM’s update with Gerber Accumark, CAD software can work for most innovative pattern design, grading and marking. Bill Brewster, Vice president of global marketing and production manager of Gerber Technology “said that, tight integration between CAD and PDM/PLM software is such an important factor in facilitating Product Lifecycle Management.”(10)

2.2 Benefits of PDM:

PDM gives the following benefits for a company:

**Time-to-Market:** Data can get instantly when you want, no need to wait for paper document or time waste. Collaboration features also speed up and speed up the entire process.
Improved Productivity: Studied have shown that people spend 25%-35% of their time for searching retrieving, handling, filing and storing document. PDM can avoid reinventing the wheel and as a result, reduce the related development effort. 

Improved Control: Authorized person can access and get the latest data for working.

3. Product Life Cycle Management (PLM):

Now all of CAD companies include PLM in their software system because a PLM system allows to go back to design library at any time to repossess and reuse the data, designer can change the design in different way, Design can easily converted into specification sheet and stores these design in an organize way in a central servers where authorize person like can use data whenever he want rather than use individual memory. Designer PLM gives the best collaboration facility within internal and external global supply chain partners.

3.1 Product development process with PLM:

Following system of PLM support to perform Product development:

- **Storyboarding**: It support selection of colors, fabrics, textures and style from the central data information unit and also store after work.
- **Color Management**: From central color library of PLM, designers can development seasonal palettes, and add color to storyboards. Color information of raw materials and product ensure accurate color use for finish product.
- **Line Planning**: Integrate design, merchandising and commercialization functions for product design.
- **CAD Based Design**: Standard tools for sketching, pattern designing.
- **Fabric and trim management**: Central tracking of lab dip approvals and development data for fabric and trim.
- **Product data management**: Design, specifications sheet, bill of materials, construction, sample management and costing data can share within the entire supply chain.
- **Costing**: Automatic cost-estimation facilities to the designer to see the effect of particular components and sewing details on overall garments cost.
- **Sourcing and Supplier management**: Monitor supplier capacity and performance to ensure on time product.
- **Workflow**: Every task determines by collaboration with different department through time and action calendars and workflow can co-ordinate with all parties’ activity to launch the product within a shorter time-to-market.
- **Business Intelligence and reporting**: People can work and learn from the storage information for giving good performance to the business. Operational, planning, and business management report of PLM helps people to work effectively. (13)
4. Use of software within the supply chain:

Product development with CAD includes: Sketches, style concepts, technical drawings, manufacturing instructions, patterns, grading of patterns and lay plans etc. These reports about product are stored in the PDM system. We can update documents/reports any time. It helps to make a production plan. For instance, manufacturers can calculate the time and cost of production by accessing documents such as- style specification, material lists, manufacturing instructions and quality specifications. When a collection is finalized for production then the PDM system transfers its data to the ERP system. But if we use PLM system instead of PDM system, we can go one step ahead before living for the ERP system. For instance, Lectra Fashion PLM is working from product development to cutting (production). ERP system deals with product, order, purchase, production, stock/distribution, economy (data). (30)

Figure-16: Use of software within the supply chain of an apparel industry. (30)
Lectra Fashion PLM is working up to production. But there production department is up to cutting department. They have different divisions, namely- Kaledo, Modaris, Diamino etc. and they are using them for product design, pattern making and marker making respectively. Kaledo consist of: Kaledo collection, Kaledo print, Kaledo knit, Kaledo weave, Kaledo knit & weave, Kaledo style for specific reasons. Modaris is upgrading day by day: Modaris Mode, Modaris ModePro, Modaris ExpertPro, and Modaris 3D Fit. The newly invented Optiplan can help with order calculation and it can deal with different orders at a time. It is helping with material purchase planning/stock, automatic marker making, interesting size combinations, correct spreading, prolific cutting, safe data exchange etc. It is doing some portions of ERP software’s work. They have Vector cutting machine that can cut fabric automatically, rapidly and continuously. Its special cutting head has XY movement and eclipse function (which helps to cut the fabric during movement of conveyor belt for passing the cut part). It has smart maintenance system, pilot software, new sharpening device also. The Esquire knitwear company of Bangladesh is using the Lectra software and they are getting following advantages—shorter development time of sample, good forecasting of cost, no shrinkage due to spreading including faster and consistent cutting, better marker efficiency etc. We got one thing crucial that in apparel sector buyers are from developed countries and they are producing their products from least developed countries. They are sending the design of product with specification from their own design house to the manufacturing countries. Then they are working with it. As a result, we have seen in Esquire industry of Bangladesh that they are using the Lectra Fashion PLMs every divisions except Kaledo. In addition, it is expensive to establish software like- Lectra, ERP, PDM etc. in an organization. So it is appropriate for developed countries where labour costs are high as it reduced the necessity of manpower. But it should not be good for least developed countries as they have very cheap manpower. At last, it is not easy to use this software and it requires skill manpower.

PDM and ERP system works on different parts of an organization but they can assist to manage the whole business chain together. They are mainly integrating the whole business chain with electronic communication. PDM works until a collection is finalized for production (Product development). From the PDM system data’s are transferred to ERP system to manage the rest of the process. By ERP system, the organization can control internet web shop (B2B, B2C, B2S), POS data. So they have a very good idea
about customer demand and in this way can make a good CRM by that. They can get the information about stock of materials to the supplier. So they can make a good SRM that results for a good CRM also. If the articles are not available, supplier can update the shortage of products and duty can be shifted to the manufacturing department instantly to produce as they are connected. So they can establish a healthy MRM (Manufacturers relationship management). If the manufacturers do not have the sufficient raw material to produce, they can purchase it easily by integrated communication. They have detail information of transaction about stock, supplier, customer, production. On the other hand, they have the data of labors working hours, VAT (Value Added Tax). So they can establish a fine relationship between company's income and expenditure. It is mentionable that PLM is working one step more than PDM (PDM is up to collection finalization of an order, PLM is up to production, for instance- Lectra Fashion PLM is working from product development to cutting).
Conclusion

From this research work, we tried to find answers of few questions. We worked to find which digital tools are using the apparel industry for the product development and organizational management. We got several brand tools and among them we have selected- PISA PDM, GARP ERP (CRM, MRM, and SRM etc.), and Lectra Fashion PLM. Lectra Fashion PLM is working on Design (Kaledo), pattern making (Modaris), marker making (Diamino), spreading, cutting (Vector). They have introduced Optiplan which can help on several purposes- order calculation, automatic marker making within a short time, safe data exchange and costing etcetera. Esquire apparel industry in Bangladesh is using Lectra (except Kaledo, as they get design from buyer). They are getting advantages like- no shrinkage due to spreading, consistent cutting, 85-90% marker efficiency and so on. Lectra’s every divisions of software’s have strong electronic communication and they are integrated. Including, they are upgrading their software continuously. Companies can get the upgrade version by paying an annual fee. But they are not working with sewing side. They have no plan to enter there as well. There is other software such as- PDM, PLM, and ERP. PDM and ERP jointly can manage a full business chain. PDM will work up to a collection finalization for production and rest will do ERP. By using ERP, we can manage CRM, SRM, and MRM and so on very easily. The Garp ERP system is used most organizations in Sweden. From our work in DTS solution AB, Lectra Sweden, we came to know that it is quite expensive to purchase our mentioned software for a company. In addition, it demands skill manpower/employee. So it is used mainly in developing countries where labor cost is high. It is mentionable that if you work with this software, you need less labor. So we have a suggestion to the Lectra Sweden AB, DTS solutions AB that they should try to minimize their selling price of their items as early as possible and make it affordable to all. There software should be very easy to use and arrange more service, training to the people who will use it in future. Furthermore, we have a special suggestion to Lectra Fashion PLM that they should work to include ERP system in their software. So any organization can maintain the whole business chain under one umbrella of a software company (for example, figure-16). We worked our best to find the answers of our proposed research questions from Lectra Sweden AB, DTS solution AB. They helped us a lot about this and promised to help us in the future. If we get chance to work on this project on future, we are hopeful to gather more interesting information’s.
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