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Efficacy of Pattern Making Software in Product Development

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Abstract The conception of a garment comprised of mutually dependent nevertheless contrasting processes. The appearance and fit of a garment is highly dependent on each process. Patternmaking is one of most crucial steps in garment manufacturing and plays an important role in deciding the future of the order. Pattern making has now reached to the advanced level and digital platform is playing an important role in this area. Although software are available but pattern making is being done manually in maximum cases. The use of computer involves big investment but at the same time advantage is that it saves time, gives more opportunity, options, and accuracy. Though there is affinity to accept high level technology but still there is confrontation either due to high investment or by operators/masters due to fear of losing their jobs. This study aims to compare the time for pattern making, sample making, grading and marker making for manual and CAD methods. It focuses on the virtual simulation of the sample in terms of saving time. The data has been collected through experiments.3 different garment models have been selected based on simplicity to complexity and stages of traditional manual method and CAD method were established. Patterns were made by experts on both manual and CAD methods and time readings were collected at different specified stages. This data is compared. The difference stemming from the comparison of the manual method with CAD has been found to be in favor of CAD.

Keywords *Product Development, Pattern Making, Costing, CAD Systems, Marker Making, Virtual Prototyping*

1. Introduction: Pattern Making, an Important Edge of Product Development

Garment industry contributes a high percentage in the country's total revenue but still facing many challenges (Varshneya and Paras, 2009). These days, customers have become more demanding and always looking for new styles and designs in the stores more frequently, which affects the turnaround time from concept to consumer. This is putting enormous pressure on the manufactures to do the same process in lesser lead time. Lead time has been shrinking a lot (Kumar, 2012). With the

increasing competition and decentralized manufacturing garment industries are looking forward to the different software solutions to systematize the processes and to overcome their challenges (Varshneya and Paras, 2009).

The garment manufacturing comprises of numerous stages such as product development, spreading, cutting, sewing, finishing and packing. Product development is the most critical of the garment manufacturing as if the garment is made correctly in terms of fit, style, colour and design at this stage, half the battle is win. We can expect less number of errors at production stages. Pattern making is the most critical of all the product development processes. A nice perfect fit contributes to the success of any style (http://www.mexcostura.mx). Pattern making process has evolved as skilled technical art through the years which requires a proper thoughtfulness (Anderson, 2005). Consequently fit approval takes the major time of the lead-time. This industry is completely dependent on the skilled pattern master (Varshneya and Paras, 2009).

Buyers are placed at distant places and in most of the cases approval needs to be done by the buyer so sending the samples to the buyer takes long time and then getting comments will take time and our first concern is time. Secondly, if we receive any recommendation on that particular sample, pattern need to be corrected so doing the pattern all over again, making the revised sample and sending again for buyer's approval will add to the time. Moreover it involves cost as well. After every variation or correction pattern master has to make the pattern again and again to see the result which eventually adds to the time of final garment making. In today's fast changing fashion world, quick response is the main key factor to success. An agile automation system will permit industries to take action towards the changing market conditions. By accepting technology, industrialists can create examples for their competitors by cost cutting and increasing profits (Varukolu, 2007). Through software such as CAD, the pattern can be made easily and correction can be done as many times as required, E-fit or virtual prototyping can be used to drape garment on model on the screen and animation helps to see fit and drape (Ondogan and Erdogan, 2006). The CAD system or Smart mark (automatic marker making) is much more productive compared to the manual method. They systems will provide great advantages in responding quickly to multi-piece, multi-size orders in small quantities (http//tukatech.com). Moreover, these will provide substantial savings as far as fabric costs are concerned.

Therefore, the objective of this study is to measure the amount of time saved using Pattern Making software at different stages of product development as compared to manual method.

1.1. Challenges for the Garment Industry

Some of the challenges that garment industry is facing are concisely discussed below:

1.1.1. **Customer Demand for Innovativeness in Lesser Time**

The market is completely customer centric. The customers are looking more and more variety in lesser time to see frequent changes and newness in the stores. Fashion cycle has become shorter. In order to be competitive manufacturers have to look for the ways to deliver new innovative product more frequently (Kumar, Nov2012).

1.1.2. **Growing Customer Base**

In order to keep up with the growing customer base and customer needs and to remain competitive, it became essential for companies to upgrade their systems (www.lectra.com).

1.1.3. **Increased Pressure to Reduce New Product Development Costs**

With the pressure of frequent new innovative product there will be increase in number of samples at product development stage but also there is a demand to keep the product development cost low because ultimately it is going to add to the production cost so it is a big challenge for the manufactures (Kumar, Nov2012).

1.1.4**. Decrease Time for Product Development and Shorten Time-to-Market**

Product development constitutes to the major time of the complete lead time. There is a need to reduce the product development time so that time from concept to consumer can be reduced (http://www.mexcostura.mx).

1.1.5. **Shrinking Lead Time for Volumes**

Along with the lesser product development time customers want to see the product in store in lesser time. Therefore bulk order lead time must be reduced.

1.1.6. **Cost Management**

The market is very price competitive. To be a head of the competition, one of the biggest challenges before manufactures to control cost and generate profit (Kumar, Nov2012).

1.2. Product Development

The creation of products with new or different characteristics that offer new or additional benefits to the customer.

“Product development may involve modification of an existing product or its presentation, or formulation of an entirely new product that satisfies a newly defined customer wantor market niche”. (http://www.businessdictionary.com).

1.3. Pattern Making and Product Sampling

Pattern making consist of the design and creation of templates from which clothing and craft items can be sewn. Patterns are made of pieces of paper shapes that are traced onto the fabric need to be cut, with each pattern piece serving as a form for an individual part of the garment or item to be sewn (http://www.wisegeek.com). As soon as the technical packages are received, the first step is to create patterns. Numbers of attempts are made in making the correct pattern to achieve the right fit that gets approved at the end(Kumar, 2012).Generally the pattern masters create pattern as per buyer’s specifications and the first fit sample is made. If fit sample gets approved in first go, it’s great, but it very rare (Verma et al., 2009).If not the whole process need to be redone and sample has to be rectified as per buyer’s comments. These revised samples need to be sent to the buyer till it get approved. The process flow of fit sample approval can be seen the Figure 1.

Process Flow in the Approval of Fit Sample

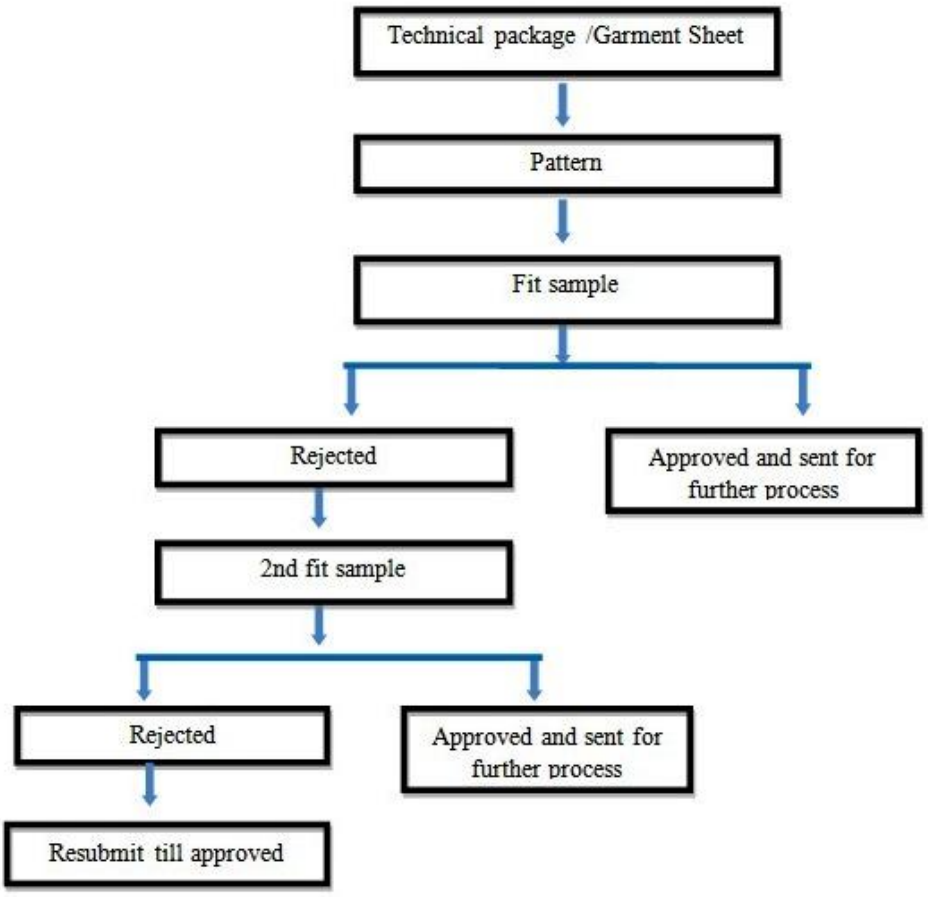

Figure 1: *Steps Involved in Approval of a Fit Sample*

1.4. Digital Pattern Making

Using the extensive CAD tools, to create a standard set of patterns for each of your own garment designs. (www.fashioncad.net).

Either - by using the blocks provided and modifying them on-screen or - photographing an existing pattern with a good digital camera and on-screen digitizing pattern lines/curves over the top of the image pixel or creating free-form patterns on screen to required lengths. Digital Pattern and Marker Making on CAD, digitizing paper patterns and pattern prints from plotter can be seen in Figure 2.

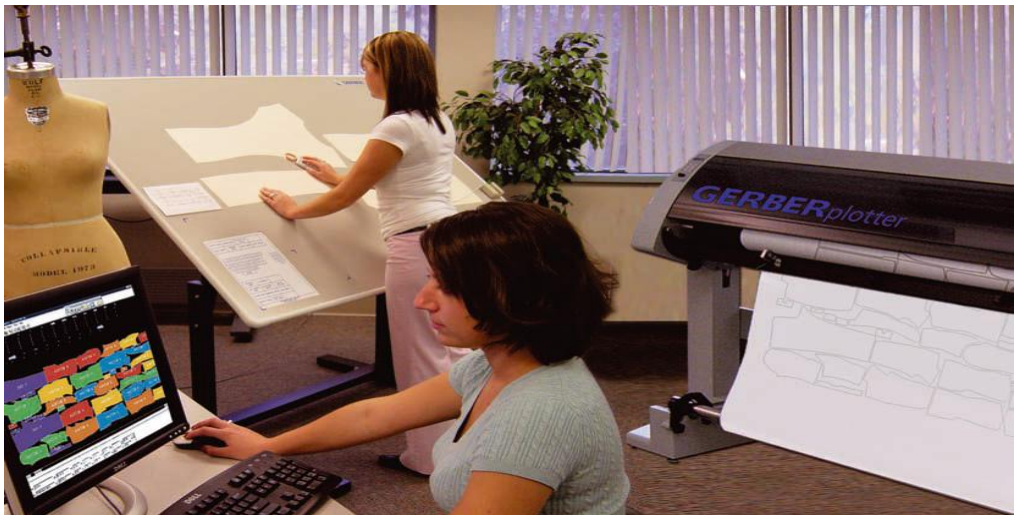

Figure 2: *Digital Pattern and Marker Making CAD; Pattern Digitization and Pattern Prints Form Plotter*
(**Source:** Aldrich, 2009)

1.5. Virtual Prototyping

Virtual proto typing is using virtual reality to create product prototypes and test their properties. It is computer-based prototyping without recourse to a physical part or object (Kumar, 2012).

Virtual prototyping is a technique in the process of product development. It contains Computer-Aided Design (CAD) and Computer-Aided Engineering(CAE) software to validate a design before committing to making a physical prototype. This is done by creating (usually 3D) computer generated geometrical shapes (parts) and either combining them into an "assembly" and testing different automated motions, fit and function or just aesthetic charm. The assembly or different parts could be opened in CAE software to simulate the behaviour of the product in the real world". (http://en.wikipedia.org/wiki/Virtual_prototyping).3D virtual prototypes from Tukatech can be seen in Figure 3.

Figure 3: *3Dimensional Virtual Prototypes (http://www.tukatech.com)*

1.6. What is 3D?

3D may refer to: 3 dimensional spaces; 3D means three-dimensional, i.e. anything that has height, width and depth (length); 3D is images having three dimensional form or appearance.

2. Review of Literature

It comprises of developments and evolution in the field of pattern making:-

2.1. Product Development and Garment Construction

Garment is the main product of textile and clothing sector. Today garment is not only the basic necessity but it stands for the status. People want stylish garments to match their status. Also garment industry is very much dependent on the season. It gets affected by the change in seasons, changes in customer's lifestyle and requirements (Varshneya and Paras, 2009). "Due to seasonal variations, the product development time is very tight and strict to the seasonal Fashion calendar. Textile and apparel product development is normally planned one year in advance*"* (Ariyatum, 2004). Frequent planning and product development is required to overcome the shorter lead times. Flexible manufacturing technology enables to respond quickly any variation in style (Ariyatum, 2004).

"Today's fashion cycles mean – more styles- more variation- less volume- thus resulting in need for quick response" (NIFT, New Delhi).

2.2. Progression of Pattern Making

Patternmaking is one of the earliest steps in the development of a garment. This craft has grown into a skilled technical process over the centuries. With the extensive research and standardized sizing; patternmaking took revolutionary step from customization to standardization. Pattern Making can be 2D or3D process (Anderson, 2005).

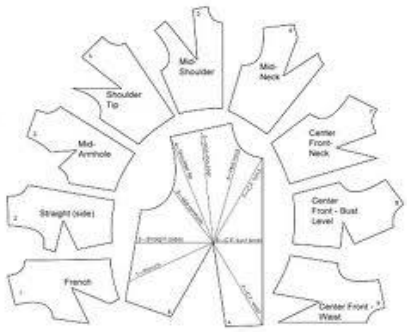

Figure 4:*2D Pattern making*

Figure 5: *3D Pattern making (Draping)*

(**Source:** http://vipdictionary.com/draping)

2.3. Computers in Pattern Making

Computers are being used by apparel companies since the early 1980's. Pattern design systems (PDS) have become invaluable tools to the patternmaker, supporting in much of the repetitive tasks related with patternmaking. Capable of storing an incredible amount of data that can be quickly retrieved, squeezed and re-filed (Anderson, 2005).

2.4. Advancement of Pattern Making

With the contribution of CAD, advancement in Pattern Making occurred in many areas which are discussed below:

i. **Reducing Gap between Designer and Pattern Maker**

Product development involves close relation between buyer/designer, merchandiser and pattern maker and fabric person. For the right product development it is important that there should be good communication between different departments but, in most of the cases designers are not in direct contact with the merchandiser or pattern maker so merchandiser sends samples to designers or buyers for various approvals. This consumes most part of the lead time. This initiates the need of automation or advancement in product development so that lead time can be reduced. If software (CAD) is used for making patterns, makers can save time as so many repetitive tasks can be reduced. Pattern can directly send by email instead of courier and time can be saved. Approval can be done in hours instead of days or weeks. Also style can be simulated and virtual drape and fit of the garment can be seen and send to the designer or buyer for approval digitally. Again time can be saved in physically making of sample and sending it through courier.

ii. **Costing**

The major component in the costing is fabric consumption. Earlier merchandiser used to give design sheets to the pattern masters and get the patterns made and grading done. This process normally used to take 3-4 day then also after taking so much time companies had to quote the price approximately. CAD has made this process tremendously easy and faster as master can made the pattern in lesser time or he can also retrieve the similar pattern see the grading and marker of that style and quote the prize.

iii. **Optimization Marker Making**

Before the involvement of the CAD in to Pattern Making and Marker Making, masters used to take hours to do the marker planning. It was a chaotic job and was unable to use the fabric optimally. With the involvement of software, marker planning has become a few minutes job. Now as the time reduced so much, masters can work on many markers and get the best efficiency. Furthermore, factories receive fabric in many widths. Fabric can be sorted out and different markers can be made for different group of fabric lots and can increase their saving on fabrics, utilize the time add profits.

2.5. 3D in Apparel Design: An Explosion in the Industry

3D technology had a very slow start in the apparel industry but continuous pressure to produce more collections under shorter lead times has directed for the use of 3D technology. Cost reduction, enriched creativity, and better communication are only the beginning of what 3D technology has to offer to this complex and dynamic market. Initially 3D technology was only capable to visualize styles and not been able to check the fit of a garment but now 3D technology is updated with the tools that respond to the specific fit challenges encountered by fashion companies worldwide. Advancements in computer speed and performance has made digital communication much more useful (www.lectra.com).Clothing simulation and animation are of great importance in computer animation. Clothing simulations have been improved so much that they can produce realistic cloth motion in real-time, they would find uses in many aspects of design and manufacturing. The ability to clothe

animated characters in designer apparel would add another aspect of abundance to 3D animation. Considering the high degree of detail in current character animations, it is easy to see that techniques that give realistic, stable, fast clothing animation will be in ever-increasing demand (Choi and Ko, 2005).

Figure 6: *3D in Pattern Making*
(**Source**: www. Lectra.com)

One of the major challenges for any fashion company is ensuring that the fit of a garment is as close as possible to its target customer. The process of fit approval is a lengthy and expensive process which may require several iterations before the garment is fit-approved or eventually rejected from the line. Involvement of 3D technology at this stage can help reduce cost and time-to-market by digitally doing the patterns and virtual making of sample which will again contribute to reducing the number of samples required and their associated costs.

Virtual prototyping permits firms to gauge and enhance product performance virtually. With simulation associated to requirements, firms can ensure that their end product meets defined requirements. Digital support is a key enabler for reducing physical prototypes and increasing the iterative use of virtual design alternatives (SEIMEN, 2010). 3D can reduce the proto typing cost drastically as companies can now decide whether or not to take a product to market using 3D technology without an actual prototype, or fewer prototypes, the cost of rejecting a style (in terms of material, labour, and time) is significantly lowered (www.lectra.com). Today, the three-dimensional body scanner is a promising new technology that will contribute revolutionary changes to the commencement, design process, manufacture and distribution of apparel. Body scanning provides multi-dimensional data that can provide new insights into sizing and grading systems. The 3D PDS system, developed for 3D pattern designing, originates from the shape of the body. It is possible to apply not only to a standard mannequin exist in the system, but also models selected or generated by the user. Thus, more suitable body measurements can be applied for made-to-measure garments.

In 3D it is possible to see fabric attributes such as the bending of the fabric because of its weight, the rubbing of the cloth against the body, and stretch in both x and y directions. Shading, transparency, and fineness of fabrics, and the capability to import trims into the software, also add to the practicality of garment simulation. Also its ability to see the pressure points or stress points where the fabric might be too tight against the body allows a much more realistic drape during the rendering of the finished garment. This facilitates and accelerates the decision-making process, even before a garment sample is manufactured or a strike-off or handloom produced (www.lectra.com).

A difficulty that stands up in garment manufacture is that patterns designed for one character cannot easily be adjusted to differently sized characters. One approach to easing this problem would be to implement the pattern grading methods.

Grading procedure heavily depends on the specific design of a garment and very much time consuming. As we all know garment industry works on many sizes not one but fit approval done for only one size (main size) only due to shortage of time. Virtual fit checking has made it possible and it is boon to the quality conscious companies. Checking patterns in all sizes is critical, as it has a direct bearing on the fit and quality of the garment. 3D technology offers a practical, easily accessible solution to the historically arduous task of full-size range fit checking.

One more, completely different method to pattern generation would be to directly adjust the 3D design of the garment and project the final result into 2D space to get the patterns. Such an approach should be more spontaneous, assumed that the ultimate aim is to design 3D apparel. The development of an automatic, spontaneous pattern generation method is possible through the pattern making software (Choi and Ko, 2005).

Also 3D gives the opportunity to produce close to the season of having to plan far in advance allows companies to avoid getting into poor designs or create ill-fitting garments. In the same way, 3D applications can be very useful in creating virtual collections lines or ranges of garments for design meetings and discussion over the Internet by design teams across the globe. 3D fit technology combined with Computer-Aided Design (CAD) pattern-making may also significantly reduce a company's carbon footprint. Virtual collections can be seen in Figure 7.

Development costs are rising, shipping charges are going up, and errors are something that most companies cannot afford. Products have to reach to market quicker, and they must be products that will sell. With all these points in mind, regular use of 3D technology in the clothing market is a vital competitive advantage for retailers, brands, and manufacturers alike.

Figure 7: *Images Showing Virtual Collections*
(**Source:** 3D Virtual Prototyping at AMFI)

2.6. Clothing Simulation with Tukatech

Tukatech provides technological solutions to the garment and apparel industry. Tuka tech advanced computer applications claim to give designers, manufacturers and distributors the tool needed to streamline operations, increase productivity and increase profits. Tuka tech offers award winning 2D and 3D pattern making, design and manufacturing software designed specifically for garment producers.

Virtual Prototyping

The process of apparel product development, as explained by Tuka tech is given below.

Step1: Get style from buyer
Step2: Get model specification
Step3: Arrange virtual model
Step4: Analyze fabric performance
Step5: Developing the pattern with CAD
Step6: Creating virtual garment
Step7: 3D virtual samples
Step8: Analyzing the fit on virtual model
Step9: Making alterations
Step10: Animations (Verma et al., Dec 2009)

3. Material Required for the Study

Material for this study comprises of garment styles, specification sheet, grade chart, pattern papers, fabric, CAD System-TUKA DESIGN, TUKA MARK and E-FIT.

3.1. Garment Styles

Three different garments were chosen top, bottom and dress. Design, specification and measurements sheet was taken from the buyers list. The garments styles were selected taken in to consideration the fact the area of working of a buyer. Starting from the simple style of bottom to the complex styles of dress and increasing number of pieces in the styles.
Garment details-Garment was divided into number of pattern pieces. Details are given below in Table 1.

Table 1: *Garment Details*

Sr. No.	Style	Pattern Piece Name	Number of Pieces
1	Bottom	Front, Back and belt	3
2	Top	Front center panel, front side panel , back, yoke, sleeve	5
3	Dress	Front , back and yoke and 10 gores	13

3.2. Garment Designs

Figure 8: *Top and Bottom*

Figure 9: *Dress*

Then, stages for carrying out the research were determined separately for the manual and the CAD working methods.

3.3. Stages of Data Collection

- Pattern making of main size
- Sample making of main size
- Grading of main size patterns to 4 different sizes
- Preparation for marker making
- Marker making

3.4. List of Information Needed

- Time required for Pattern making of main size, Sample making of the main size, Grading of main size pattern to different sizes and marker making manually.
- Time required for Pattern making of main size, Sample making of main size, Grading of main size pattern to different sizes and marker making through Pattern making software (CAD).

4. Methodology

Evaluation Research aims to demonstrate to what extent previously stated targets have been reached within the unity of the research by trying to determine the relationship among input, output, and process and performance variables in the studies being carried out (Kaptan, 1981). Bearing in mind the fact that this research includes logical assessments, the Evaluation Survey Methodology was chosen, as it is the most suitable method for the objective direction, application studies and data evaluation of the research. Garment design, measurements and grade rules tables of the styles which form the material of this research were taken from the buyer's list. Three different garments were chosen Top, bottom and dress. Design and specification sheet was taken from the buyers list.

Two methods were applied to obtain the findings of the research, the manual and the CAD method. Then, stages for carrying out the research were determined separately for the manual and the CAD working methods. On this basis the procedures forming the research were also established. The research was carried out in two directions: In the first direction, the manual method was compared with the CAD method to investigate the effects of style complexity. The sequence steps and procedures for the style chosen were applied both manually and by the CAD method. The sequence steps and procedures for the manual method and CAD method were realized by were realized by the author.

During the studies carried out in the second direction, the aim was to compare the manual method with the CAD method separately for each stage value and the total values. At this point all three styles were handled and related stages and procedures were conducted by expert pattern designers and pattern technicians, by expert CAD system operators and operator assistants by using CAD system. The pattern designers had experience of more than 15 years in the industry, and were capable of preparing all kind of patterns. The pattern technicians chosen had the same level of expertise. The CAD system operators were chosen from among people who had good command of patterns and the CAD system. The requisite duties were presented to both groups in the form of a list of instructions by the author, and the work was carried out under her supervision.

4.1. Manual Method

- The specification sheet with the complete details (stitch detail, fabric detail etc.) of the garment for 3 different styles was given to 3 different pattern masters. They were asked to make patterns manually and time was each pattern was recorded.

- Main size pattern was given to tailors and asked to make the sample for all the three styles and time was recorded in making of each actual sample. Fit has been checked of the physical sample.
- Grade sheet was given to masters and asked to grade the pattern manually in 4 sizes. Time was recorded.
- Nested patterns were given for the preparation of Marker Making which includes Separation of sizes of nested patterns; cutting of patterns on transparent papers, transferring patterns on transparent papers to cardboard, checking and cutting the patterns on cardboard and time was recorded.
- Marker was done and time was recorded.

4.2. Digital Method

- Same Specification sheets were given to CAD Experts and they have asked to make the first main size pattern on CAD. Time was recorded for the same.
- The main size pattern updated to E-fit and stitching details was given to the style as per specification of stitch, drape and fabric etc. Time was recorded in doing the complete process. Fit has been checked of the virtual draped garments.
- Patterns were graded in 4 sizes by the CAD experts and time was recorded.
- File order was given for marker planning.
- Marker planning was done and time recorded for the same.

5. Evaluation of Findings

The Mann Whitney U Test was used to evaluate the findings obtained. The Mann Whitney Test is a method of statistical evaluation which compares the medians of two independent samples and which is nonparametric. It is used if the two independent groups are the same. This test does not necessitate a normal or near-normal distribution, but it needs the obtainment of the following hypothesis.

- Random sampling,
- Independent sampling,
- Independent observations for each sample group.

5.1. Findings and Discussion

Time Comparison of Total Product Development

Time-related data obtained as an outcome of studies conducted can be seen in Table 2. As can be seen in this table, the time difference between the manual and CAD methods increases as one moves from bottom to dress; in other words, from the simple model to the more complicated one.

Table 2: *Time Saved Between the Manual and CAD Process*

Number	Styles	Time saved(min)
1	Bottom	385
2	Top	471
3	Dress	575

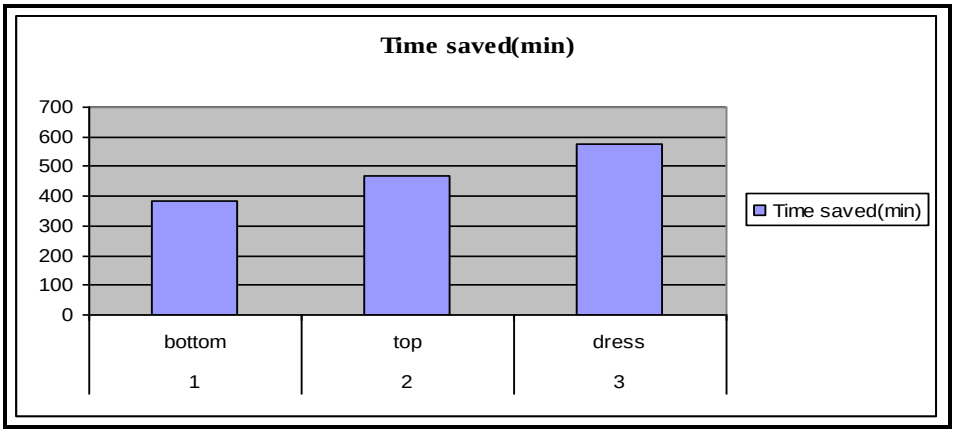

Figure 10: *Comparison of Time Saved Between Manual and CAD Methods (3 Styles)*

Table 3: *Time Related Data According to Stages for Manual and CAD Methods (3 Styles): Unit Time: Minute*

Number of Stages	Stages/Time(min)	Bottom		Top		Dress	
		Manual	CAD	Manual	CAD	Manual	CAD
1	Pattern Making	105	30	158	105	110	35
2	Grading	110	45	190	90	125	25
3	Preparation prior to Marker Making	100	10	151	18	120	20
4	Marker Making	125	30	100	35	150	15
5	Sample Making	150	100	270	150	270	105

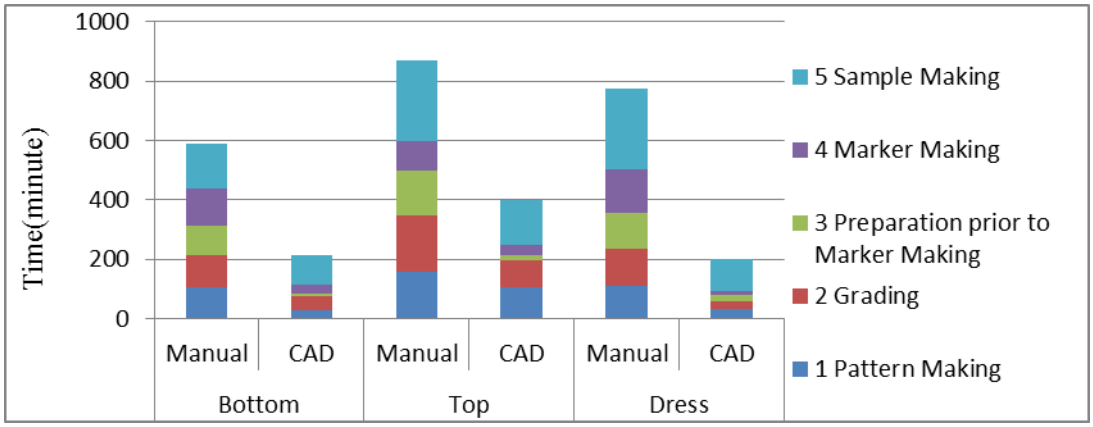

Figure 11: *Comparison between the Manual and CAD Methods with Regard to Time-Related Data (3 Styles)*

Findings obtained after the data in Table 3 were assessed by the Mann Whitney Test, as shown in Table 4.

Table 4: *Findings Obtained as Result of Assessment of Time Related Data by Mann Whitney U Test (3 Styles)*

No.	Styles	Method	Median	Standard Deviation	Significance Level(P)
1	Top	Manual	158	56.09	0.0367
		CAD	90	47.94	
2	Bottom	Manual	110	18.06	0.0216
		CAD	30	30.59	
3	Dress	Manual	125	58.99	0.0122
		CAD	25	33.17	

The 'P' value was seen to have reached its lowest level in "Dress", which has the longest pattern perimeter due to increased number of pieces.

Moreover, in the assessment for all styles, where P<0.05, the difference stemming from the comparison of the manual method with CAD has been found to be in favour of CAD.

Time Comparison of Pattern Making (Analysis)

Figure 13 depicts no significant difference in time for all 3 styles in manual pattern making where as it can be seen that the time occupied for pattern makingthrough CAD is similar for both bottom and dress.Although Bottom has less number of pieces than dress. Here it can be said that CAD is favourable for complex styles where there are repetetive patterns. As fas as Top goes time taken is more than the dress and bottom through CAD but it has a big differnce from manual methods. Top has more number of different pattern peices. So it can be said that in pattern making process CAD is favorable for the repetative tasks.

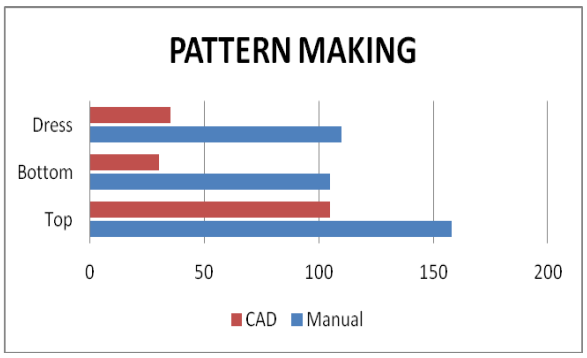

Figure 13: *Time Comparison between Manual and CAD Method for Pattern Making Process (3 Styles)*

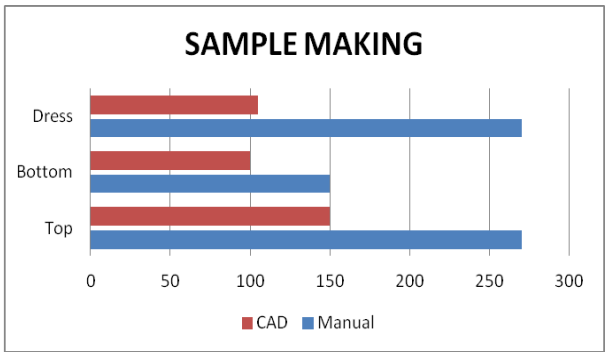

Figure 14: *Time Comparison between Manual and CAD Method for Sample Making Process (3 Styles)*

Time Comparison in Sample Making (Analysis)

Figure 14 shows that the time occupied in making the physical samples of top and dress quite similar through manual method as both the garments has complex styling and lesser in bottom due to less number of pieces whereas through CAD in virtual sample making process there is no significant difference in all three garments although the time for bottom and dress has become equal so we can say that virtual sample making is not very much dependent on the pattern pieces. Sample making through 3D technology is suitable as it reduces the sample making time and number of samples as ones the sample is made it can be sent to many buyers through email whereas the physical sample can be sent to only one or we need to make many counter samples.

Time Comparison in Grading (Analysis)

Grading time depends on the number of points at which grading is required, number of sizes, number of components and style of garment. Figure 15 depicts that the grading time is lowest for the dress through CAD although the components are more. The dress has same 10 gores so grading can be copied for all the gores. Number of pieces is less for the bottom but the grading points are more so the grading time is more. Top has all 5 distinct components and more points to grade so grading time is more. So we can say that repetitive task can be done in lesser time through CAD.

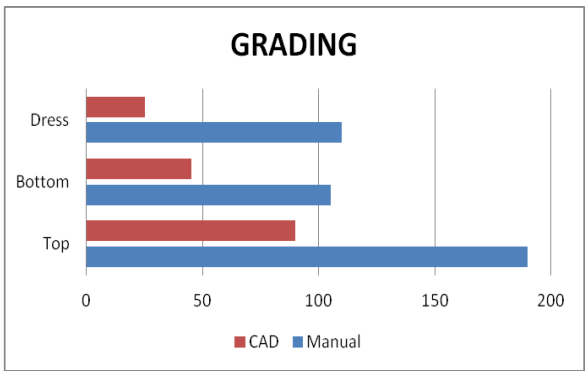

Figure 15: *Time Comparison between Manual and CAD Method for Grading Process (3 Styles)*

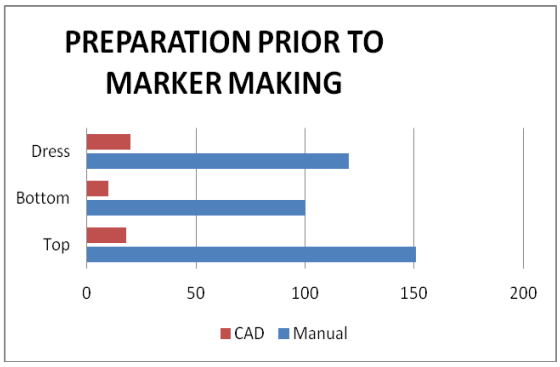

Figure 16: *Time Comparison between Manual and CAD Method for Preparation Prior to Marker*

Time Comparison in Preparation Prior to Marker Making (Analysis)

As making arrangements prior to marker making procedures (i.e. Separation of sizes of nested patterns, cutting, checking and correcting of patterns on transparent papers, transferring patterns on

transparent papers to cardboard, cutting the patterns on cardboard) demand manual labour and time, it is only natural for the CAD systems to be beneficial in these steps which is shown in Figure 16.

Time Comparison in Marker Making (Analysis)

Trend has completely changed here in Figure 17. Manually time is maximum for dress due to number of pieces and long length of pieces and lowest for top whereas in CAD time for dress is lowest and maximum for top. Here we can say dress has repetitive pattern but top has all the pieces different.

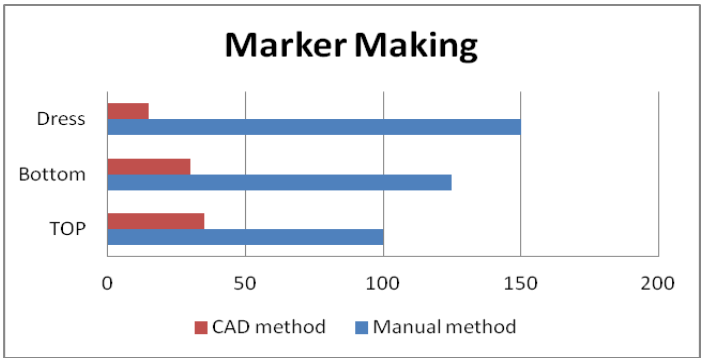

Figure 17: *Time Comparison between Manual and CAD Method for Marker Making Process (3 Styles)*

6. Results

The following results have been derived from the above analysis:-

- In pattern making of main size patterns, no significant difference has been found for the simple patterns but as complexity of styles increases CAD method is favourable. Also this is very much dependent on the personal skills and productivity in particular. Also CAD is favorable for the repetative tasks.
- Virtual sample making though CAD definitely saves time and it does not any tailor material etc. The virtual sample made by the CAD can be sent to the buyer by email where as physical sample needs to be sent through courier, which will again affect the time. The fabric saving and time saving in virtual sample add to much more profit. Also carbon foot prints can be reduced.
- Since grading main size patterns and making arrangements prior to marker making procedures demand manual labour and time, it is only natural for the CAD systems to be advantageous in these steps.
- During marker-making preparation and plotting procedures, again CAD method was found to be superior.
- In assessing the total times for all stages, the level of significance between the two methods was found in favour of CAD.

7. Conclusion

The study of secondary data as well as primary data shows that digital platform can play an important role in apparel product development. We have divided the different stages of product development to conclude and reached to the following conclusions-

7.1. Pattern Making

In the area of pattern making we can see that in simple patterns time difference between Manual and CAD method is negligible but as the complexity of the patterns increases the CAD is more beneficial in terms of time saving. As we have seen that pattern can be made in less time by using CAD, which takes the significant time of sampling so we can conclude that lead-times can be reduced by using CAD for pattern making in product development. Also with the advanced features of CAD software design possibilities can be increased.

Pattern storage used to be a big problem with the manual patterns and you need to destroy the patterns after some time due to space constraint and with so many patterns it was not easy to find any pattern if we receive any repeat order after long period of time. Doing patterns on CAD has additional benefit that large amount of data can be stored on the computers, can be retrieved easily and adaptations can be made at any time. CAD patterns can be easily sent to the buyers for their comments. It has been observed that acceptance for pattern making software has increased and many companies are doing first pattern with the CAD.

7.2. 3D or Virtual Prototyping

It has been perceived that Virtual prototyping can be used as significant tools in product development as fit and look of the garment can be approved by the buyer without even making the physical sample so it is effective in terms of time as well as cost. Many variations can be done virtually. Complete Virtual collections can be presented to the buyers without making the physical samples so speed to market can be increased also carbon foot prints can be decreased which means increase in profit but still people have resistance in using 3D technology.

7.3. Pattern Grading

In terms of grading again CAD is a winner. CAD is being used by the industry in grading for years now. Time can be saved drastically through CAD in grading patterns as computers are master in doing the repetitive tasks and in grading process, grade rule of one point can be required to copy on many points. The masters can save time in grading and make many more patterns. Costing is very important aspect. CAD makes the costing process time effective as patterns on CAD can be made in lesser time ,patterns can be graded and lay out can planned and consumption is calculated which makes the major part of the costing.

7.4. Marker Making

Most attempts to minimize the amount of fabric waste have focused on various types of marker-making software that place the garment pieces on a length of fabric as compactly as possible. CAD is being used by most of the industries now for marker making. CAD is quiet efficient in saving time and fabric in marker making. Due to less time consumption factories can work on different markers for assorted fabric widths and increase the fabric efficiency and make money but there is some limitation of the software. For Example -While placing the pattern pieces of different sizes of a particular style, all the pieces are placed on 4m length and one pattern piece (e.g. sleeve) is left so marker will take it as separate complete length and show the consumption as double the length which means 8metres whereas in manual marker planning master can do the small layer separate for the sleeve and show the efficiency.

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