ADOPTION OF CAD IN APPAREL MANUFACTURING UNITS- A PERCEPTION ANALYSIS

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ABSTRACT

This paper attempts to highlight the motivations and barriers towards CAD adoption among stakeholders in the Indian apparel manufacturing sector. Interactions with many leading garment manufacturers reveal that the low adoption rate of Apparel CAD can be attributed to several factors, which include lack of trained manpower to manage the improved technology, 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 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 the impact of technology advancements lead to the genesis of this study.

Keywords: *CAD, TAM, Apparel Manufacturing, ANOVA, Correlation*

INTRODUCTION

CAD technology is a crucial element in the production process and has a major role to play in the dynamic changes in the textile and apparel industry. 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 units is roughly around 10 % whichis abysmally low in comparison to units in leading garment exporting countries. Such low adoption rate of CAD despite its numerous benefits pose an academic interest and found worthy of research especially having spent about a quarter of a century by the researchers directly on the use of CAD. The paper dwells into the perceived usefulness, ease of use, cost-benefit of Apparel CAD in improving garment manufacturing efficiency by different stakeholders. It also attempts to assess the sufficiency of such factors in explaining the reasons for low adoption.

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). The most widely employed model of IT adoption and use is the technology acceptance model (TAM) that has been shown to be highly predictive of IT adoption and use (Davis, Bagozzi, &Warshaw, 1989; Adams, Nelson, & Todd, 1992; Venkatesh& Davis, 2000; Venkatesh& Morris, 2000)

The paper focuses on determining the status of apparel CAD technology by assessing the installation and update of the software, the purpose for which the software is being used, the people involved, and the overall perspective of the return they get on investing on

CAD technology. It focusses on the perception of different stakeholders across India on the adoption of Apparel CAD in Indian Apparel Manufacturing Industry. Paper aims to ascertain the usefulness and ease of use of CAD in Apparel Manufacturing as perceived by different stakeholders. Further attempt has been made to establish relation between adoption of CAD with education/ training given for the software, volume of production, and type of garments produced.

EXPERIMENTAL PROCEDURE

Descriptive survey research design was employed to gather information about the status of adoption and the attitude of selected apparel manufacturing organizations. A survey of 80 respondents from various categories of stakeholders was conducted which included garment manufacturers for domestic retailers and exporters. The stakeholders proposed to be included for the study were categorized as listed below:

a. Decision makers of apparel manufacturing
b. Apparel CAD practitioners;
c. Academicians in the field of Garment Manufacturing;
d. Students in the field of Garment Manufacturing;

20 respondents from each category were stratified. The data gathered was analyzed using SPSS software and key findings have been included in the preceding section.

RESULTS AND DISCUSSIONS

Table 1: Distribution of Respondents by Age

Age Group	Number	Percentage
18-29 years	38	47.5
30-39	20	25.0
40 & above	22	27.5
Total	80	100.0

As observed from Table 1 a significant number representing the sample belonged to the age group of 18-29 years.

Table 2: Distribution of Respondents by Availability of CAD System

	Number	Percentage
Yes	71	88.8
No	9	11.3
Total	80	100.0

Source : Based on survey data

As reported in Table 2, majority (88%) of the respondents had CAD systems within the organization.

Table 3: Purpose(s) for which Apparel CAD system is being used

Description	Number	Percentage
For creation of first patterns	69	86.4%
For digitizing the patterns	62	77.3%
Alterations in patterns	53	66.7%
Grading	70	87.9%
Marker planning	69	86.4%
3D Virtual Sampling	18	22.7%
Others	8	10.6%

Source : Based on survey data

An important inference drawn from Table 3 is that majority of the cases,CAD system was largely used for 2D applications. Only 22% of the respondents were using 3D CAD.

Table 4: Awareness of any CAD systems

Awareness	Number	Percentage
Not aware	3	3.8
Slightly aware	7	8.8
Moderately aware	2	2.5
Fairly aware	16	20.0
Extremely well aware	52	65.0
Total	80	100.0

Source : Based on survey data

Out of all the respondents, majority of them were well familiar with CAD system. (65% extremely aware and 20 % fairly aware)

Table 5: Proficiency in any CAD systems

Description	Number	Percentage
Not Proficient	13	16.3
Slightly Proficient	2	2.5
Moderately Proficient	6	7.5
Fairly Proficient	20	25.0
Extremely Proficient	39	48.8
Total	80	100

Source : Based on survey data

A large number of respondents were found to be proficient in CAD systems (39% extremely proficient and 20 fairly proficient). It may be noted that 50 % of the sample includes faculty and students.

Correlation between awareness, proficiency, usefulness and ease of use of CAD was calculated using Pearson Correlation (r) coefficient and is reported below:

Table 6: Correlation between awareness, proficiency, usefulness and ease of use of CAD

		Awareness about CAD	Proficiency in CAD	Usefulness of CAD	Ease of use of CAD
Awareness about CAD	Pearson Correlation	1	.737**	.121	.259*
	Sig. (1-tailed)		.000	.142	.010
	N	80	80	80	80
Proficiency in CAD	Pearson Correlation	.737**	1	.081	.223*
	Sig. (1-tailed)	.000		.237	.023
	N	80	80	80	80
Usefulness of CAD	Pearson Correlation	.121	.081	1	.486**
	Sig. (1-tailed)	.142	.237		.000

	N	80	80	80	80
Ease of use of CAD	Pearson Correlation	.259*	.223*	.486**	1
	Sig. (1-tailed)	.010	.023	.000	
	N	80	80	80	80

As seen from the above table the correlation between awareness and proficiency is +0.737 and is statistically significant.

Further, one way analysis of variance was performed to testthe significance in perception of usefulness of CAD and ease of use among 4 differentstakeholders and the findings are reported in Table 7.

Table 7: Analysis of Variance

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Usefulness of CAD	Between Groups	3.764	3	1.255	5.426	.002
	Within Groups	17.571	76	.231		
	Total	21.334	79			
Ease of use of CAD	Between Groups	4.312	3	1.437	3.985	.011
	Within Groups	27.412	76	.361		
	Total	31.724	79			

As seen from the table above, there is a significant difference with regard to the usefulness of CAD among different category of stakeholders (P= 0.002). Also, there is a significant difference with regard to the Ease of Use of CAD among different category of stakeholders (P= 0.011).

Table 8: Multiple Comparisons

Dependent Variable	(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.
Usefulness of CAD	Decision maker	CAD practitioner	-.47941*	.15205	.024
		Academician	-.56324*	.15205	.005

		Student	-.27941	.15205	.344
	CAD practitioner	Decision maker	.47941*	.15205	.024
		Academician	-.08382	.15205	.959
		Student	.20000	.15205	.632
	Academician	Decision maker	.56324*	.15205	.005
		CAD practitioner	.08382	.15205	.959
		Student	.28382	.15205	.330
	Student	Decision maker	.27941	.15205	.344
		CAD practitioner	-.20000	.15205	.632
		Academician	-.28382	.15205	.330
Ease of use of CAD	Decision maker	CAD practitioner	-.44000	.18992	.156
		Academician	-.64000*	.18992	.014
		Student	-.40000	.18992	.227
	CAD practitioner	Decision maker	.44000	.18992	.156
		Academician	-.20000	.18992	.775
		Student	.04000	.18992	.998
	Academician	Decision maker	.64000*	.18992	.014
		CAD practitioner	.20000	.18992	.775
		Student	.24000	.18992	.661
	Student	Decision maker	.40000	.18992	.227
		CAD practitioner	-.04000	.18992	.998
		Academician	-.24000	.18992	.661

In Table 8, the mean difference is considered to be significant at 0.05 level. It can be inferred that CAD practitioners have a better perception about usefulness of CAD than Decision makers (P=0.024). Academicians have a better perception about usefulness of CAD than Decision makers (P=0.005). Also, academicians have a better perception about ease of use of CAD than Decision makers (P=0.014).

Further, t – test was conducted to check whether there is any significant difference between any formal training received by the respondents and their perception with regard to the usefulness and ease of use of CAD which is reported below in Table 9.

Table 9: Mean Scores

	Did you get any formal training on CAD?	N	Mean	Std. Deviation	Std. Error Mean
Usefulness of CAD	Yes	66	4.2981	.46176	.05684
	No	14	3.9874	.69942	.18693
Ease of use of CAD	Yes	66	3.9848	.59004	.07263
	No	14	3.6714	.78249	.20913

Table 10: Independent Samples t-Test for Equality of Means

		t-test for Equality of Means		
		t	Df	Sig. (2-tailed)
Usefulness of CAD		1.590	15.489	.132
Ease of use of CAD		1.701	78	.093

It can be seen from the above table that those who had received training had better perception about ease of use than those who did not. This confirms that training does help to enable ease of using the technology.

Table 11: Perception towards accuracy of creation of pattern shape on CAD

	Frequency	Percent
Neither Agree nor Disagree	5	6.3
Agree	27	33.8
Strongly Agree	48	60.0
Total	80	100.0

Table 12: Perception towards ease of learning CAD Softwares

	Frequency	Percent
Disagree	2	2.5
Neither Agree nor Disagree	10	12.5
Agree	39	48.8

Strongly Agree	29	36.3
Total	80	100.0

Table 13: Perception towards user friendliness of interface

	Frequency	Percent
Neither Agree nor Disagree	14	17.5
Agree	30	37.5
Strongly Agree	36	45.0
Total	80	100.0

Table 14: Perception towards use of CAD and category of garments produced.

		Product category									
		Men's wear		Women's wear		Kid's wear		Lingerie		Total	
		Count	%	Count	%	Count	%	Count	%	Count	N %
Use of Apparel CAD system/s	Yes	39	88.6	22	81.5	17	77.3	1	100.0	40	85.1
	No	5	11.4	5	18.5	5	22.7	0	0.0	7	14.9
	Total	44	100	27	100	22	100	1	100.0	47	100.0

Table 15: Pearson Chi-Square Test

Product category		
Use Apparel CAD system/s	Chi-square	9.616
	df	4
	Sig.	.047*,b,c

The Chi-square statistic is significant at the .05 level. More than 20% of cells in this sub-table have expected cell counts less than 5. There is an association between type of garments produced and use of CAD (P=0.047). Users of CAD are highest in Men's Wear (Excluding Lingerie category as only one respondent belonged to this category).

Table 16: Perception towards use of CAD and Volume of Production

			Production Volume (pcs/day)			Total
			< 1000	1000 - 2500	> 2500	
Use Apparel	Yes	Count	5	11	14	30

CAD system/s		%	16.7	36.7	46.7	100
	No	Count	1	5	0	6
		%	16.7	83.3	0.0	100
Total		Count	6	16	14	36
		%	16.7	44.4	38.9	100

Table 17: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.250[a]	2	.072
Likelihood Ratio	7.159	2	.028
Linear-by-Linear Association	2.091	1	.148
N of Valid Cases	36		

As observed from Table 17, there is no association between volume of production and use of CAD system (P=0.072).

CONCLUSIONS

The conclusions drawn from the analysis of the survey data are as given below.

- There is a significant difference in mean perception of different category of Stake-holders (P=0.002 and 0.011).
- CAD practitioners have a better perception about use of CAD than Decision makers (P=0.024).
- Academicians have a better perception about use of CAD than Decision makers (P=0.005).
- Academicians have a better perception about ease of use of CAD than Decision makers (P=0.014).
- There is a significant difference with regard to the usefulness of CAD among different category of stakeholders (P= 0.002)
- There is a significant difference with regard to the Ease of Use of CAD among different category of stakeholders (P= 0.011)
- There is no association in the perception of stake holders about use of CAD and volume of Production
- There is an association between Type of Garments and Use of CAD (P=0.047). Users of CAD are highest in Men's Wear.
- There is a difference in mean perception of the respondents regarding usefulness among the respondents who got training and respondents who did not get any training. (Got Training 4.2981, without training 3.9874). The respondents who got training is of the opinion that the usefulness of CAD is better compared to the respondents without getting any training.
- There is a significant difference in mean perception of the respondents regarding ease of use among the respondents who got training and did not get any training. (Got Training 3.9848, without training 3.6714). The respondents who got training is of the opinion that the ease of use of CAD is better compared to the respondents without getting any training.

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