



## RESEARCH ON IMPLEMENTING LECTRA CAD / CAM SOFTWARE ON THE ENHANCEMENT OF APPAREL FASHION DESIGN TRAINING FOR TVET POLYTECHNIC COLLEGES IN ETHIOPIA

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### ABSTRACT

Textile and apparel manufacturing industry of Ethiopia is second highest employment generator sector and largest contributor to Ethiopia's GDP. Unfortunately, it lacks behind in innovations and adoption of technology to meet the challenges. The basic problem remains as how to bring varied designs to market quickly with less efforts and cost. The adoption of Lectra CAD technology in various TVET Colleges in Ethiopia offering enormous benefits to apparel manufacturers and it makes quick and efficient revisions in apparel design changes including color adjustments on fabric pattern and resizing garments. CAD system enables designers to produce more accurate designs with less chance of mistakes by saving cost and time. Its integration with CAM offers many advantages during manufacturing process and makes the apparel production faster with consistent and accurate results every time. As all information related to design and productions are stored in file format, it makes very easy to produce the same design again without repetition of previous activities. The introduction of CAD technology in the TVET polytechnic colleges resulted to improved efficiency of the design process due to automation of routine design tasks, increased employee productivity and shortened lead time in the product development process. This study highlights on adoption of Lectra CAD technology, the study addresses the rate of Trainers /TVET Teachers facing a problematic consistent manipulation technique of Digital Technology in class delivery, particularly TVET Trainers are a knotty of pursuing Apparel Fashion Software's. the CAD/CAM integration appears to be inapplicable to non-integrating companies despite the fact that some of these are technically capable of achieving it students/trainees of teaching ways, methods and the level of understanding apparel fashion software in Garment Sector and its impact on the engineering product development in developing country like Ethiopia's Textile and Apparel Production.

**Key words:** - TVET Trainers, Lectra Software, Fashion, Polytechnic College

## 1. INTRODUCTION

Understanding of major CAD/CAM programs has become a vital tool for numerous fashion designers, and the practice of new design and manufacturing technologies is commencement to blowout from the catwalk to the high street. Fashion designers use 2D CAD software to generate preliminary ideas for their designs. Then, when they are prepared to create the full piece, they employ 3D CAD software to envision their designs on virtual models. From haute couture to the mass market, each sector of the fashion industry has felt the impact of CAD. As such, knowledge of CAD has become a progressively significant benefit for safe a job in fashion design. It's easy to see why the industry has encompassed CAD. (AAZRA SEDIC, 2019) Nowadays CAD software is obtainable as either industrial or commercial, Industrial software emphasizes on specific industry desires and often prices higher than commercial ones, CAD in the "real world" emphasizes the day to day productivity requirements to hack it within a continually demanding industrial environment. This is an enthusiasm and thwarting in taking theory into practice and frequently enlightening processes of design and product development. (Aldrich W. et al 1992) Further, the extortionate rate of computers and the insufficiency of user-friendly software also limited CAD to these two sectors. The achievement in the aerospace and defense sectors promoted the use of CAD in the automobile industry. CAD is extensively employed not only to bring forth new exterior model designs but more efficient and aerodynamic designs as well. With the advent of the personal computer and user-friendly software, CAD has found new applications in the fields of architecture, civil engineering, mechanical engineering, and textiles and clothing. The recent advancements in computers have made CAD a commonplace tool. (Gong DX, Hinds BK, et al 2001) CAD is ever more being used in the fashion design industry. Although most designers begin with sketch designs by hand, a growing number also render these hand sketches to the computer. CAD allows designers to outlook designs of clothing on virtual models and in countless colors and shapes, precisely made and effortlessly adjustable graphical representations of the product. The user can virtually view the actual product on screen, make any alterations to it, and present his/her concepts on screen without any sample, particularly during the early stages of the design process. Achieve complex design analysis in a short time, Record and recall information with consistency and speed. Innovative Fashion Design states to both the design and the manufacturing processes. (Mahajan Net al 2020) The enclosure of both developments permits for this technology to be categorized as "innovative." It exploits Computer-Aided Design (CAD) to pattern-make and design. The leading

CAD package for clothing came out in 1985 and assisted in pointedly diminution incompetence increment and rearranging panel patterns. Since 1985, software packages containing computer clothing design have made marvelous innovations. Itemized below are the purposes of the CAD package. (Kasich DJ, et al 2005) Intangible the use of Product Data Management (PDM) systems can store the whole design and processing history of a certain product, for forthcoming reprocess and upgrade; (Jerrard R. 1976) Apparel products are cyclical and consequently need speedy delivery which can be reached through effective and proficient operations (Kedia BL et al 1986). As technologies converge, Apparel CAD Technology is embryonic into an integrated environment that drives the entire company. Apparel CAD technology is not only serving design and production functions within the company, but it has also become an essential part of the company including in ranges of sourcing, merchandising, and

marketing. "The advancement of the computer is making it possible to extend the designer's mental as well as physical capabilities" the computer, when used only as an extension of the designer's medium, allows the designer to complete the design process with greater efficiency (Hands C et al 1996). In the Apparel industry, CAD systems are mostly used in countless processes such as garment design, pattern preparation, pattern grading, and marker making. Computer-Aided Manufacturing (CAM) systems embrace computerized sewing machines, fabric spreading, cutting systems, and automation systems used in Apparel production (Davis FD, et al 1982). CAD is a renowned tool in the clothing industry, with many commercial systems offered to assist in the process (Glock RE et al 2005). CAD systems auxiliary garment manufacture processes consist of computer hardware, software, and communication equipment (Venkatesh V.2000). The advance of a new generation of multifarious and prevailing computers and software packages places more intricate requirements from computer hardware (Adams DA et al 1992). The computer hardware of the new generation Apparel CAD systems for designing the models, collection of patterns, marker making layout, and cutting in the production of garments consists of; a CAD server, powerful micro-computers for particular work stations, high-resolution color graphic displays, input and output devices, communication devices and special equipment for laying and cutting (Doll WJ et al 1998). The CAD progression is noticed from the mass production of a bulky retail chain store of garment business in terms of design, quality, delivery, and price. The computer is a very useful tool that when used properly can escalate precision and productivity, and accomplish information. This eradicates the time-consuming tasks of cutting card patterns and planning and drawing markers by hand and the replication of hand-written instructions. This computer technology has empowered clothing design, pattern construction and product development to be integrated into a more incessant process. A lot of software's are obtainable to fashion designers to perform various tasks namely fashion research, fashion design and illustration, pattern design, patternmaking, textile

### Importance of Computer-Aided-Design (CAD) Fashion Design Technology

is the advance of skills to pinpoint and breed concepts and examine into the manufacturing of clothing and accessories. This vital role is performed by the fashion designer. The capacity of fashion designers covers may range from the prediction or generation of the next season's range to pattern cutting and responsibility for the finished sample as stated by (Grover V 1993). Fashion Design has three main branches namely Clothing technology, Textiles technology, and Fashion illustration which needs to be exploited with CAD. Wikimedia (Premkumar G et al 1993) indicated that Computer-Aided Design is a tool used by engineers and designers and it is used in many ways depending on the profession and the use and the type of software in question. CAD software is used to surge the efficiency of the design, improve the quality of design and improve communications through documentation, and generate databases for manufacturing. She/he extra drives on to say that it is used in many fields; it is used in electronic design, fashion design, and other fields which style the process of drawing with the use of computer software. Leach (Mechling GW, et al 1995), also revealed that CAD is a tool that can be used for design and drafting doings, and can also be used to make rough idea sketches although it is more well-matched to craft exact finished drawing. CAD has powerful tools which help creativity and visualization. The media industry was on track using CAD before the fashion designer integrated it into computer drawings and designing. Computer-Aided Design also known as Computer-Aided design first knockout the fashion scene in 1987

and it is castoff in the designing of tools and machinery and also used in the manufacture of components of garments, production of patterns, and the manufacture of garments. There are different types of CAD and each of these types of CAD systems entails the operator to contemplate differently about how to use it to design virtual components differently.

## 2. METHODOLOGY

The research was conducted both qualitative and quantitative data analyses involved knowledge and practice of a group of respondents and situation or attitude of the researcher in exploring causality in relation to two variables, respectively in addition to assess the level of their ways of teaching mode and manipulating CAD/CAM software in Garment Department of Tegbared and Misrak polytechnic college, in such manners the total number of TVET institution in Addis Ababa are six(6) Polytechnic College and Nine(9)-TVET institute are available and randomly selected Two Polytechnic college for conducting the research, the researchers observation of his own experience of employability rate, the level of staff profile compare with other polytechnic college for determining for sampling, Total population 120 garment trainers from A –level to c-level within six polytechnic college 34 –TVET Trainers could fill the questionnaires from the two polytechnic colleges. The research was beneficial for the TVET colleges in Ethiopia that took part in it the main practical benefit to these TVET sector occurred through feedback reports on the study's findings. While the reports were addressed to the level of Digital Technology dissemination and implementation of Lectra and Calido Fashion software through public polytechnic college in Tgibred and Misrak polytechnic, a wide range TVET trainers capacity to delivery techniques and user friendly of Teachers/trainers in the college could benefit in addition practically from their contents because integration involved cross-functional, the traditional classroom teaching based on theoretical system is changed into a comprehensive teaching mode of “theoretical system + Project + practice” driven by task. The task refers to the competition, curriculum design and graduation design topics related to the course, as well as the actual cases of enterprise engineering or related scientific research projects. In the traditional teaching mode, it creates opportunities for students to go out of the classroom, enter the project group, and integrate with other curriculum groups. The specific forms are summarized as follows: Task driven in the form of curriculum design or graduation project. Do the works related to the course, and experience the theoretical essence of the course in the process of forming my own works. For example, take the secondary reducer completed in the course of mechanical design as example, let students use 3D CAD software to complete modeling, assembly and motion simulation. On this basis, aggravates is used to analyze the stress and deformation of transmission shaft and transmission gear. Feedback contained basic data analysis and practical recommendations to the government of Ethiopia, TVET agencies and TVET policy makers who played key roles in supporting infrastructure from donors and NGOs, the introduction of CAD and the integration of CAD/CAM in their respective companies. They received insight not only into their own situation but also were able to contextualize that situation in terms of information derived from the literature review and the comparative analysis of organizations in the same region, against which they could compare their progress. The aim of the applied aspect of the research was to promote improved skilled workers in Ethiopian Industry Park of technology projects in the future. The benefit could be extended to companies that shared similar characteristics to those studied. The Sample

technique based on= Two/2= polytechnic college selected=31 –Trainers ,The highest ranked TVET polytechnic college in terms of staff profile and educational training facility compare with other TVET institute, Total public TVET polytechnic and college =15 in Addis Ababa=total staff 314 2TVET polytechnic selected for study of specific department = The Garment sector from 334 Trainers available.

### 3. DISCUSSION BASED ON THE DATA COLLECTIONS

The study sought to collect data from 15 respondents, among which 10 respondents furnished all details of the questionnaire and their responses were considered for analysis. Table 1 below exhibits all demographic information of respondents and size of the firms. At the same time Table1 demonstrates various Designing methods adopted by Apparel Manufacturing companies in CAD. The main objective of this paper is to find a possible solution implementation and sustainability of Lectra software in polytechnic college in Tgibred and Misrak polytechnic training lab and enhancing the manipulation of apparel fashion software training delivery and diversification apparel software in selected main cities of the country for easy access for productivity of garment Industry Park.



Table- 1- Data Collection Report

No	Questionnaires		Level of Agreement and Dis-Agreement				
			Excellent	Very Good	Good	Satisfactory	Poor
			5	4	3	2	1
1	How would you rate Fashion /Garment software CAD training taught in this institute in each category listed below?	CAD in pattern Design	10	4	6	5	0
		CAD in pattern grading	8	6	9	6	3
		CAD in marker making	6	9	9	12	4
		CAD in Fashion illustration	6	6	7	7	5
		CAD in Digital embroidery	6	7	7	8	8
		CAD in pattern cutting/plotting	4	4	8	8	9
2	How do you rate the availability of equipment, facilities, computer hardware and software for each category listed below?	CAD in pattern Design	8	4	3	4	1
		CAD in pattern grading	8	4	3	8	2
		CAD in marker making	8	6	4	4	2
		CAD in Fashion illustration	6	10	3	6	1
		CAD in Digital embroidery	6	5	2	7	3
		CAD in pattern cutting/plotting	5	5	4	8	2
3	Which learning materials are available to students for learning purposes in the following areas?	CAD in pattern Design	8	7	11	4	1
		CAD in pattern grading	8	7	7	5	4
		CAD in marker making	6	8	8	6	2
		CAD in Fashion illustration	6	6	6	5	6
		CAD in Digital embroidery	5	5	10	11	2
		CAD in pattern cutting/plotting	5	4	5	8	7
5	How would you rate the training undertaken by students in college in preparing them for Fashion /Garment software CAD related jobs in the industry?	Handouts	4	8	11	2	4
		Textbooks	3	4	8	5	8
		Lecture notes	3	5	11	5	5
		CD-ROM	3	5	10	5	6
		Internet sources	1	6	11	4	7
		e-learning	0	2	8	10	9

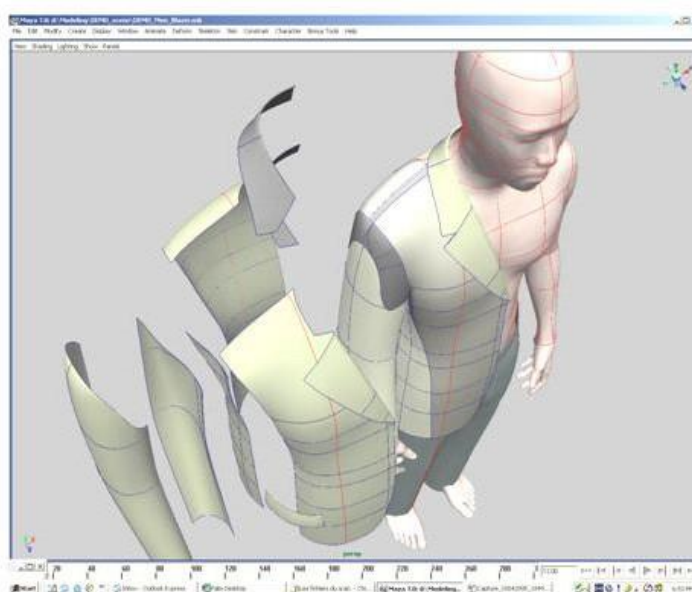
6	How would you rate the training program undertaken by students in preparing them to work in the textile and apparel industry?	0	11	3	0	2	



### 3.1. Apparel Pattern Design CAD

Pattern making involves drafting paper patterns to create well-fitted garments. It's like creating the blueprint of style on the paper before making the actual garment. So, garment construction is the core of fashion designing. It involves understating machines, seam types and of course stitching of the garment. CAD allows designers to view designs of clothing on virtual models and in various colors and shapes, thus saving time by requiring fewer adjustments of prototypes and samples later. Software can help students draw, create woven textures, drape models to create patterns, adjust sizes and even determine fabric colors. In the apparel manufacturing sector, CAD stands for computer-aided design. Nowadays, Computer-aided design or CAD software has become one of the most essential tools for pattern making and related jobs in the clothing industry. It is used for pattern making, pattern grading, and the making of the marker. Using CAD software, a fashion designer can create new sketches, patterns, prints more quickly and precisely. TVET Colleges has been increasing use of CAD; fashion designers can create multiple variations of a single design and style and adapt it to varying material and pattern. The similar findings was obtained by (AdlerPS.1995)

**Image-1-Customer Requirements Apparel fashion software**



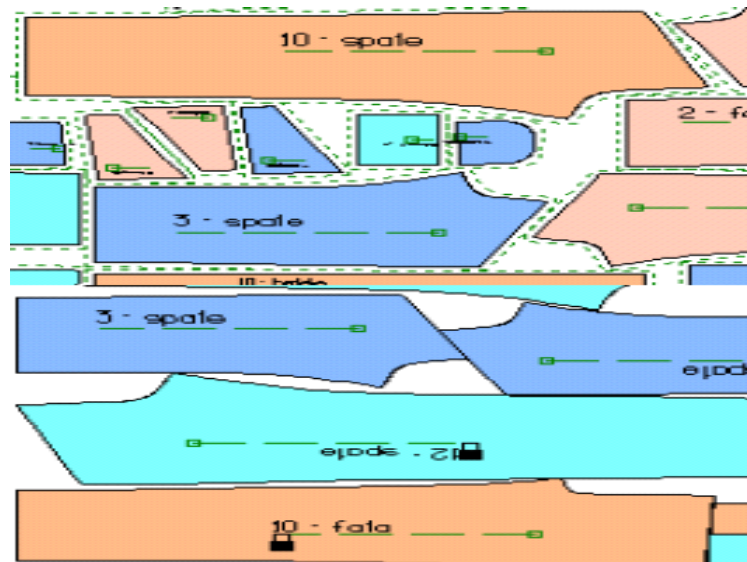
## Image-2-Soft Dress Forms



### 3.2. Mark planning through CAD

Marker planning is one of the most important pre-production steps of garment production. A highly efficient marker plan increases the fabric utilization in the garment industry, which in turn increases the overall profit of the garment industry. Marker planning is the process of plotting all the pattern pieces for all the sizes of a particular style of garment on a thin piece of paper. The marker planner makes a plan for each pattern and its position on marker paper to ensure better efficiency. It can be done manually or using a CAD system. Marker Layout provides the means to position patterns inside a fabric rectangle of a set width to determine layout and yardage requirements. Marker Layout ships free with your purchase of the Cameo Pattern Design module. Marker planning is a conceptualizing, initiative, open and creative process, in contrast to making up a jig-saw puzzle, which is an analytical, step by step and closed process. There is no final planning solution to a marker. There are numerous solutions with tightly packed patterns of TVET a Polytechnic college has implanted in Lectra software CAD Technology in their workshop for advanced learning platforms. The similar study was concluded by **(Badham R 1989 and Taylor M et al 2004)**

### Image-3-Marker Lay Planning - Operation Principle



### 3.3 Parametric CAD Design

Parametric modeling is an approach to 3D CAD in which you capture design intent using features and constraints, and this allows users to automate repetitive changes, such as those found in families of product parts. Parametric modeling uses the computer to design objects or systems that model component attributes with real world behavior. Parametric models use feature-based, solid and surface modeling design tools to manipulate the system attributes. The TVET implanted the new Lectra software in the advanced pattern making system of apparel and workshop their used for new adoption in the leaning efficiency of their institute. The similar study was conducted on (Beatty CA 1998)

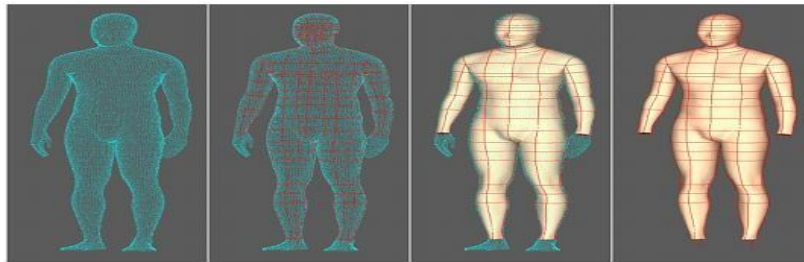
### 3.4. Lectra software in the path of CAD Adoption

The Lectra involved in the adoption and use of CAD technology in various companies surveyed are as follows: Sudden breakdown of computers can damage the whole work; work is also prone to viruses and can be hacked easily in lack of security licenses. Lectra CAD is only a technological tool for designer, innovative and best designing on CAD depends on the skills of designer, it can tell only what a design looks like, hence adoption of CAD require skilled professionals CAD hardware and software are quite costly and requires not only huge initial investment but also continuous import of technology. Sometimes, it's too tough to find skilled professionals to run Lectra CAD software, CAD operators also have to train themselves according to the update of CAD software. There is lack of financial support from the government to small-scale apparel units; in the era of stiff competition it is essential to give financial assistance to the small-scale apparel manufacturing industries to purchase CAD software and hardware components. Penetration of technology is also low in TVET and most of the companies are not aware of the benefits of technology adoption, hence in the case of Lectra CAD adoption, few companies are still not aware with usage and benefits of CAD in garment manufacturing and designing process. When design teams use different

CAD tools, problems often arise because different CAD tools still use different native file formats. If design team members want to share data stored in both file formats among firms connected with supply chain networks, a problem in data consistency might exist. Data communication problems due to using the Internet as a communication channel may also exist. The similar work was done by (Agrawal B et al 2019)

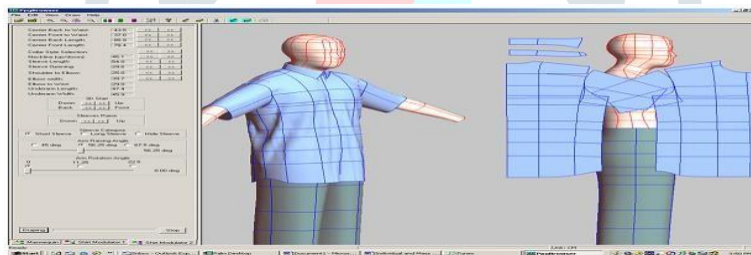
### Image-4-Developments within Computer-aided Apparel Systems

#### A, Parametric human generator (PHG)

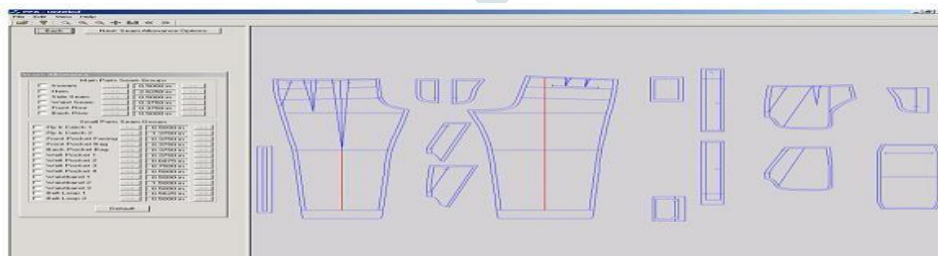


#### B, Developments within Computer-aided Apparel Systems

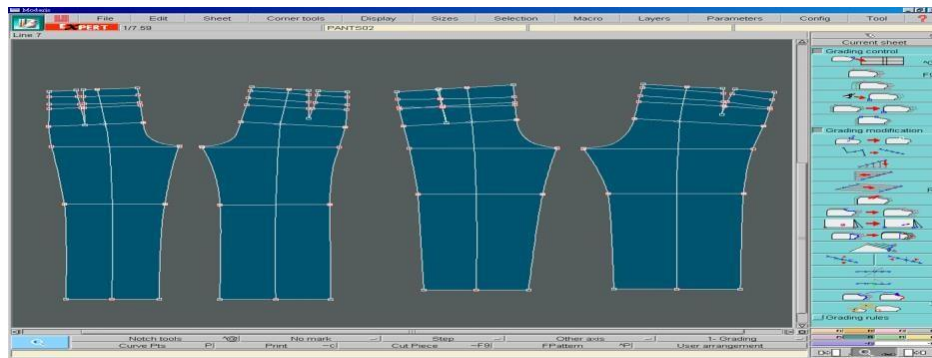
##### 1. Parametric pattern generator (PPG)



##### 2. Men's pattern



### 3. Modaris image of -2D



#### 3.5 Respondent statements of Lectra CAD adoption impact on performance

From the analysis above it has been revealed that majority of the respondents out of 10 respondents agreed the statement that CAD adoption has positive impact on TVET apparel manufacturing Departments performance in terms of cost effectiveness, production efficiency, customer responsiveness, employee's productivity, competitive capability, Quality and innovative designs and increased sales.

#### 3.6. Regression analysis

TVET Colleges analyze the relationship between independent variables and one dependent variable multiple regression analysis (MRA) was applied, Lectra CAD adoption was a dependent variable and Increased sales, Quality and innovative designs, Employee's productivity, Cost effectiveness, Customer responsiveness, Production efficiency, Reduced lead time, Competitive capability were taken as independent variables. The measurement of the proportion of the variance between dependent variable and independent variables are determined by the coefficient of  $R^2$ . Higher coefficient of determination indicates higher explanatory power of the regression model. It represents the value of  $R^2$  for the use of CAD technology is .862%, which denotes that 86.2% of the variance in Use of CAD technology is explained by the model. This high value of  $R^2$  denotes that the regression model is very good. The model is statistically significant at  $F 16.29$ , confidence interval 95%, and  $p < 0.001$ . Regression coefficients of increased sales, Quality and innovative designs, Employee's productivity, Cost effectiveness, Customer responsiveness, Production efficiency, reduced lead time, Competitive capability are statistically significant. The similar analysis was concluded by (Saini HK et al 2014 and Wolfe GM 1998)

#### 4. Conclusion

This research was investigated to identify the status of CAD technology adoption, its impact on business performance on apparel industry and factors affecting CAD adoption. Research revealed that in the fast-changing era of technology development 64% of the surveyed garment manufacturing TVET still rely on manual work and not aware with the usage of Lectra CAD technology. Though majority 36% of the surveyed TVET use CAD technology but they are lacking behind in use of advanced CAD systems as Lectra, The research question concerned with factors that affect CAD adoption in apparel Technology department and Correlation analysis supported all formulated on the model. From the study, the results showed that desktop computer hardware was available to most

students for use as identified by the students. Forty five percent said they were using desktop computers while 10% used their own laptops. With the student population of over 70 students, the respondents indicated that there were few computers in the departments of apparel design in relation to number of students, and that is why they used computers from other departments. This meant that the departments gave limited consideration to acquisition of computer hardware and software when implementing the apparel CAD program. Plotter and due to multi software availability it's difficult to overcome all garment software application familiarities due to industries inters varies from on software to another In regular course class it's difficult to master all the tools and system except continuous training provided by the school organizer Scarcity of training laboratory and software stability of frequently changing the new version of fashion Software Company All trainers will not equally catch the skill of manipulation unless the skill gap training is fulfilled. Accordingly, it can be concluding that adoption of CAD technology is positively related with increased sales, Quality and innovative designs, Employee's productivity, Cost effectiveness, Customer responsiveness, Production efficiency, Reduced lead time, Competitive capability of apparel Technology TVET Colleges. Regression analysis further depicted that Quality and innovative designs, Employee's productivity, Cost effectiveness, Customer responsiveness, Production efficiency, reduced lead time, Competitive capability were significant predictor of the performance and influenced positively with the use of CAD technology.

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