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Benefits of Using CAD for Garment Manufacturing: A Perception Analysis

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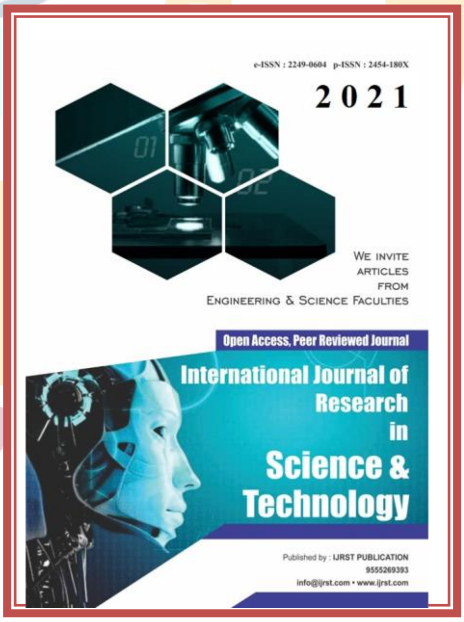

ABSTRACT

The present research investigated the perception of four stakeholders' viz. industry managers/supervisors, CAD practitioners working in Garment Manufacturing industry and faculty and students from Fashion Technology discipline towards CAD adoption in the Indian scenario.

Initial interactions with the CAD vendors revealed that the adoption of CAD by Indian Garment Manufacturers is significantly low compared to their counter parts of neighbouring countries despite the acceptance of the fact by majority that the advancement of technology has a clear impact on manufacturing efficiency. This mismatch led to the present research.

The study employed a survey method using a structured questionnaire to obtain responses from the above-mentioned four stakeholders. Findings proved that all the four respondents viz Industry Managers, Industry CAD practitioners; Academic Faculty and Academic Students are of the opinion that CAD systems are useful and beneficial to the garment industry.

The study used one of the very popular information systems theories known as Technology Acceptance Model (TAM) that models how users come to accept and use a technology. Structural Equation Modeling (SEM), a multivariate statistical analysis technique was used to analyze structural relationships between measured variables and latent constructs, notably Perceived Usefulness (PU) and Perceived Ease of Use.

TAM structural model suggests that if managers need to increase the behaviour intention to use CAD, the usefulness and ease of use should be increased. In addition the results show that increasing the ease of use can increase the actual use of apparel CAD. Therefore, the stakeholders need to create user manuals and provide better training for increasing the intention to use CAD.

The report concludes with the scope of further research to investigate the reasons of low penetration of CAD among Indian apparel manufacturers despite well appreciating the benefits of it.

INTRODUCTION

Textiles and apparel industry plays a major role in the Indian economy through its pivotal contribution to the country's industrial output, employment generation and export revenues (Joshi, Rakesh Mohan, 2018).

The Textiles and apparel sector is one of the leading manufacturing sectors of the Indian economy and is amongst the largest employment generators. The sector contributes for about 2.3% of the GDP, and around 11.4% of the total Indian exports revenues. This sector also provides direct employment to over 50 million people (Sunanda S, 2019).

The Textiles and apparel industry has achieved a substantial position as one of the major exporters of textile and apparel products including natural and manmade fibre, cotton, silk-based textiles, knitted apparel and accessories among others. India currently holds a share of about 4.5% in the world exports of textiles. This is still a very minimal share in spite of the textile sector in India is one of the oldest sectors (Joshi, Rakesh Mohan,2018).

The global textile industry today is going through a major shift with the usage of automations, robots, big data analytics, and the Internet of Things. Automation and Industry 4.0 offer a range of opportunities to the textile sector for improvement in design and manufacturing. Textile and clothing companies are increasingly experimenting with improved technologies such as Artificial Intelligence applications and improvement in productivity and energy efficiency and come up with innovative products to cater to the evolving consumer demands (Sunanda S, 2019).

Until 2005, the garment trade was controlled by quota system. Under this system, quantitative restrictions were imposed on the exporting countries. The countries could export only upto the allocated quota for the particular category. In 2005, the quota system got abolished and the buyers are free to source as much as they desire from any country. Due to this, the factors controlling the trade changed completely. Cost of the product, Size and Scale became important criteria for sourcing. The developed countries gave preferential access to specific sourcing countries. Apparel manufacturing has shifted from the developed countries to the developing countries, especially in Asia. Currently, China, Sri Lanka, Bangladesh, Vietnam, Indonesia, Cambodia and India are the key exporters of garments to the world. United States, European Union and Japan are the major consuming markets. (Technopak, 2018).

Garment manufacturing industry is highly labour intensive and it is fragmented in India and driven by individual entrepreneurs, leading to limited technological investment. The garment manufacturing process starts from design of the product, which is based on the fashion trends forecasted. Once design features such as fabric, style, color etc. are finalised and order quantities are estimated, the sampling and costing process is initiated with several vendors.

Each vendor showcases their capabilities in terms of raw material procurement, quality, workmanship etc. by submitting garment proto samples along with costing. The buyer selects the vendor based on their price, quality and delivery offering (Technopak, 2018).

The apparel CAD was incepted in 1970 and has evolved into a powerful tool for product development and manufacturing as it has developed from early stages of computer modelling to the modernized concept of CAD integration with CAM (Grolier, 1996). The Apparel CAD has received considerable attention in research over the years (Hardaker & Fozzard, 1995), with an aim of saving on production time and improving the quality (Disher, 1991; Gray, 1998; Bae & May-Plumlee, 2005).

The competition is especially high in fast moving industries which are represented by short life cycles and consumer demands that change over weeks or even nights (Sheridan, 2006). At the same time, the phenomenon of fast fashion has swept the global apparel manufacturing and sourcing landscape. Fast fashion firms aim to provide low-cost, low-quality, trend-based clothing to consumers at unprecedented speeds (Lambert, 2014).

A study by CRISIL (2010), while evaluating the implementation of Technology Upgradation Fund Scheme (TUFS), a scheme launched by Govt. of India to facilitate modernization/ technology upgradation of Textile and Jute Industries also concluded that technological change does facilitate an increase in productivity, cost and waste reduction and improves quality across the value chain. New manufacturing technologies such as 3D body scanners, CAD/CAM systems, and digital textile printers have played a key role in increasing the effectiveness, flexibility, agility, and precision of production (Bae & May-Plumlee, 2005).

Pattern grading and marker making were the first processes in garment production that were automated. At the initial stage, these systems functioned as isolated islands, were expensive and could be afforded by a few (Hands, Cathy, Hergeth & Hudson, 1997;Stjepanovic, 1995). In 1980s, considerable progress was made in commercial development and application of computers in automatic systems of pattern grading and marker making. There was rapid uptake of these new methods and a dramatic decrease in the price of entry-level systems (Byrne, 1995; Hands et al., 1997). Use of apparel CAD enabled a greater throughput of styles in a shorter time period and therefore an effective response to the competitive market demand.

The interactions with CAD vendors in Asia reveal low adoption of CAD by Indian Garment Manufacturers. Tukatech, US based CAD firm reports a 90-100 % CAD adoption rate by Sri Lankan Garment Exporters, whereas the same is about 50-

60% only among Indian garment exporters. Though the technology providers have promoted the benefits of CAD adoptions extensively, still, CAD's adoption rate has been low in the Indian Market (Apparel Resources, 2015).

The researcher's interactions with many leading garment manufacturers reveal that the low adoption rate of Apparel CAD can be attributed to several factors which includes; lack of trained manpower to manage the improved technology, cost of acquiring CAD systems, perception about the impact of CAD on manufacturing efficiency, and the like. However, there has been no research attempt till date either to determine the reasons attributed for such a low adoption or to capture the perception of stakeholders regarding impact of CAD on manufacturing efficiency in Indian apparel sector. Paucity of such a research and mixed reactions by the entrepreneurs with regard to impact of technology advancements lead to the genesis of this study. The present study is an attempt to investigate the perception of different stakeholders towards CAD adoption in the Indian apparel manufacturing sector. The study specifically focuses on the perception of different stakeholders about the use of apparel CAD on manufacturing efficiency with reference to Pattern Making, Grading and Marker making among Indian garment manufacturing units. It also attempts to explore the importance of usefulness and ease of use of CAD on the low adoption rate of CAD applications in Indian garment manufacturing sector.

MATERIALS AND METHODS

Review of Literature

Various literatures such as articles, websites, reports etc. related to the research topic as well as allied topics were reviewed to understand the existing studies in this area. Some of the related literatures are listed below:

Garment Manufacturing Technology

The word manufacturing is derived from the Latin word 'manus' meaning hand, 'factus' meaning made, and is defined as "the making of goods and articles by hand or, especially by machinery, often on a large scale and with the division of labour". Manufacturing has been practiced for several thousand years, beginning with the production of stone, ceramic, and metallic articles (Schey, 2000). The technology for the garment industry can be categorised in three main areas, such as pre-sewing operations, sewing operations and post sewing operations (Bheda, 2003).

Computer Aided Design (CAD) in garment manufacturing

Computer Aided Design (CAD) can be defined as the use of computer systems to assist in the creation, modification, analysis or optimization of a design (Groover and Zimmers, 2008). Computer Aided Design is a set of tools for automating certain of the steps in the design process (Ingham, 1990).

CAD or Computer-Aided Design has brought a revolution in the Textile and Garment Industry. CAD has made the time consuming and cumbersome process of textile designing easier. Now thoughtful and innovative designs are available to the textile designers and textile manufacturers at the click of a mouse.

Apparel 2D CAD

The use of CAD/CAM systems in clothing began only in early 1970s. The first applications were used to design 'lay plans' – templates showing how pattern pieces will be cut out of cloth, minimising the amount of waste material that inevitably occurs (Stephen Grey, 1998). As the use of computer systems increased, a second range of functions was added to the basic lay planning capability – the making of different sizes of a garment, a process known as grading. The companies that installed this technology were almost exclusively, the larger manufacturers (Stephen Grey, 1998).

Technology Adoption

As we have seen earlier, CAD is a technology used in garment manufacturing. The study focuses on the concept of CAD technology adoption and adoption models as discussed below. Society for Economic and Social Transition (2002) concluded that the most serious problem identified in the SSI sector, including garmenting, is the use of outdated and obsolete technology by a large number of units and the inability or even the unwillingness of the owners and managers to upgrade to modern and appropriate technologies which would enable them to improve the quality of their products to international standards, reduce production costs and improve the profitability of their units. The responses received in the study indicates that the adoption of improved technology is a complex issue in which factors other than availability of finance and access to the desired technology are also involved.

Therefore, the basic premise of the proposed study is that there is a low adoption of Apparel CAD among Indian apparel firms. As per the estimates by Technopak report 2018, there are approx. 30,000 garment manufacturing units with a minimum 225 sewing machines across the country. Based on the researcher's interactions with many leading apparel CAD suppliers, the present status of garmenting units owning CAD systems are roughly around 5.5%.

Technology Acceptance Models

Information Technology acceptance or adoption has received considerable attention in the last decade (Qingxiong & Liping, 2004). Technology acceptance research has attracted several theoretical perspectives including the technology acceptance model (TAM), the theory of planned behavior (TPB), and, recently, the unified theory of acceptance and use of technology (UTAUT) (Agarwal 2000; Venkatesh et al. 2003).

In the Technology Acceptance Model, there are two determinants which includes, perceived ease of use and perceived usefulness. Perceived usefulness is the degree to which an individual believes that using a particular information system or information technology would enhance his or her job or life performance.

Perceived ease of use is the degree to which a person believes that using a particular information system or information technology would be free of effort.

The impact of the perception of stakeholders has been measured using the Technology Acceptance Model (TAM).

Summary of the literature reviewed

The operations in Garment Manufacturing units can be classified into Pre-sewing, Sewing and Post-sewing operations. The major activities of pre-sewing operations are Pattern Making, Grading and Marker Making. Computer Aided Design Systems in pre-sewing operations have numerous benefits such as Improved productivity, Shorter lead times, Reduced personnel requirements, Customer modifications are easier to make, Improved accuracy of design, Provides better functional analysis to reduce prototype testing, Designs have more standardization, Better designs provided, Improved productivity in tool design, Better knowledge of costs provided etc.

Technology Acceptance Model (TAM) is one of the most influential research models in studies of the determinants of information technology acceptance to predict significance of using information technology by individuals. An experimental study carried out by V Parthasarathi (2010) comparing the pre-sewing operations of two garment units (i.e. CAD/CAM unit vis-à-vis Manual unit) reveals that the unit that uses CAD/CAM applications has achieved better results in the pre sewing operations

Although technological interventions are applicable in the entire garment manufacturing processes, application of

Computer Aided Design (CAD) in pre-sewing processes like pattern making, grading, marker making etc. and its effectiveness is unquestionable. Nevertheless, its penetration in Indian apparel manufacturing is far from below owing to unknown reasons.

Such low adoption rate of CAD despite its numerous benefits poses an academic interest and found worthy of research especially having spent about a quarter of a century by the researcher directly on the use of CAD. Therefore the researcher intends to study the perceived usefulness, ease of use, cost-benefit of Apparel CAD in improving garment manufacturing efficiency by different stakeholders and to assess the sufficiency of such factors in explaining the reasons for low adoption.

Research Design and Methodology

The research focuses on assessing the perception of stakeholders regarding usefulness and ease of use of Apparel CAD systems in garment manufacturing units. The stakeholders in this study are listed below:

a. Middle-Level Managers & Supervisory level executives
b. Apparel CAD practitioners
c. Academicians in the field of garment manufacturing
d. Students in the field of garment manufacturing

Objectives of the Study

For the present research study, the following research objectives were formulated.

- To assess the perception of different stakeholders across India on the adoption of Apparel CAD in Indian Apparel Manufacturing Industry
- To ascertain the usefulness and ease of use of CAD in Apparel Manufacturing.

The following hypotheses were formulated and tested for the aforesaid objective and relationships besides carrying out the descriptive study.

1. There is a significant difference in mean perception of different category of Stake-holders regarding usefulness of CAD
2. There is a significant difference in mean perception of different category of Stake-holders regarding ease of use of CAD
3. Adoption of CAD depends on volume of production.
4. Adoption of CAD depends on type of garments produced.

5. Adoption of CAD depends on education/training

Research Design

This doctoral research has adopted the research design involving a combination of both qualitative and quantitative methods through the usage of the Technology Adaption Model. This has further been discussed in the section below.

Sample Design

As mentioned above the study had four types of respondents i.e., managers/ supervisors, CAD operators, academicians and students.

1. **Target population:** The population for the managers / supervisors, CAD operators was garment manufacturing units located anywhere in India having minimum 225 sewing machines. There are approximately 30,000 garment manufacturing units matching this characteristics (Technopak, 2018).
2. **Sampling method:** Owing to the absence of a sample frame of garment manufacturing firms, a non-probability sampling method specifically judgmental / purposive sampling method was used while selecting samples from garment manufacturers.
3. **Sample size:** The researcher attempted to find the formal size of apparel manufacturing industries available in India. However, there is no such published or official statistics available. As apparel manufacturing industry is highly fragmented, unorganized and spread across different clusters in India, the discussion with industry experts, study report on "Garment Sector to understand their requirement for Capacity building" by Technopak (January 2018) lead to the estimate of 30,000 (approx.) apparel manufacturing units across the country with minimum 225 sewing machines. Accordingly the minimum sample size with an approximate population of 30,000 was calculated by using the Yamane method.

As per the report published by NIFT (2011) on the number of fashion design institutes in India, there are163 institutes offering UG level Fashion Design Courses in India. Out of a total of 163 institutes offering Fashion Design courses, considering 40% of the institutes offering Garment Manufacturing Technology (GMT) courses, the total population workout as 520 academicians and 1950 GMT students

Time frame: The sample was collected over a period of seven months from June 2018 to December 2018

RESULTS AND DISCUSSION

Introduction

This section deals with the statistical analysis of the data keeping in view the research objectives. After completion of full-fledged survey with finalized questionnaire, data was arranged in an orderly fashion. Prior to proceeding data analysis, reliability testing was done to check the internal consistency of the items used.

Structural Equation Modelling

Path Analysis - Structural Model Analysis

Description of TAM 3

A structural model based on TAM was developed in the AMOS. In the model, there are following sets of variables:

Table 4.153: Variables used in TAM model

Sr. No.	Observed, Endogenous	Observed Exogenous	Unobserved Endogenous	Unobserved Exogenous
1	Result Demonstrability (Demo)	Voluntariness (Volun)	Usefulness	e1
2	Output Quality (Quality)	Experience	Ease of Use	e2
3	Job Relevance (Relevance)			e3
4	Image			e4
5	Subjective Norm (Sub_norm)			e5
6	Objective Usability (Usab)			e6
7	Perceived Enjoyment (Enjoy)			e7
8	Playfulness (Playful)			e8
9	Computer Anxiety (Anx)			e9
10	External Control (Ext_cont)			e10
11	Self-Efficacy (Self_effi)			e11
12	Behavioural Intention (BI)			e12
13	ACTUAL_USE			e13
				e14
				e15

(Source: Based on research data)

In structural equation modeling endogenous variables are the variables computed within the model and exogenous are the variables computed outside the model. Observed variables are measured directly by researcher, while latent or endogenous and ‘e’ are unobserved variables, inferred by the relationships or correlations among the variables in the analysis. This statistical estimation is accomplished much in the same way that an exploratory factor analysis infers the presence of latent factors from shared variance among observed variables.

In SEM the relationships among independent (causes) and dependent (effect) variables are represented using path diagrams. Ovals or circles represent the unobserved, endogenous or latent variables, while rectangles or squares represent measured, exogenous or observed variables.

Model Run:

1. **Test of absolute fit:**

Notes on model fit in AMOS gives the details of adequacy of model. It uses chi-square statistic to see if model fits the data. In the output shown below, AMOS reports that minimum was achieved with no errors or warnings. The absence of errors or warnings means that it is safe to proceed and look at ***Fit Measures*** output.

Chi-square test of absolute model fit is sensitive to sample size and non-normality of distribution of input variables, one can look at various descriptive fit statistics to assess overall fit of model to data. Model may be rejected on an absolute basis but still one can claim that the given model outperforms some other baseline model by substantial amount. Put another way model is substantially less false than a baseline model, typically the ***independence model***.

Fit Measures:

The validity of the modified model is verified by the goodness of fit indices. The CMIN/DF value is 2.804, which is clearly within the acceptable limit and indicates that the tested model is the best fitting model for the given data and there is less probability that a better model than this can be found. TLI = 0.987, CFI = 0.994 and RMSEA=0.03 are very well above acceptable fit of the model. Considering the various fit measures, the model can be said to be valid and perfect fit for the data i.e., the model is proved empirically true.

Table 4.155: Goodness of Fit Indices

Goodness-of-fit model index	Estimated Value
Chi-square/Degree of freedom (CMIN)	2.804
Tucker-Lewis Index (TLI)	0.987
Comparative Fit Index (CFI)	0.994
RMSEA (Root Mean Square Error Approximation)	0.03

(Source: Based on research data)

Though absolute measure shows that model does not fit the data well, the other relative fit measures such as CMIN, TLI, CFI and RMSEA show that the model out performs the saturated and independence model and hence can be considered as adequate model which fits the data.

Interpretation of the findings

Since the obtained model fits well and that is theoretically consistent and it provides statistically significant parameter estimates, one can interpret it and draw the conclusions to support the hypothesis.

In the model there are perceived usefulness and perceived ease of use with two moderators experience and voluntariness.

There are 5 determinants of perceived usefulness – subjective norm, quality, relevance, image and result demonstrability. All the regression coefficients of these variables are very significant which means that they contribute to the usefulness significantly.

Similarly 6 determinants of ease of use are enjoyment, computer playfulness, Computer anxiety, Perception of external control, perception of self-efficacy and objective usability. They are contributing significantly to the ease of use.

Ease of use is the significant determinant of Behavior Intention (BI), while usefulness and voluntariness make no significant contribution.

Actual Use has two highly significant determinants – External control and quality. However experience, ease of use and relevance also contribute significantly.

The two moderator variables also contribute significantly to the usefulness. Voluntariness also contributes significantly to the ease of use.

TAM structural model suggests that if managers need to increase the behaviour intention to use CAD, the usefulness and ease of use should be increased. In addition the results show that increasing the ease of use can increase the actual use of apparel CAD. Therefore, the stakeholders need to create user manuals and provide better training for increasing the intention to use CAD.

CONCLUSION

Introduction

This chapter explains a brief of the research topic and summarises the outcome of the research in terms of various analyses conducted on the data such as descriptive analysis, hypotheses testing and Structural Equation Modelling as given below:

Descriptive Conclusions derived from Survey results

The survey results gave various conclusions regarding the varied response among the stakeholders.

The stakeholders from Academics that are teachers and students felt that the CAD is easy to use as its user friendly; further, usage of CAD improves accuracy and reduces time. The responses for the same from CAD practitioners in industry were also in tandem with that of academic sector. However, industry managers were found to have less confidence on the benefits offered by CAD state above.

The actual respondents involved in direct application of CAD that is the academic students and the CAD practitioners from industry, both were keen on working with CAD and learning CAD. Whereas the other two sectors who are indirectly involved with the usage of CAD were found to be less keen on learning and using CAD. About, CAD tools with active experimentation to be a fun activity, academic teachers were found to agree to this the maximum, because of the reason that it enables them to make students lean it faster and efficiently. The industry respondents didn't have much affirm opinion on the same.

Inferences drawn from Analysis of variance and Post-Hoc test

Analysis of variance was also carried out to test the responses for being statistically significant. Further, Post-Hoc test was also carried out to reinforce the findings.

It was observed that the opinion on Subjective Norm between respondent groups differs significantly. In order to check further Post Hoc test was carried out. It showed that the opinion of Industry Managers differs significantly with Industry CAD Practitioners and with Academic Teachers. It further showed that the opinion of Industry CAD Practitioners differs significantly with Industry Managers and Academic Teachers. Also the opinion of Academic Teachers differs significantly with Industry Managers. The opinion of

Academic Students differs significantly with Industry CAD practitioners.

It was further observed the opinion on Image between groups also differed significantly. Post Hoc test was carried out which showed that the opinion of Industry Managers differs significantly with Industry CAD Practitioners, Academic Teachers and Academic Students. Industry CAD Practitioners differs significantly in their opinion with Industry Managers, Academic Teachers and Academic Students. Opinion of Academic Teachers varies significantly with Industry Managers, Industry CAD Practitioners and Academic Students. The opinion of Academic Students varied significantly with Industry Managers, Industry CAD Practitioners and Academic Teachers.

Also the opinion on Job Relevance between groups differs significantly. In order to check further Post Hoc test was carried out. It shows that the opinion of Industry Managers differs significantly with Industry CAD Practitioners. Industry CAD Practitioners differs significantly in their opinion with Industry Managers, Academic Teachers and Academic Students. Opinion of Academic Teachers vary significantly with Industry CAD Practitioners. The opinion of Academic Students varies significantly with Industry CAD Practitioners.

Similarly, it was observed that the opinion on Output Quality between groups differs significantly. In order to check further Post Hoc test was carried out. It shows that the opinion of Industry Managers differs significantly with Academic Teachers. The opinion Industry CAD Practitioners did not differ significantly with any other category of response. Opinion of Academic Teachers vary significantly with Industry Managers. The opinion of Academic Students did not differ significantly with any other category of response.

The opinion on Result Demonstrability between groups differs significantly. In order to check further Post Hoc test was carried out. It shows that the opinion of Industry Managers differs significantly with Academic Students. Industry CAD Practitioners differs significantly in their opinion with Academic Students. Opinion of Academic Teachers did not differ significantly with any other category of response. The opinion of Academic Students varies significantly with Industry Managers and Industry CAD Practitioners.

It was noticed that the opinion on Usefulness between groups differs significantly. The Post Hoc test also shows that the opinion of Industry Managers differs significantly with Industry CAD Practitioners and Academic Teachers. Industry CAD Practitioners differs significantly in their opinion with Industry

Managers. Opinion of Academic Teachers vary significantly with Industry Managers. The opinion of Academic Students did not differ significantly with any other category of response.

It was observed that the opinion on Computer Self Efficacy, Perception of External Control and Computer Anxiety between groups does not differ significantly. The same was confirmed across all category of respondents through Post Hoc test as well.

The opinion on Computer Playfulness between groups differs significantly. In order to check further Post Hoc test was carried out. It shows that the opinion of Industry Managers differs significantly with Academic Teachers and Academic Students. Industry CAD Practitioners differs significantly in their opinion with Academic Teachers and Academic Students. Opinion of Academic Teachers vary significantly with Industry Managers and Industry CAD Practitioners. The opinion of Academic Students varies significantly with Industry Managers and Industry CAD Practitioners.

Lastly ANOVA test also confirmed that the opinion on Perceived Enjoyment between groups differs significantly. In order to check further Post Hoc test was carried out. It shows that the opinion of Industry Managers differs significantly with Academic Teachers and Academic Students. Industry CAD Practitioners differs significantly in their opinion with Academic Teachers and Academic Students. Opinion of Academic Teachers vary significantly with Industry Managers and Industry CAD Practitioners. The opinion of Academic Students varies significantly with Industry Managers and Industry CAD Practitioners.

Hypothesis Testing using ANOVA also shows that there is a significant difference in perception of usefulness of Apparel CAD among 4 groups. This proves that there is a gap between the stakeholders in usefulness of Apparel CAD which leads to low adoption of CAD in Indian Garment industry

The analysis shows that there is a significant association between Production Volume and Purchasing Apparel CAD ($P=0.00$ i.e. < 0.001). Ownership of Apparel CAD increases with volume of production. This also signifies the low adoption of CAD in Indian Garment Industry as maximum numbers of units are in the category of small units. Here, Factory owners with higher production volume tend to possess use of Apparel CAD more.

Further the Chi Square showed that Apparel CAD doesn't depend on complexity of products. It was signified when there was no significant association between product categories and purchasing Apparel CAD was found.

The analysis also showed that there is a significant association between education and usage of Apparel CAD. This signifies that more the entrepreneurs and Industry managers will be educated, more they will be inclined towards usage of technology, in this case Apparel CAD.

Inferences drawn from Structural Equation Modeling

A structural model based on Technology Acceptance Model (TAM) was developed in the AMOS, statistical software, which is an added module of SPSS, was used for Structural Equation Modeling.

The validity of the model was verified by the goodness of fit indices. The CMIN/DF value was 2.804, which was clearly within the acceptable limit and indicates that the tested model is the best fitting model for the given data. From the above analysis one can conclude that all the four stakeholders are of the opinion that adoption of CAD system in garment manufacturing units are beneficial and should be used.

The TAM test proved that Ease of Use is the significant determinant of Behaviour Intention whereas usefulness and voluntariness make no significant contribution. This concludes that usage of Technology and software is preferred by the users on Ease of Use than on usefulness. This gives a further recommendation to the CAD suppliers to make the software in lighter versions (may not cover all the features as usefulness is not a criteria) for small factories with a lesser price but it should be easy to use and understand by industry managers, entrepreneurs and practitioners.

The 6 determinants of ease of use i.e. enjoyment, computer playfulness, computer anxiety, perception of external control, perception of self-efficacy and objective usability contribute significantly to the ease of use. The CAD technology providers while redesigning CAD software interface to increase user adaptability in Indian Garment Industry can adapt these factors.

Ease of use is the significant determinant of Behavior Intention (BI), while usefulness and voluntariness make no significant contribution which implies that the CAD manufacturers can provide a lighter version of the software for small scale factories with a focus to increase user adaptability based on the interface which will be easy to use.

TAM structural model suggests that if managers need to increase the behaviour intention to use CAD, the usefulness and ease of use should be increased. In addition the results show that increasing the ease of use can increase the actual use of apparel CAD. Therefore, the CAD companies need to create user manuals and provide better training for increasing the intention to use CAD.

Further study can be done on the adaptability of lighter version of CAD Modules with ease of use and cost effectiveness, which can increase its adaptability in Small Scale units. Also, research can be done to fill the gap between different stakeholders through training and awareness of CAD.

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