Una observación sobre los procesos asistidos por ordenador en la producción de prendas de vestir. Comparación y análisis del software CAD/CAM en Bangladesh

An observation toward Computer aided processes in Garments production. Comparison and analysis of CAD/CAM Software in Bangladesh

Md. Shazzat Hossain[1], Md. Abdus Samad [2], Md. Hasan Ali [3], Prahlad Sutradhar[4], Jubayer Islam[5], Md. Hazrat Ali[6], Md Al-Amin[7,] Md. Zahir Uddin Babar[8], Md. Rezaul Karim[9,] Mohammad Ullah[10]

[1,2,3,4,5] University of Dhaka. Dhaka, Bangladesh.
[6,7] Bangladesh University of Textiles . Dhaka, Bangladesh.
[8] Green University of Bangladesh. Dhaka, Bangladesh.
[9] University of Rajshahi. Rajshahi, Bangladesh.
[10] Khulna University of Engineering and Technology. Khulna, Bangladesh.

[*] Autor para correspondencia:

Resumen

Este trabajo de investigación indaga sobre los diferentes atributos de los procesos asistidos por ordenador en la producción de prendas de vestir. Esta perspectiva de investigación fue realizada por nuestro valiente equipo de 2021 a 2022. Revela información adecuada sobre la intención de la industria de la confección y los criterios para la elección de software CAD/CAM. Por el bien de esta investigación, hemos visitado más de 600 industrias para recopilar datos en bruto; Cada industria trató de asistir a esta investigación de una región diferente de Bangladesh de buena gana. Después de recoger todos los datos en bruto de la industria de la confección. Los datos de la industria de prendas de vestir fue coordinado por el programa Excel. Consecuentemente, los datos fueron analizados e implementados estadísticamente para identificar los atributos de la Industria de la Confección para la satisfacción con el software CAD/CAM. Este proceso también detecta muchos retos y define y aconseja una solución adecuada a los problemas a los que se enfrenta la industria de la confección en la situación actual. Este trabajo de investigación muestra información adecuada sobre los criterios y la demanda de la industria de la confección a la hora de adquirir software asistido por ordenador.

Palabras clave: Software CAD y CAM textil, diseño asistido por ordenador, fabricación asistida por ordenador, proceso asistido por ordenador, software CAD y CAM de prendas de vestir.

Abstract

This research paper inquires about different attributes of Computer-aided processes in garments production. This perspective Research was done by our courageous team from 2021 to 2022. It reveals adequate information on the Garments industry's Intension and criteria for choosing CAD/CAM software. For the sake of this Research, we visited more than 600 industries to gather raw data; Every Industry tried to attend this Research from a different region of Bangladesh willingly. After collecting all raw data from the garments industry. The data of the Garments industry was coordinated by Excel program. Consequently, the data was analyzed and implemented statistically to identify the Garments Industry attribute for satisfaction with CAD/CAM software. This process also detects many challenges and defines and advises a proper solution to the problems that the Garments industry is facing in the current situation. This research paper demonstrates adequate information about the Garment's criteria and demand in purchasing garments Computer-aided software.

Keywords: Textile CAD and CAM software, Computer aided design, computer aided manufacturing, computer aided process, Garments CAD and CAM software.

Introducción

Nowadays, the garments industry faces numerous problems that must be addressed through constant stamina and Targeted Research. Insufficiency is the constant companion of Bangladesh that surprisingly influenced Industry behavior [1]. The clothing market is dependent on foreign buyers because of targeted profit. Nevertheless, in this Modern period, buyer expectation is higher than usual. So every industry focuses on buyer demand and satisfaction. Buying behaviors of a Buyer and uses of the Computer-aided software of industry rely on different aspects of retention, perception, financial state, and the other Circumstance. Owing to the issue, every vendor needs to realize what the industry is willing to buy and use and what affects Buyer satisfaction [5]. With the modern revolution, industry and buyer behavior have alternated dramatically in the past few years. Every Buyer focuses on their money and how they spend more than ever before, Rather than wasting energy and time. The Buyer wants products that satisfy their Criteria, and the industry relies on some affordable attributes [6]. Foreign buyers are not a complicated attitude but are harder to define [3].Computer-aided processes play a very far-reaching role in garment production. The CAD and CAM software is Garments products capable of enhancing garment production. It also played a vital role in Buyer satisfaction and provoked buyer loyalty, which impacted the specific company's reputation. The majority, Companies are aware of increasing the production flow of an industry [7]. However, it depends on many affordable attributes [1]. Now a day, the demand has increased dramatically in the marker [10]. Hence, this Research focuses on the present study to explore the garments industry behavior in using CAD/CAM software and Buyer satisfaction. Regarding performing the research analysis, The garments industry and buyer satisfaction were treated as the root point. Eventually, the Different

Respondent sentiment was considered about the Attribute of garments Cad and Cam software.[11] . This Research detects the preferable Attribute for Using the behavior of Garments Computer aided process [2].

Procedure

The goal of this inquiry was to collect the data with specific Research on numerous Bangladeshi Garments industry on the different aspects such as quality, time, performance, price, mistake, production size, prices, etc. The Buyer expectation was implemented using targeted Research [12]. The Cad and cam users experimented with specific designing with buyer requirements. They enabled the Buyer to write their honest opinions and expectation of demand about the Cad and cam software [2]. The Goal of this inquiry was to collect the data with a specific research of numerous Bangladeshi Garments industry on the different aspects such as quality, time, performance, price, mistake, production size, prices, etc. The Buyer expectation was implemented by using targeted research [12] . The Cad and cam user were experimented with specific designing with buyer requirements. This enabled the Buyer to write their open opinions and expectation of demand about the Cad and cam software [2].

Obstacle Analysis

The analysis has been performed to detect Buyer demand and the Attribute of Cad and cam software. Simultaneously it determines the industry aspects of using specific software and its root causes *[13]*. The general Research was conducted through Cad and Cam engineers in the targeted industry, and this study tried to focus on the Buyer's needs. This Research was initially carried out to collect valuable data with Targeted criteria that create a sense of overall behavior for Industry and Buyers. Overall, using software's behavior positively impacts both Attribute and gratification, ultimately leading to customer Satisfaction *[4].*

Evolve Questions

The provided questions and experiments are created to adequately collect information to construct a view of a user and Buyer's intentions regarding disjunction variables such as time, price, activity, design quality, preference, and reason for using specific software and Buyer expectation *[5]*. The user can answer with "a tick mark" and show their experiments in garments CAD and CAM lab. This study expounds on the psychology of different users regarding Garments CAD and CAM software and Buyer demands *[8].*

Data assortment and Inspect

There were 600 users and 600 buyers attending this research experiment; most were aged 18 to 55. Most respondents are Bangladeshi users and foreign buyers [14]. Most of the experiments and interview locations were chosen at the industry lab, where engineers from different industries use their CAD and CAM software *[9]*.

Final Data Scraping and Analysis

Final Data scraping and analysis was a very challenging part of this Research. Because we have focused on 2 sites-

    1] User experience and satisfaction

    2] Buyer criteria and demands

    Data analysis is regulated through the User intention and faculty to use specific software in fewer worthwhile groups. In the same way, it analyzed the Buyer's demands. The statistical data analysis succeeds using the process of an open coding system. Consequently, this method of data analysis permits us to illustrate the actual data *[6]*

Magnitude and measurement

For data collecting, we tried to make a sample size of 600 Industry Users for respondents we took to ensure adequate ratios where most respondents are directly CAD and CAM software experts. On the other hand, we have collected information from more than 600 buyers about why they require and Satisfy with specific software *[4]*. Eventually, the authors can collect Data and information from respondents from 5 different Industrial areas such as Dhaka, Tangail, Gazipur, Narayanganj, and Narshingdi *[2]*

Data manipulation and Integration

    Data integration is a vital element of quality research, where this process considers several analyses with some data points *[15]*. It controlled ideal and correct decisions with decreasing misleading data. This process can evaluate and recognize data where the specific statistics come from respondents. That is why this combination is implemented for quality results *[6]*

Primary analysis & Discussions

1st and 2nd Priority level To Using CAD/CAM software For a Software user:

In this analytics, two specific charts represent the priority level of the different users with some attributes. However, the line and bar charts represent exact data and the same value differently. The Research Determine that the majority of the Software user give first preference to production and second priority to the quality of the Software performance and production. According to the linear priority level, this is clear that the highest preference is production size with minimum time. So every user of an industry chooses the software with Bulk production to save valuable time. The following Line chart shows the highest priority for software production, where first and second priority accounted for 71.50% and 69.08%, respectively. The bar diagram clearly expressed that the price, speed, and mistake are the maximum preferences for second priority. The following line diagram shows the volume of each priority in percentage.
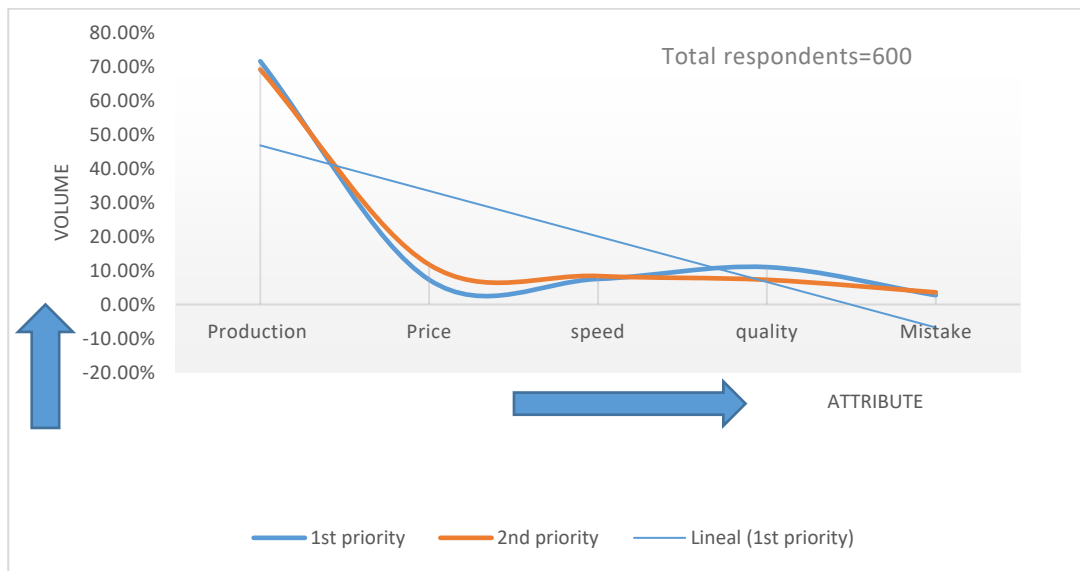

Figure 1: 1st and 2nd priority of software user with Line chart

This bar chart is illustrated the priority level of software user considering with some attribute. However the following bar diagram created with almost same data and value.
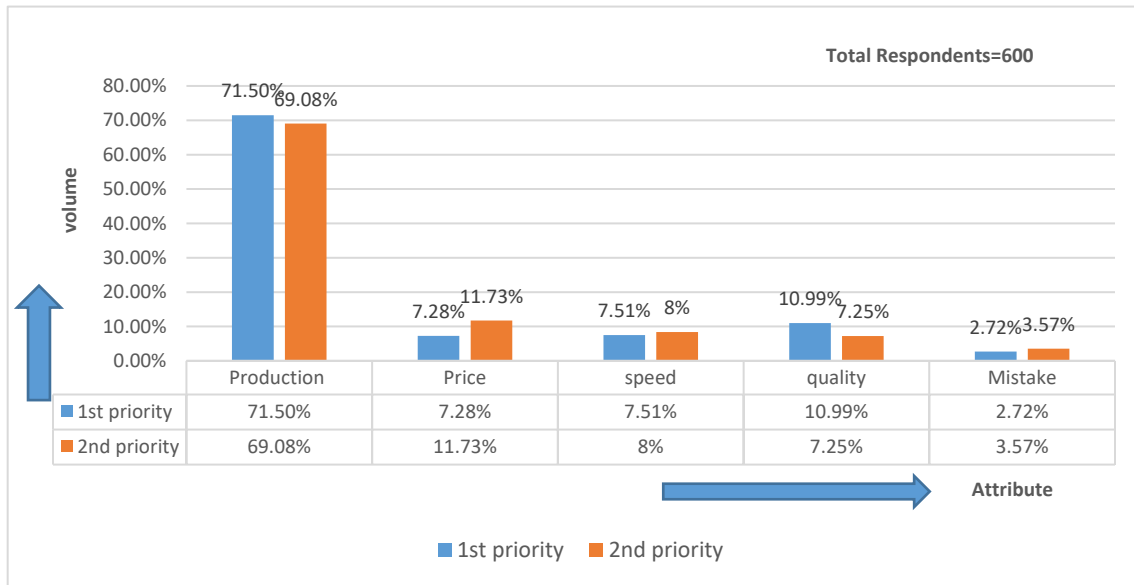
Figure 2: 1st and 2nd priority of software user with Bar chart

Here, in the upper following chart

Production = the amount of production per hour or per unit time.

Price = how much needed to buy a software/ the amount of money.

Speed= the software flexibility and how much it faster.

Quality= the quality of the design and final production

Mistake= the possibility of mistake when a software user working on a design.

Quality Selection of CAD and CAM software

For quality selection, Firstly, we have to choose five attributes, such as time to make a design, the software's brand, the software's price, the possibility of Mistakes when making the design, and the complexity of the software. A user is keen on software quality, which most users consider a maximum priority as the software brand and time for making a design. The priority accounted for Brand, Time, price, mistake, and complexity, respectively, 37%, 35%, 15%, 7%, and 6%, and it was followed by just 25%, 30%, 20%, 10%, and 15% for second priority. So, the user is Possibility of the mistake and Complexity of software in case of quality selection. The possibility of mistakes and complexity of software is almost identical for all types of software. People always try to focus on the brand and time to make a design. The volume of priority for quality is shown individually in the following bar chart and pie chart.
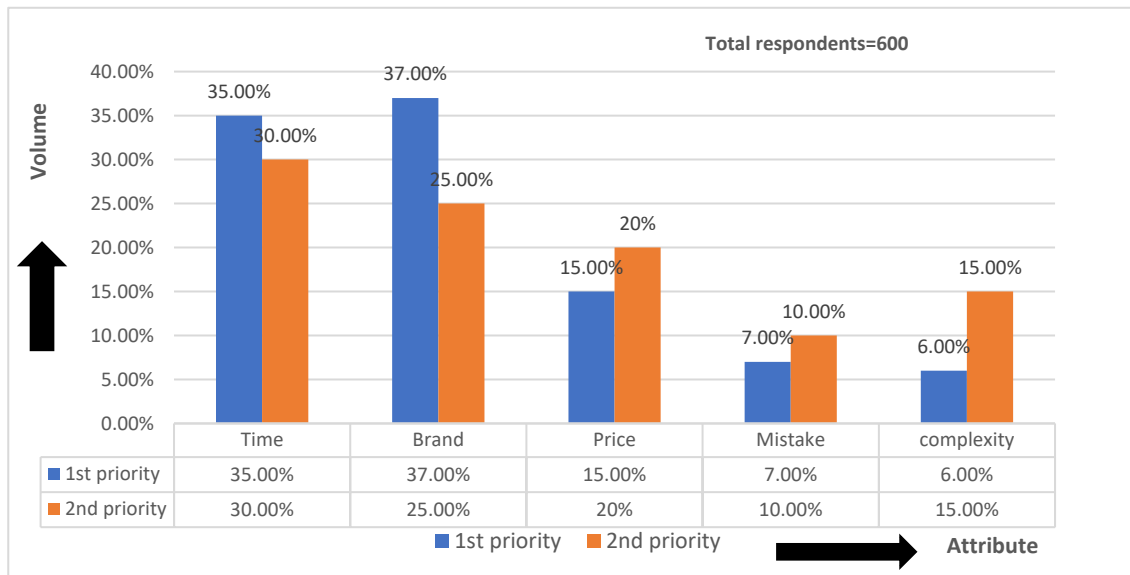
Figure 3: Bar chart for quality selection of CAD and CAM software

Buyer priority to select software with their satisfaction:

Most of the Buyers intended to Use branded and well-reputed company software rather than the price and speed of the software. However, the highest proportion of buyers chooses to use a software brand and the production quality, accounting for 60.59% and 39.41% for priority, followed by just 41.27% and 58.73%, respectively, for second priority. Among them, Buyers avoid the price of the software and how much faster it is. Buyers are confident that another software attribute will be better if the brand is well-reputed. That is why every Buyer avoided the price and faster properties of the software. So a buyer chooses the best-branded software like Lectra or Optitex software. However, Buyer focuses on Lectra software in the first place. The software selection priority percentage is shown in the following bar chart.
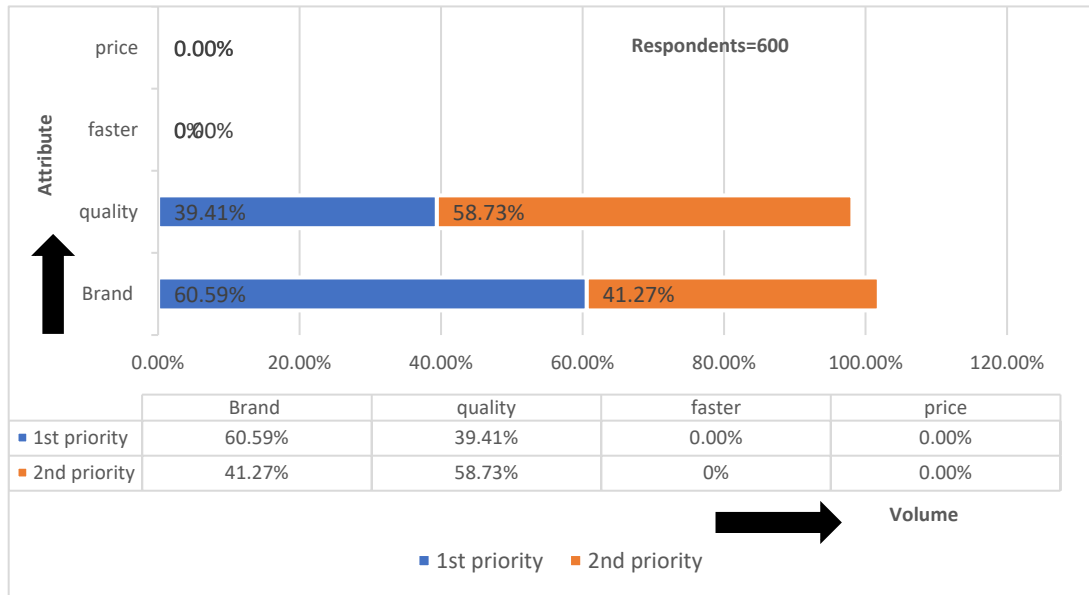
Figure 4: Buyer priority for software selection with bar chart

How garments industry and buyer awareness increases over time:

This Bar chart and line chart are created with the same data and properties. However, both charts clearly expressed the industry and buyer awareness about using CAD/CAM software. There is little comparison of software price with their awareness over the period. For the last 6 years, the software price has gradually increased, and awareness has changed with the price. According to the chart, the software prices increased in 2016, 2017, 2018, 2019, 2020, and 2021 respectively, 50%, 52%, 54%, 56%, 57%, and 59%. From the line chart, it is found that buyer awareness was maximum in 2016 when the company used the software. However, industry awareness was lower than buyer awareness. However, gradually, industry awareness surpassed buyer awareness in 2021. The following bar sketch show the industry and Buyer awareness over time. However the Bar chart

	2016	2017	2018	2019	2020	2021
■ Price	50.00%	52.00%	54.00%	56.00%	57.00%	59.00%
■ Industry Awarness	35.00%	42.00%	53%	60.00%	70.00%	80.00%
■ Buyer awarness	45.00%	48.00%	55%	60.00%	63.00%	65.00%

Figure 5: Industry and buyer awareness overtime with bar chart

The Following line sketch is clearly illustrated the buyer awareness, industry awareness and price of the software. However this line sketch created with same data and same value. But this chart more clear explanation of awareness changing over time.

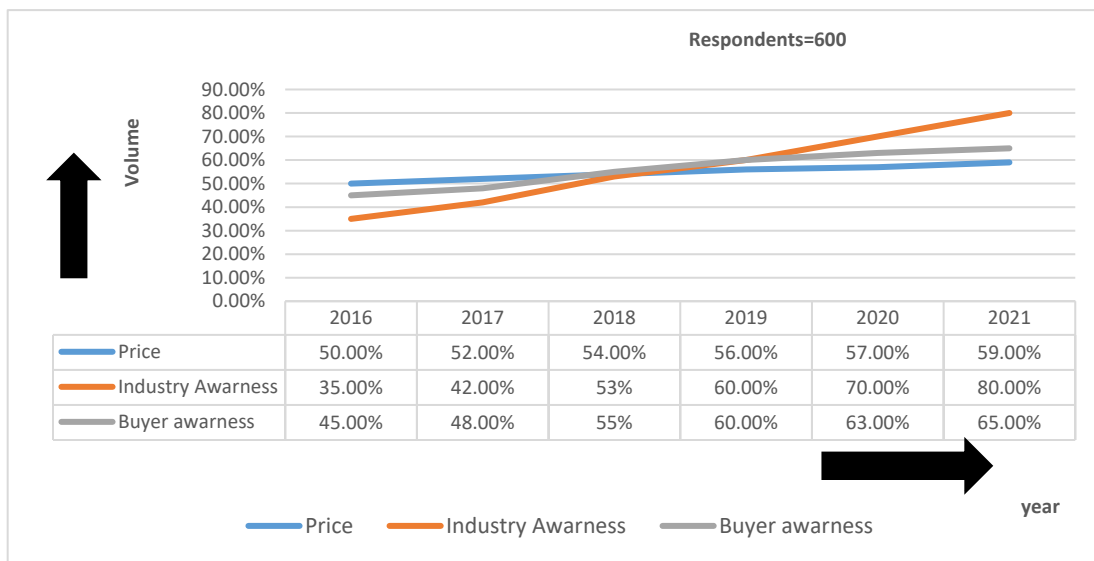|	2016	2017	2018	2019	2020	2021
Price	50.00%	52.00%	54.00%	56.00%	57.00%	59.00%
Industry Awarness	35.00%	42.00%	53%	60.00%	70.00%	80.00%
Buyer awarness	45.00%	48.00%	55%	60.00%	63.00%	65.00%

Figure 6: Industry and buyer awareness overtime with line chart

How industry user increased with software price:

The following line chart represents how the price of the software and software user changed over time. This analysis collects data from the last 11 years. The price of the CAD and CAM software increased and decreased over time from 2010 to 2020 which is accounted for 50% for 2010, 49% for 2011, 45% for 2012, 47% for 2013, 43% for 2014, 40% for 2015, 48% for 2016, 52% for 2017, 55% for 2018, 60% for 2019 and 60% for 2020. Where CAD/CAM software user increased 10% , 20% , 25% , 35% , 50%, 60% , 67% , 70% , 75% and 80% following by the year. The result of user with software price is shown in the following figure.
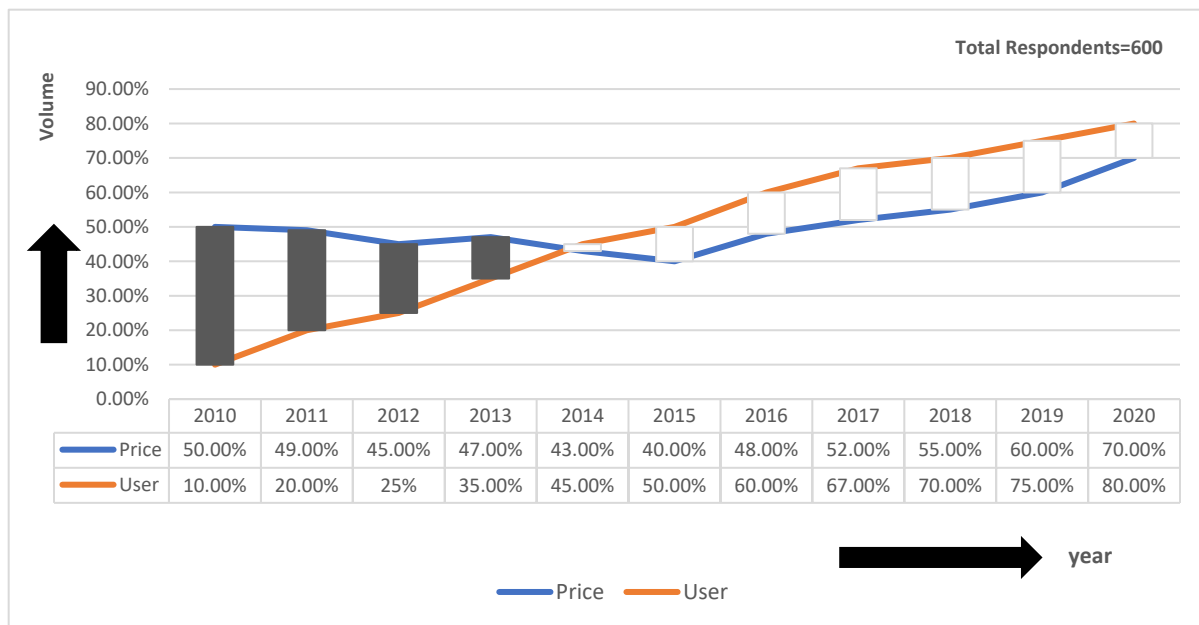

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Price	50.00%	49.00%	45.00%	47.00%	43.00%	40.00%	48.00%	52.00%	55.00%	60.00%	70.00%
User	10.00%	20.00%	25%	35.00%	45.00%	50.00%	60.00%	67.00%	70.00%	75.00%	80.00%

Figure 7: Industry user increasing trend with Software price

Most used software in Bangladesh with industry satisfaction:

This analysis primarily focuses on the final result of the whole Research because this Research represents which software is usually used by the industry for their satisfaction and why this software meets their industry criteria.

 The following chart explains the software name, number of the software user, type of factory, and price of the software in Bangladeshi currency, taka. However, more than 355 industries intended to use Lectra software. However, the price of the software is high, but most big factories like EPZ and others prefer to use Lectra Modaris software. On the other

hand, 150 industries like to use Optitex software. Most of the factories are medium class. So they never want to spend a big budget on buying Lectra software. The small factory chooses to use Gerber software for the low price. They choose Gerber for low prices and a small amount of production. Approximately 600 industries were attended in this Research. The following table shows the number of software user with different attribute.

Name of the software	Number of user	User percentage%	Type of factory	Price of software[Taka]
lectra	355	59%	Big factory	10,00000-15,00000
optitex	150	25%	Medium factory	300000 - 500000
Gerber	95	16%	Small Factory	250000-300000

Note: Number of respondents=600 industry

Table 1: Number of software user industry with a table

An actual Garments order sheet for analysis:

For the research purpose, we have the carry out a real test with a Buyer order sheet. Most of the respondents used their preferred software with specific measurements. The buyer KIABI company sends a requirement for a half shirt. The specific measurement below is in figure 1; on the other hand, figure 2 represents the half shirt's specific design style, where more than 600 respondents were directly involved with making this half shirt design.

We carefully observe the software performance when the software user is trying to make a design. Our observation includes some basic questions and parameters. Such as-

1. How much time is required to make this specific design?

II. The possibility of mistakes was carefully observed.

III. The production ability was calculated with this software.

IV. Quality of the final design

V. Quality of the final product with specific measurement.

VI. Buyer satisfaction

VII. Complexity of the design with the specific software, etc.

Where Lectra Modaris software performed terrifically, so every big, gigantic factory like EPZ, Square Fashions ltd, Denim, Ha-meem group, Beximco, DBL Group, Opex Sinha Group, Fakir Group, Epyllion Group, Standard Group, Asian Apparels Limited, Viyellatex Limited and the AJI group is using Lectra Modaris software.

On the other hand, Optitex is also better for medium-quantity production. The performance of using Gerber software is fewer users than in small factories. But for small production, this software suits. During our research we have tested more than 600 user with different measurement. The following figure 1 represent the measurement chart for the half shirt of KIABI company.

KIABI	TECHNICAL FILE : **ARKW22CDOM6** (ZH331)		GPM : TANT VALERIE			Version 1 - Page 4 / 6
	Season : HIVER 22		Designer : TRAN HUYEN TRAN			14-02-2022 09:49

Description : P6 SPE DOM TOM TH TROP 6 CHEMISE MC COL MAO IMPRIME ET UNI BCI COTTON

Technical description :

Market : KIDSBOY	Department : GRKIDS	Class : KIBSHIRTSS	Category : ALL	Typology : FVI	Type : SHIRT

Measurement chart >> SHIRT short sleeves

Measure		Ctrl	Tol +	Tol -	3A	4A	5A	6A	8A	10A	12A										Comment
AA - 1/2 Chest round-	CM	X	1.0	1.0	33.0	34.0	35.0	36.0	38.0	41.0	44.0										
WW - 1/2 Waist round	CM	X	1.0	1.0	32.0	33.0	34.0	35.0	37.0	40.0	43.0										
HWF - Front waist height from shoulder	CM		0.0	0.0	24.0	25.0	26.0	27.0	31.5	34.5	37.5										
VV - 1/2 Bottom round	CM		1.0	1.0	33.0	34.0	35.0	36.0	38.0	41.0	44.0										
CF - Front breadth	CM		0.5	0.5	24.5	25.5	26.0	27.0	28.5	31.0	34.0										Take at middle of armhole
CB - Back breadth	CM		0.5	0.5	25.0	26.0	26.5	28.0	29.5	32.0	35.0										Take at middle of armhole + back pleat closed
HSF - Front from shoulder lenght	CM	X	1.0	1.0	35.5	40.5	42.5	44.0	48.0	52.0	57.0										*
HSB - Back from shoulder length	CM	X	1.0	1.0	37.0	42.0	44.0	45.5	49.5	53.5	58.5										*
EB - Shoulder incline degree	CM		0.0	0.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0										
EA - Shoulder length	CM		0.5	0.5	7.5	8.0	8.5	9.0	10.0	11.0	12.0										At shoulder fold
EH - Armhole height	CM		0.5	0.5	13.5	14.0	14.5	15.0	16.0	17.0	18.0										
SHW - 1/2 Upper sleeve width	CM	X	0.5	0.5	11.0	11.5	12.0	12.5	13.5	14.5	15.5										
SWB - 1/2 Bottom sleeve (short)	CM	X	0.5	0.5	10.0	10.5	11.0	11.5	12.5	13.5	14.5										
SLS - Sleeve length (short)	CM	X	1.0	1.0	12.0	12.5	13.0	13.5	14.0	15.0	16.0										

Figure 8: KIABI company measurement chart for half shirt

Figure 9: CAD/CAM design for half shirt

Automatic template design system:

An automatic template design system is a process where a user is capable of making a CAD/CAM design with a previously created template. This Template provides the facility to make a garment design easily. This automatic template design system allows users to re-edit the design with their criteria [16]. A designer can re-edit the measurement

also. So the time to make a design is less in this automatic system. The purpose of discussing these properties is to make it clear which software consists of the highest facilities.

Where Lectra has a rich resource of automatic templates because Lectra is a software created by a well-reputed company, they are trying to develop the software within a period. They updated the software gradually and added a lot of automatic template designs. Optitex software recently added some automatic template design systems. Nevertheless, this is less effective compared to Lectra software.

On the other hand, Gerber still has backdated software compared to Lectra and Gerber. So this software has no resources for an automatic template design system.

Final analysis and discussion:

Now the final analysis is done from previous preliminary Research. The final analysis represents the actual parameter and Attribute, which is why a company chooses a specific software. The following table is more complex than the whole Research. Where it represents the different attributes, this specifically represents why companies choose software for their industry [12] . The positive Attribute of Lectra software is the quality of design, the possibility of mistake, and the production rate, which accounted for 98%, 8%, and 99%, respectively. Where Optitex is accounts for 80%, 15%, and 70%, respectively. The Gerber also accounted for 75%, 20%, and 50%, respectively. The possibility of the mistake of creating a design is less in Lectra, which plays an essential role in choosing Lectra.

However, Gerber and Optitex are faster, have minimum complexity, and fewer prices. Where Gerber accounted for 90%, 70%, and 25%. On the other hand, Optitex accounted for 80%

However, Optitex and Gerber have many more limitations than Lectra. The following bar chart represents the different Attributes with different software with the following data table.

| Software	speed	quality	mistake	complexity	price	production
lectra	75%	98%	8%	80%	100%	99%
optitex	80%	80%	15%	75%	35%	70%
gerber	90%	75%	20%	70%	25%	50%

Table 2: different attribute for a software

Here,

Speed = the working speed of the software

Quality =quality of the garments design which done by CAD/CAM software

Mistake= the possibility of mistake when a user using a software to making design

Complexity= how difficult the software to learn and how difficult to Operate the software

Price= price of the specific software to buy.

Production = production size or amount of production per hour.

= IT INDICATE POSITIVE IMPACT   = IT   INDICATE NEGATIVE IMPACT
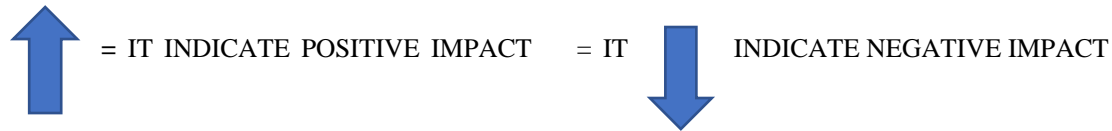
The following bar chart illustrated in accordance with data and value of table 2.which clearly explains the software popularity with user priority level.
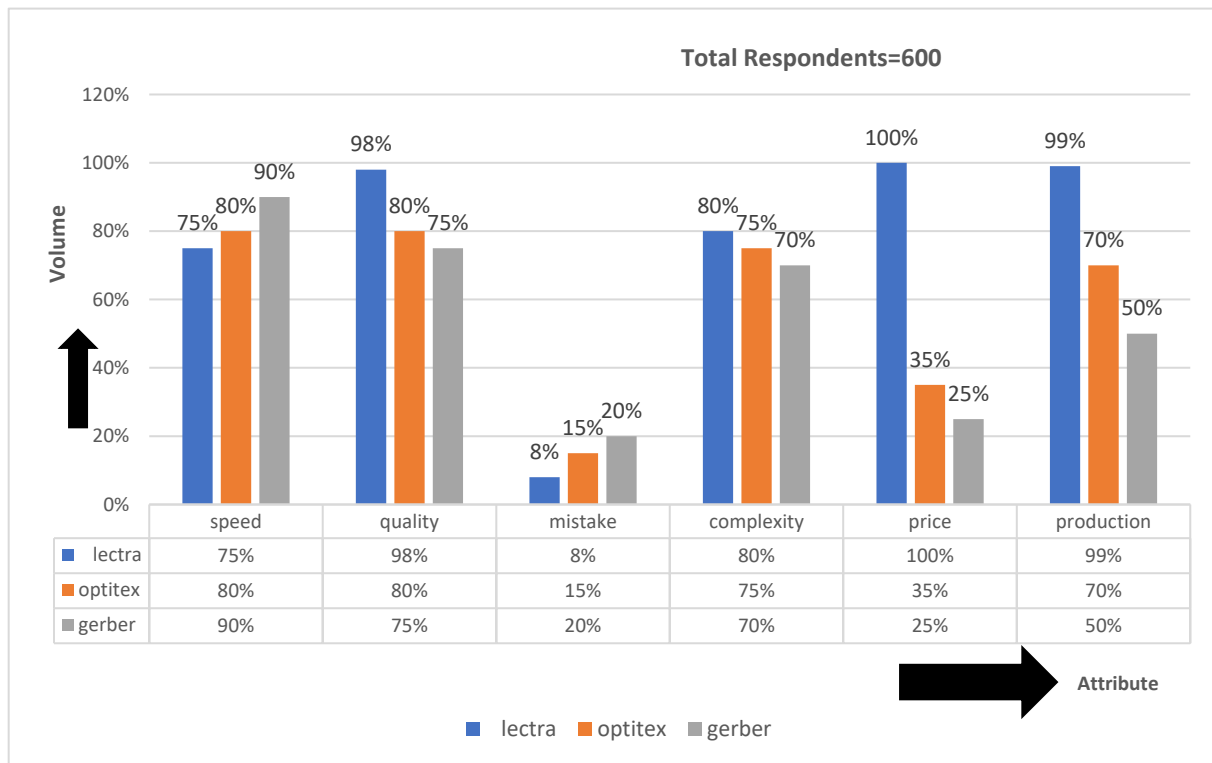

Total Respondents=600

	speed	quality	mistake	complexity	price	production
lectra	75%	98%	8%	80%	100%	99%
optitex	80%	80%	15%	75%	35%	70%
gerber	90%	75%	20%	70%	25%	50%

Figure 10: Different software attribute with a bar chart

Conclusion:

From the Research that was performed successfully, it can conclude the Bangladeshi industry's attitude toward CAD/CAM software and Identify Attributes that affect User behavior for particular Garments Software [4]. Overall, customers' highest priority was Production, speed, and Brand. The speed table represents that the faster software is Gerber than optics and Lectra. However, why an industry chooses Lectra for their industry? If we look up, the quality of the design of Lectra is maximum. The possibility of mistakes in Lectra is less compared to other software.

On the other hand, the production rate is also maximum in Lectra software. However, the speed, complexity, and price are maximum, negatively impacting Lectra software. Nevertheless, the design quality, the possibility of the mistake, and production accounted for 98%, 8%, and 99%. The price of the Lectra software is maximum, accounting for 10,00000 to 15,00000 taka. However, the price of the software is the too high price. However, the other Attribute plays a positive impact. That is why the user has ignored the price of the software. Lectra software also has complex and slower than other software.

So the production and design quality rate hit the maximum, positively impacting Lectra Modaris software. The possibility of a mistake is 8% means Lectra Modaris software has a minimum possibility of mistakes. The other significant factor is that Lectra software is the leading template system, which helps a user make automatic software, the most extensive facility for making a design quickly. That is why Lectra choose a maximum number of big industries in Bangladesh. Owing to compatibility, the production of the software plays a vital role in influencing the user's tendency to buy CAD/CAM software.

For the medium industry, they focus on some attributes for their company satisfaction. So every medium-class factory intended to buy Optitex software. Optitex is software that is faster than Lectra software. Complexity is also lower than the Lectra software. The price of the software is low compared to Lectra software. That is the way the 3 attribute of the speed of the software, complexity, and price, which is accounted for 80%, 75%, and 35%, plays an essential role in choosing Optitex software. For medium-class factories, the production size is less. So they try to ignore the production size.

For a small factory, they always preferred to buy Gerber software for their satisfaction. Gerber is enough to meet their criteria, also. Where the small factory ignored 3 attributes such as quality of design, the possibility of mistakes, and production size; on the other hand, they focused on the software's speed, complexity, and price. Where speed,

complexity, and price are accounted for 90%, 70%, and 25%. So it represents that the speed and price of the software are minimum.

Moreover, the complexity of the software is less. So it is pretty easy to learn and use. To recapitulate, 59% of users prefer to buy Lectra Software, 25% prefer Optitex software, and 16% prefer to use Gerber software. There are 3 types of Gerber software available. Such as gamine, bock, Emma, Etc. Every Buyer wants faster and quality software that involves the proper time delivery.

 Buyer also focuses on attributes such as quality and brand, accounting for39.41% and 60.59% for priority, followed by 58.73% and 41.27% for second priority. However, the Buyer has no choice about the price of the software. Because of that, there is no influence of the price upon a buyer.

[6] .

To encapsulate considering all the properties user is intended to buy 59% Lectra, 25 % Optitex, and 16% Gerber.

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Roles de Autoría

Md Shazzat Hossain: Conceptualización, Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Md. Abdus Samad:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Md. Hasan Ali:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Prahlad Sutradhar:** Análisis formal, Investigación, Metodología, Redacción - borrador original. **Jubayer Islam:** Análisis formal, Investigación, Metodología, Validación, Redacción - borrador original. **Md. Hazrat Ali:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Md. Al Amin:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Md Zahir Uddin Babar:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Md. Rezaul Karim:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original. **Mohammad Ullah:** Análisis formal, Investigación, Metodología, Software, Validación, Redacción - borrador original.