

**THE ROLE OF DESIGN AND E BUSINESS IN THE
ADVANCEMENT OF INDIGENOUS CRAFT: A CASE
STUDY OF HANDMADE GLASS INDUSTRY**

A Thesis submitted to the

UPES

For the Award of

Doctor of Philosophy

in

School of Design

By

Rakesh Sah

June 2024

Supervisor

Dr. Samrat Dev



School of Design

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Dehradun-248007: Uttarakhand

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DECLARATION

I declare that the thesis entitled **“The role of design and e business in the advancement of indigenous craft: a case study of handmade glass industry”** has been prepared by me under the guidance of Dr. Samrat Dev, Associate Professor of School of Design, UPES. No part of this thesis has formed the basis for the award of any degree or fellowship previously.



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CERTIFICATE



CERTIFICATE

I certify that Rakesh Sah has prepared his thesis entitled “**The role of design and e business in the advancement of indigenous craft: a case study of handmade glass industry**” for the award of PhD degree of the UPES, under my guidance. He/she has carried out the work at the Department of School of Design, UPES.

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ADVANCED ENGINEERING | COMPUTER SCIENCE | DESIGN | BUSINESS | LAW | HEALTH SCIENCES AND TECHNOLOGY | MODERN MEDIA | LIBERAL STUDIES

ABSTRACT

India is one of the significant providers of craft work to the world market. The Indian craft work industry is profoundly work concentrated cabin-based industry and regionalized being spread everywhere throughout the nation in rustic and urban zones. Various craftsmen are occupied with creating chips-away at low maintenance premises. The business gives work to more than 6,000,000 craftsmen (counting those in cover exchange), which incorporate an enormous number of ladies and individuals having a place with the more vulnerable areas of the public. With the thought of getting a total understanding into one such circle, I am fortunate to be involved with glasswork, as it makes me appreciate the effort that must have gone into perfecting such a remarkable craft. This archive, accordingly, is our undertaking to make all mindful of the current condition of this specialty, and to whatever degree it prevails with regards to doing such, we would think of it as a lovely achievement. Improvement of new structures is a fundamental factor for the endurance of pattern-based businesses in the present worldwide markets. Plans by and large, goes about as the distinctive factor to situate items at the opportune spot in the universal market as we keep on making new items and new requirements for the individuals, we likewise need to additionally investigate the mixing of innovation, craftsmanship and specialty. In today's world crafts is facing its most critical test of survival due to the massive change that is happening in the global infrastructure leading to huge displacements of population and loss of

traditional occupations and unrelenting urbanization development. The crafts sector needs an appropriate strategy that would be to continue to build high quality catalysts who can act as the transformers in a growing circle of influence through research, design, and direct field action. In developing countries craft is acting as a core part of development of micro economy.

Research Questions: - Glass craftsmen are still making glass jewellery in the traditional form?

- Does their glass jewelleries have contemporary look?
- Can the design intervention create better market for glass jewelleries?
- Does glass craftsmen still involve in conventional business?
- Does glass craftsmen require e-business?

During this research, my aim was first to understand the handmade glass craft and design contemporary handmade glass jewellery. The developed design could give craftsmen's products an innovative touch as per the market need. In addition, the e- business platform will provide opportunities to craftsmen to sell their product however craftsmen might require support to handle the e-business platform as they have limited technological and unconventional marketing skills.

There are traces which indicates India has a history of 2000 years back handmade glass making craft is practiced by several communities across the country. Firozabad is famous for it and called “city of Glass” as well as “Suhag Nagri”. It provides a high level of skills for glass jewellery making and other products. It contributes to the economy, employability and livelihood of craftsmen which sustain and grow by using this material. Most of the glass products are used in the country. To buying the product aesthetics and usability plays a vital role to attract and influence the consumer. In addition, in this thesis work an e-commerce base business eco system is planned for betterment of selling of handmade glass jewellery and thus the livelihood of Indian craftsmen in this sector.

At present scenario craftsmen are unable to develop contemporary handmade glass jewellery as per the market and user need. Therefore, evaluation of aesthetic and emotional need of target consumer is important. Parameters for aesthetic and emotional design evaluation of glass jewellery are important. These parameters include- 1) old vs novel, 2) common vs unique, 3) non-innovative vs innovative, 4) visually bad vs visually good, 5) ugly vs beautiful, 6) unattractive vs attractive, 7) fake vs neutral, 8) mechanised vs handmade, 9) artificial vs realistic, 10) inorganic vs organic, and 11) dead vs lively. If we can ensure aesthetic and emotional qualities embedded in handmade glass jewellery, it may attract or influence consumers for glass jewellery purchase.

When users buy jewellery in the physical store, they can be able to touch and feel the jewellery and understand the usefulness or ease of use of the jewellery. However, in online buying using e-commerce platforms, apparent usability becomes important as they are unable to perceive actual usefulness or ease of use of jewellery. Based on the literature, the aim of the first study is to find out the role of aesthetics and usability in glass jewellery purchase. In the context of handmade glass jewellery design aesthetics and emotions are firmly related to one another and style of a product improvement, might prompt various fundamental emotions. It is feasible to create positive emotions among users or consumers through contemporary design. Both aesthetic and usability are valuable predictors for glass jewellery purchase. Although, from the mediation effect of apparent usability, it is now clear that apparent usability is more important factor than the aesthetic in the context of glass jewellery purchase.

Measurement of apparent usability is important in the context of online jewellery purchase as many young Indian consumers love to purchase jewellery from online stores in compared to physical store, especially due to COVID 19 scenario. The prediction equation derived in the study might be useful to predict purchase intension of jewellery.

Further in the second study it specifies that at present scenario, Indian craftsmen are facing challenges to sell their handmade glass jewellery as they always don't have opportunities to display their products in appropriate market as they mostly involve selling their product through traditional way of business.

In addition, middleman, or NGOs work as a mediator to sell products of craftsmen. As per the study the design of user interface of an e - commerce portal for selling handmade glass jewellerys of India is developed. Designing assisted interactions that helps users to conduct their business smoothly where they will get support to use the e-commerce platform. The designed interface that re-moves the middleman from the picture and makes the vendors self-reliant. The interface was designed for both the craftsmen and consumers considering simplicity, user friendliness, language (Hindi / regional and English), aesthetics, and trustworthiness. As craftsmen are not highly educated, they only have primary education in National language (Hindi) and they understand symbolic languages: the interface of the dash-board for craftsmen is designed using infographics and Hindi or regional language. On the other side, a minimalistic visually good interface language was designed for target consumers. The trustworthiness of the ecommerce portal was planned through implementation of following features – 1) Time to Time notifications for product delivery; 2) Cash on delivery option; 3) Doorstep replacement guarantee; 4) Product insurance option 5) AI based chatbot for handcrafted product stories and purchase assistance, 6) Within domain craft product search product optimization and AI based hand crafted product suggestion. The Heuristics Evaluation Method was used to determine usability of the designed interface prototype for the e-commerce platform, and it showed there is consistent design language of the solution followed throughout. The proposed

design has a clean and standardized look which is helpful for both the customer and the sellers, to navigate the app back and forth.

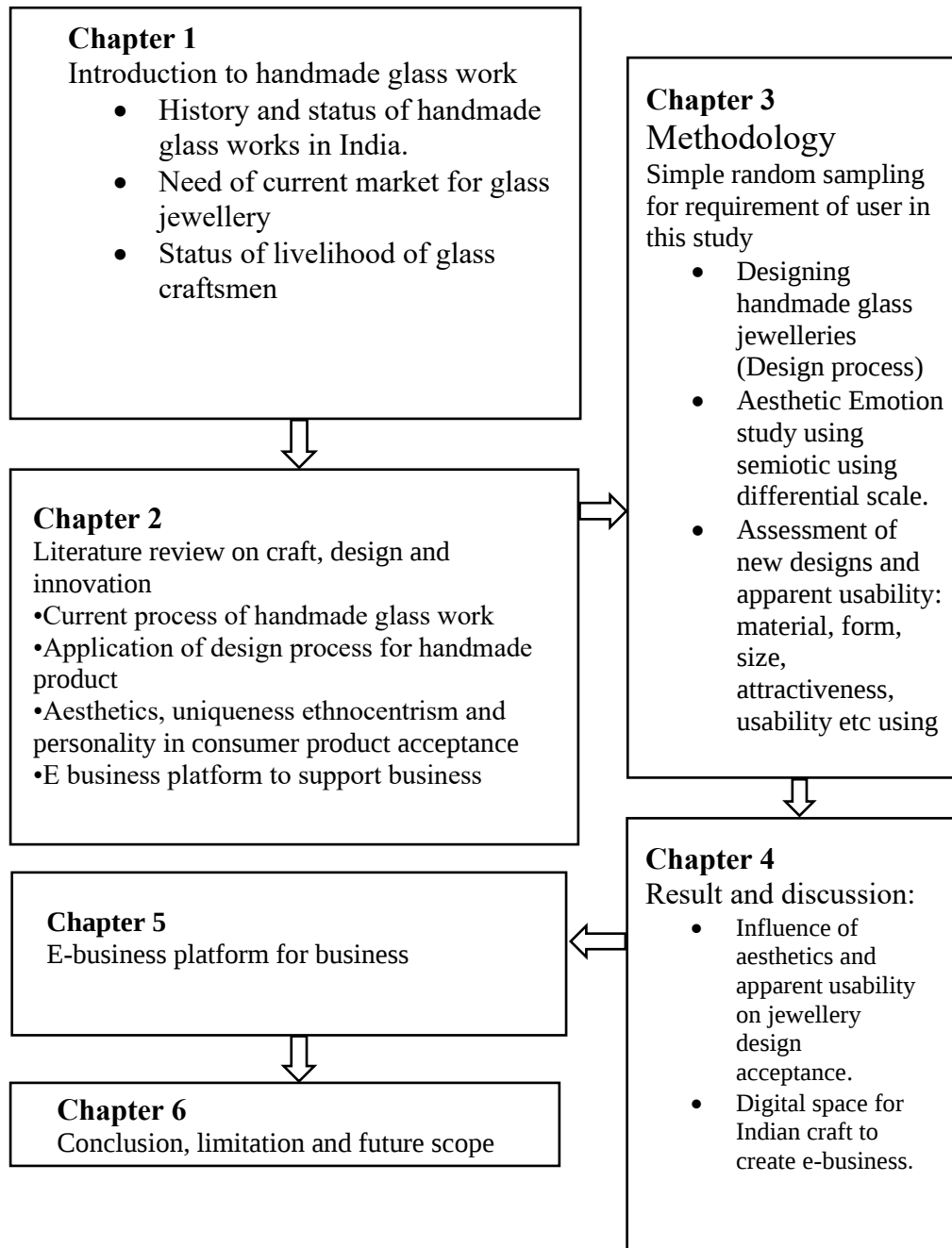
In the third study, based on a contextual analysis which was led on Indian handmade glass cluster (Flame work) to comprehend issues looked by small scale businesses and thus how might HCI based framework to develop system model can be proposed to assist these ventures for development. Since India has more than 13 lakh small scale businesses, they require unique thoughtfulness regarding be paid for their development, efficiency and business. Current review recommends a digital intervention (web-based) answer for Indian handmade glass cluster. This framework interfaces glass craftsmen to likely purchasers and the unrefined substance providers. Glass craftsmen from Firozabad areas were consulted and examined to figure out the current issues of the handmade glass cluster. In addition, the study insights regarding e-business plan arrangement will support craftsmen to flourish not only their business but also in their lifestyle and eventually the eco - system. This e-business platform can be increased for different limited scope initiatives like handmade glass cluster.

Conclusion, limitation, and future scope

Indian crafts always play a huge role in our economy, day to day life and to the society. The craft has been imbedded in our culture for ages. At present Firozabad is famous for it. The craftsmen of this cluster create traditional products which become monotonous and lack contemporary look hence new

designs will play a vital role for future growth of the craft business. In the study it reflects that apparent usability and aesthetics can attract and influence users to purchase new designs. It also reduces the risk of failure of new designs. As change is the only constant so, it's important to create new designs as per the user's need. In this study, the reported user centered design process to help to meet user needs in a timely manner. On the other side during the study, it is found that craftsmen are still indulging in traditional business practice and lacking in using e-commerce platforms. As a result, craftsmen are getting exploited by the middlemen. It also indicates that glass clusters need an online platform along with digital support to grow their business. In addition, e-commerce platforms and new technology will create impact on craft business as per the present and future scenario. This study suggested that the user centered system design framework will help craftsmen to sustain and grow their business in the present situation. In the near future, other new mediums and business models can be explored to enhance craft business. In this thesis work, scholar considered to develop new designs and online platform to adopt changes in way of selling glass jewellery based on perception and situation.

The flow of the whole thesis work was systematically presented



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Chapter 1

Introduction

1.1. History:

The technology of glass making evolved accidentally all through certain kinds of operation where metallurgical process was involved. The term “glass” involves many types of products which have character based on their cooling temperatures from liquid to solid form. It is important that glass should not crystallize when it's colling. A glass is formed with composition of Silica(75%) which comes from sand, soda around 10% and other compounds such as lime (10%) along with colour oxides and metallic oxides.

We have not got evidence or trace of glass during the oldest civilization of India, Indus Valley and Harappan civilization; rather they preferred faience, a type of proto glass. The Indian glass industry started gaining thrust after the Christan Era. Although the manufacturing knowledge was restricted to very few products such as bangles, glass beads, ear-reels, small objects, beads for eye decoration and artifacts. In different parts of India near about 30 archaeological sites, we found objects which verifies that Indians have produced many glass objects in various colours such as (Fig 1.1) like green, blue, red, white, orange, and fragmented parts of vessels. In Hastinapur, India the glass evidence has been found which represent Chalcolithic period. In some literature it's mentioned that

glass in India is associated with the Shatapata Brahmana and in some places it's also known as Vinaya Pitaka. Although, In the ancient era of Takshashila, 3rd century BCE, the first distinctive evidence with huge quantities found from their archaeological site's excavations.

During the 1st century, in South Asia glass was used as an ornament and for casting as per the evidence. It came to the notice that when Indian artisans got connected with the Greco- Roman world they got to know and developed newer techniques and skills regarding glass works such as molding, texturing, decorating, finishing and colouring in the later eras. Composite glass was also found in the Satavahana era. In spite of such expansion, it was difficult for glass to flourish like metal and ceramics. Metallic and pottery vessels were preferred particularly on religious occasions. Consequently, the importance of glass failed to achieve the recognition, and this probably contributed to its hindered development and application in modern science in India.



Fig.1.1 Glass Object of Varied Colours

Indian Handmade Glasswork: A Historical Journey



Early Dynastic
Influence (500 BCE -
400 CE)



The Mughal Era
(1526 - 1857)



Modern Indian
Glasswork (20th
Century to Present)

Timeline

Ancient Beginnings:
Harappan Civilization

Early Glasswork
(1500 BCE – 300
BCE)



The Medieval Period
(700 CE - 1200 CE)



Colonial Influence and
Industrialization (18th -
19th Century)



Firozabad Handmade Glasswork: A Historical Journey

Firozabad, the heart of India's glassmaking tradition, has been crafting exquisite handmade glassware for over 500 years."



Timeline

Ancient Beginnings (14th Century)

"The art of glassmaking in Firozabad dates back to the 14th century during the Mughal Empire, where artisans began crafting delicate glass objects."

Mughal Influence (16th-17th Century)

"Under Mughal patronage, glassmaking flourished, introducing new designs and refined techniques. Glass bangles and decorative items became popular."

Industrialization (19th Century)

The glass industry expanded during the British period, seeing an influx of mechanized processes and greater global demand for Indian glass products

Early 20th Century & Modernization

Firozabad emerged as the centre of India's glass industry, producing glass bangles, figurines, and beads in large quantities.

Global Fame (Late 20th Century to Present)

"Today, Firozabad glass products are recognized worldwide, symbolizing India's rich cultural heritage."

Glass making in India is an ancient process with reference to glass usage in Mahabharata period. During the medieval era the craft of glassware flourished and gained popularity. It's important to mention that glass craft got patronaged by Mughal emperors Even glass engraving became popular during the Mughal era. The excellence of Mughal craftsmen became evident with the manufacture of delicate foliated designs on glass objects.

1.2. Background:

India is known for its craftworks in the world. It provides significant craft products to the global market. India has huge craft cluster and cottage base industry, which recognized and being dispersed all over throughout the country in rural and city areas. The business provides sustenance and livelihood to more than 6,000,000 craftsmen (counting those in cover exchange), including innumerable number of women and individuals from the poor socioeconomic strata.

In our country handmade glass works are carried out at a number of locations both in urban and suburban areas. Of these, Firozabad in Uttar Pradesh occupies a prominent place where labor-intensive small scale glass works are performed since time immemorial right from the Mughal Era. The Locale is associated by rail and transport to significant urban communities. The closest Air terminal is Agra (Fig.1.2).

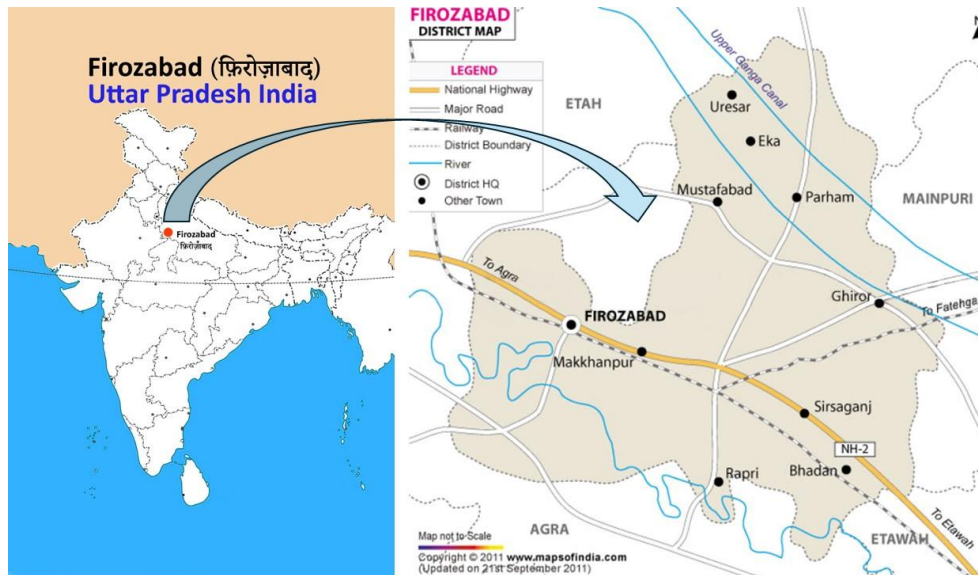


Fig. 1.2 Location of Firozabad

Often referred to as “The Glass City” in modern times or Chandwar Nagar in ancient times, the name of Firozabad was given by Firoz shah Manshab Dar during Akbar’s period in 1566. The Locale is associated by rail and transport to significant urban communities. The closest Air terminal is Agra. A fairly large part of the unorganized small scale glass production is concentrated in Firozabad district which produces more than 70% of total manufacturing of the nation. Firozabad obtains a natural cluster of SMEs’ glass producers which produce products like tableware, container glass, mouth blown handicraft ware, bangles, beads, toys etc.

Firozabad glass cluster is one of the largest clusters for glass SMEs in the globe with around 421 registered small and medium enterprises. Amongst

these 190 units are in running condition. Apart from tableware and bangle making industries, there are clusters of flame work artisans located in and around the city making toys, figurines, accessories etc. Bangle making was probably one of the first techniques that got introduced to this cluster followed by blowing, engraving, cutting etc. The presence of a high level of skills for blowing, cutting, engraving, polishing, toy and jewellery making with the help of torch work etc. are still existent in the cluster, although limited to a very few production set ups. The entire region in some way or the other earns their livelihood through this material's production. About 2 lakh skilled and semi-skilled workers practicing glass come to the city from nearby villages with the purpose of work and return late in the evening. The bangle industries provide the largest employment for these workers.

1.3. Type of Glass:

I) Hot Glass: the objects made by using this process includes glass blowing, solid glass for sculpture and glass casting. In these craftsmen work with hot molten glass which has temperature around 2000° degrees (Fig. 1.3). The craftsmen melt the glass in the furnace using crucibles and use it to produce different objects such as sculpture, products using moulds, ornaments, vases, bowls, goblets, marbles etc. by using different techniques and processes. In the glass casting craftsmen use mould to give shape and create product.



Fig. 1.3 Molten Glass

II) Warm Glass:

In this process craftsmen heat the glass in the kiln or furnace and use different forms of glass such as flat sheet glass. The flat sheet or plate glass heated in the kiln at 900° to 1400° degree depends on the thickness and kind of glass to slump and take shape. This process is known as glass slumping. The glass heated enough to slump and bend easily as per the gravity and flexibility. Usually, one would use the mould to create shape in the glass slumping process (Fig.1.4). The characteristics of glass play an important role in this.



Fig. 1.4 Glass Slumping

III) Fused glass:

In this process the glass is crushed or broken into small pieces and put in the desired moulds to create form then they put this in the furnace or kiln to heat it. The temperature varies from 1000° to 1500° as per the requirement to fuse glass together. One can use multiple glasses, but they should be compatible with each other. Many times, one can do slumping and fusing together.

IV) Cold glass:

In this process glass doesn't need to heat rather it is used in natural state. Many kinds of techniques are used to do etching, grinding, cutting, polishing, texturing, engraving and finishing. These techniques are used on the surface of

the glass. Hence, it's known as a cold working process or technique.

V) Acid-etched glass:

In this technique acid is used on the surface of the glass. Acid reacts with the glass surface and creates matt finish translucent surface. This technique is usually used to create surface decorations. In this composition of acid and types of acid is important. Many craftsmen use hydrofluoric acid for this technique.

VI) Sandblasted glass:

Fine sand is used for this technique, and it also gives a similar kind of effect like glass etching. The craftsmen do it with the help of compressor and sand blasting gun. This technique is also used for glass surface decoration.

VII) Silicate glass:

This is mainly used in commercial glass production and silica is used for it to produce. In this Quartz sand is the prime material for glass composition. The composition of the material is heated till fused together and form glass. This kind of glass is chemically pure silica. It has great resistance to thermal shockwave and very low in thermal growth. This kind of glass is very hard and has resistance to high temperatures and compound weathering. Its transparency is better than ordinary glass and it is used where these characters are important to create specific impact and effect.

VIII) Soda-lime glass:

It is a low temperature glass and contains sodium carbonate which is responsible for lowering the temperature. In this kind of glass to improve quality one adds magnesium oxide and alumina along with other general components. Though it is not good for thermal resistance, as it has high current expansion. This kind of glass is used to produce products such as glass windows, lights, bottle and jars.

IX) Borosilicate glass:

In the Borosilicate glass composition 4 to 16% boron trioxide is usually seen. Compared to soda lime glass thermal expansion it has very low coefficients. In the laboratory ware its common to see borosilicate glass. It is also used in functional ware and car head lamps. It is used due to chemical and thermal strength of borosilicate glass.

X) Lead glass:

In this glass lead oxide is used within the glass composition. It's a high temperature glass due to lead oxide. The lead glass melting point is 1300° to 1500° degree which makes it unique. It has a high reflective index due to high density. Therefore, used in functional glassware to make it more attractive and noticeable.

XI) Alumino-silicate glass:

In the alumino-silicate glass composition usually 5 to 10% of alumina is used. The melting temperature of this glass is more compared to borosilicate glass. Hence, create challenges to melt and give shape. It shows great thermal endurance and stability, hence, used for making fiberglass.

XII) Glass-ceramics:

This kind of material composition has both non crystalline glass and ceramic with crystallizations. To create this a base glass is heated in a controlled nucleation and mature expression till it takes the desire form. One of the unique characteristics of this material is resistance to thermal distress.

XIII) Fiber- glass:

This kind of material is created by the combination of plastic resin and glass fiber. The resin is reinforced with the other elements which make the fiber glass unique. This is also known as fiber reinforced plastic (GRP). In this material the glass is heated and later pulled into fibers. That's why it's called fiber glass. Craftsmen or artisans weave these fibers together like a cloth and put plastic resin to create a form though it takes some time to settle and solidify. Overall, it has a unique property of lightweight and durability.

1.4. Glasswork in Firozabad:

Firozabad is known for its glassware manufacturing and the largest cluster for it in the country. This is an unorganized sector. All kinds of products are manufactured here which have different characteristics and uses along with shape and size. People have started noticing products from here not only domestically but also globally. In the handicraft sector, glass products are the fast-upcoming craft. The traditional glass blowing technique using mouth blowing gives a nostalgic feeling in the glass craft production process. It is inspiring to see those different shapes, forms, objects with variety of colours are not to not only satisfy Indian consumer but also global consumer with inherent Indianness.

More than 400 industries are involved in producing products in Firozabad and registered here. Since 1989, some of these industries have been producing fabulous work which is in different types and uses. Here these industries are using natural gas as fuel rather than coal. Almost 50% of the production happens for exports. The pot furnace is used these days for blowing and manufacturing along with tank kiln.

With the development and new era Firozabad has turned into a center for glass manufacturing. Now they represent themselves in the global market with a variety of products. These products are based on market demand and

need. This development is creating impact, positive influence and flourishing on logistic, packaging, services and chemical industries. It is inspiring to see that this growth is leaving a footprint on production, employment and progress of glass market in domestic and abroad (Fig 1.5).

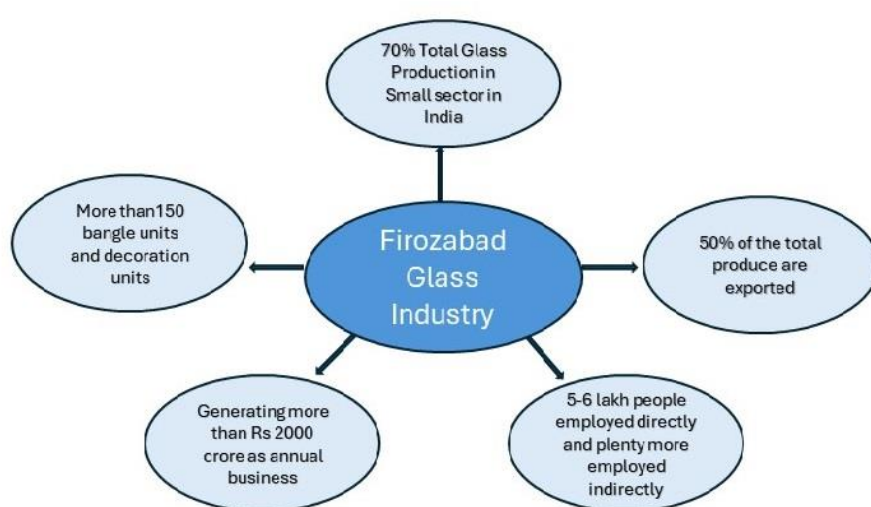


Fig. 1.5 Firozabad Glass Industry

Firozabad has a wide scope of glasswork. In any case, the item range can be isolated based on techniques, glass type and the item type. It tends to be partitioned into the accompanying four classes based on the innovation applied in their separate classes:

Glass Blowing:

In this process the molten glass is taken and balanced on a metal pipe and from the other side of the pipe the glass blower manually blows air to create a desired shape. During the process they need to keep rotating the pipe to

balance the glass. In this process usually hollow products are created such as vases, bulbs, bottles, flasks etc. It's a very skilled and distinctive process which requires a master craftsmanship on the skill (Fig. 1.6).

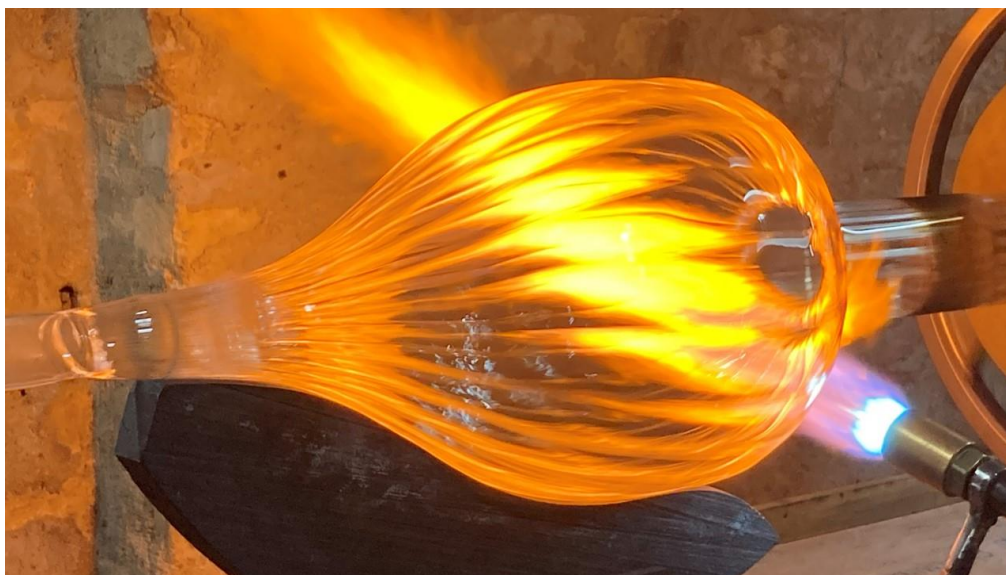


Fig. 1.6 Glass blowing

Glass Bangle:

The assemblage involved in glass bangle manufacture (Fig. 1.7) makes the process extraordinary from rest of the classes. Post fabricating, embellishing bangles is another art applied on bangles before being sent to the market. The shading of bangles is finished by either utilising hued glass or applying hues to the top/upper peak of bangle. The bangle could

be round, level, oval or winding based on beating the surface in a specific manner.



Fig. 1.7 Glass Bangle

1.5. Glass work technique used in Firozabad & products:

Firozabad craftsmen use mostly three kinds of glass. These glasses are soda-lime, borosilicate and lead. The following processes and techniques are involved in the manufacture of a glass product:

Blowing:

Since the 1st century B.C. people have been using this technique to form and give shape to the glass. In the technique molten glass is taken from the kiln with the help of metal pipe. From this blown pipe air is

blown to give form to create unique object or for specific purpose. It's mainly used for hollow objects and wall thickness plays a vital role in it, many time craftsmen use moulds to give desired form. For this kind of process glass factories are required to do the job in the right manner.

Fusing:

This technique is used when two or more glasses are fused together. In Firozabad cluster many craftsmen use this technique to make the desired objects. Compatibility of used glasses is the most important thing in this process. Glass surface fused together and creates the form. It happens on the surface of the glass. Many craftsmen have small setups to do this process. Some of the glass works craftsmen do in their home workshop and other productions in the industry.

Flame work:

This technique is mainly used in the cottage industry to create figurines, idols, toys, ornaments, beads, jewelleries, and souvenirs. Numerous little beautiful pieces, toys, symbols and so on are produced using glass rods and tubes with the use of flame torch. Glass rod or pipe is heated by the flame torch to make it soft and molten to give unique shape. Master craftsmen have the ability to control and created

various shapes and when required combine other coloured glass and repeat the process till final outcome. (Fig. 1.8). In the Firozabad cluster many craftsmen practice this technique to create objects in their home. Craftsmen use borosilicate glass mostly for this technique.

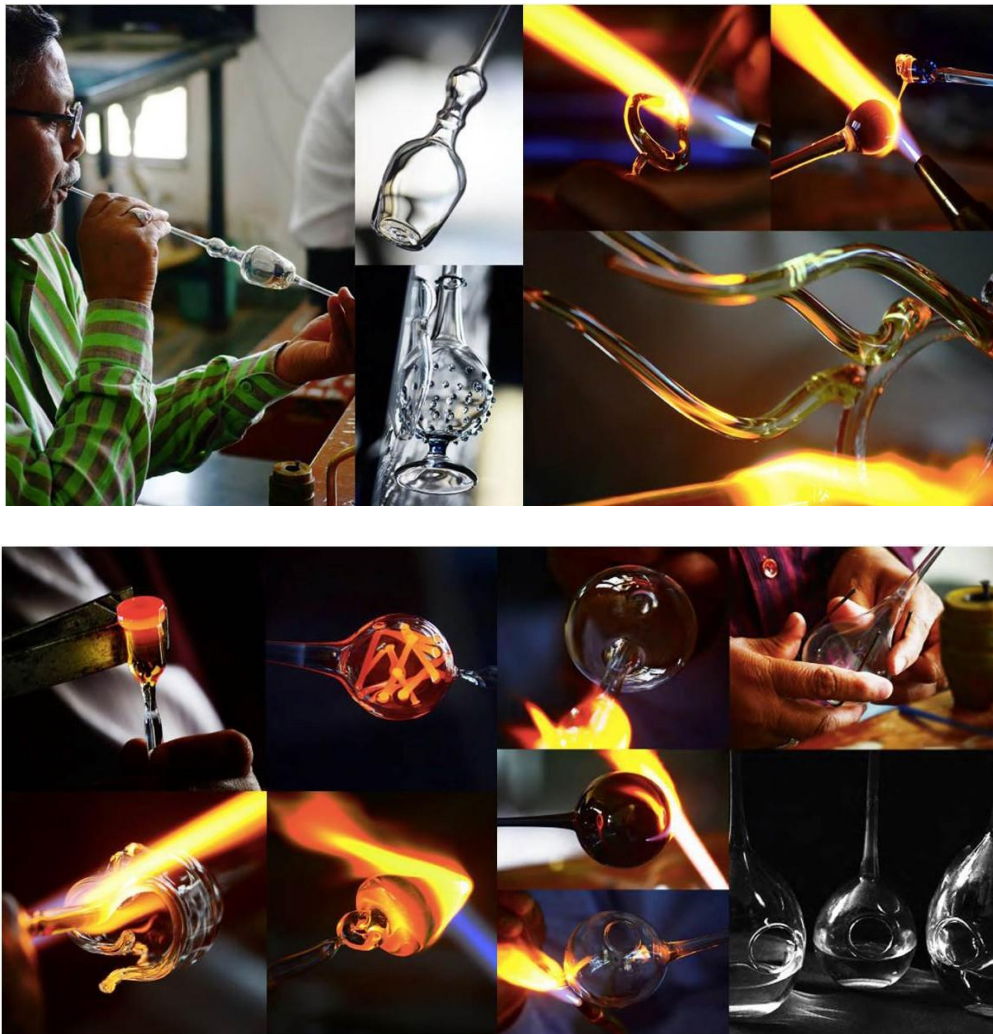


Fig. 1.8 Flame Work Technique

Four different methods are used to give shape and finishing to glass products which are blowing, pressing, drawing and casting.

Glass tube blowing:

A glass tube is heated till it becomes softer and molten then air is blown from the other end of the tube to give shape. During this process it's important to keep rotating the tube and balance it till the process is done.

Pressing:

Automatic, Semi-automatic or manual machines are involved in this process. A mould is used to give desire shape. Molten glass is filled in the mould and pressed by machine to give the desired shape. This process happens in the industrial setup.

Drawing:

In this process molten glass is spread into a float bath and gets cool when taken to the air. It's a furnace which has tin. In the process glass solidifies higher than tin's temperature. In this glass sheet remains transparent but distorted.

Casting:

This process is mainly used to create glass artwork or lenses. For glass casting craftsmen also need a mould to give the desired form. In this process molten glass is poured in the mould and put in the kiln for annealing.

Once cool down it is removed from the mould. No pressing is involved in this process to give shape like pressing method.

The Product range offered from the handicraft cluster of Firozabad are as follows: -

Decorative products: Item or objects used for decoration purposes. Such as Glass vases, toys, etc. (Fig.1.9)

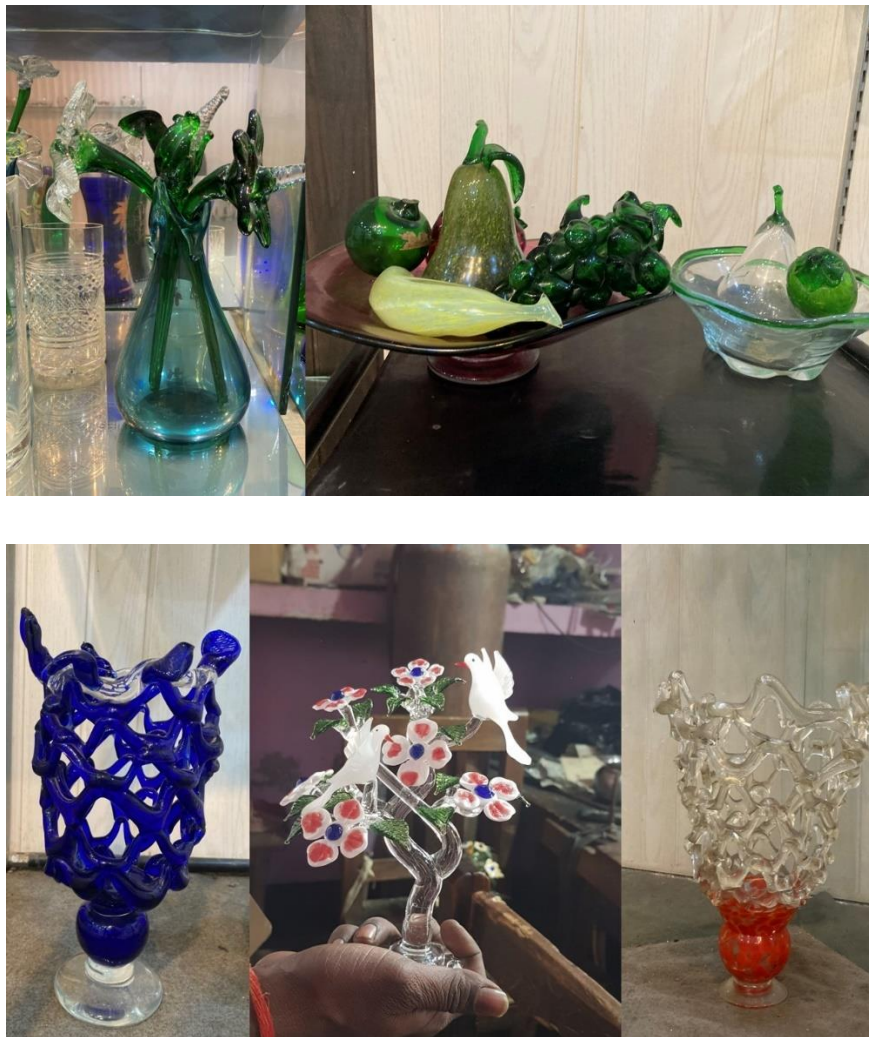


Fig.1.9 Decorative Glass Products

Glass Jewellery: beads and bangles – Craftsmen create manually make glass beads and later convert in jewellerys (Fig.1.10).



Fig. 1.10 Glass Jewellery

Functional ware: Dinner set, wine glass etc. Craftsmen create these products with the help of machines as well as handcrafted (Fig 1.11).



Fig. 1.11 Functional Ware

Glass chandeliers & Glass hardware: for science laboratories such as beakers, flask, other glass goods etc. and automobile industries such as light bulbs (Fig. 1.12) etc.

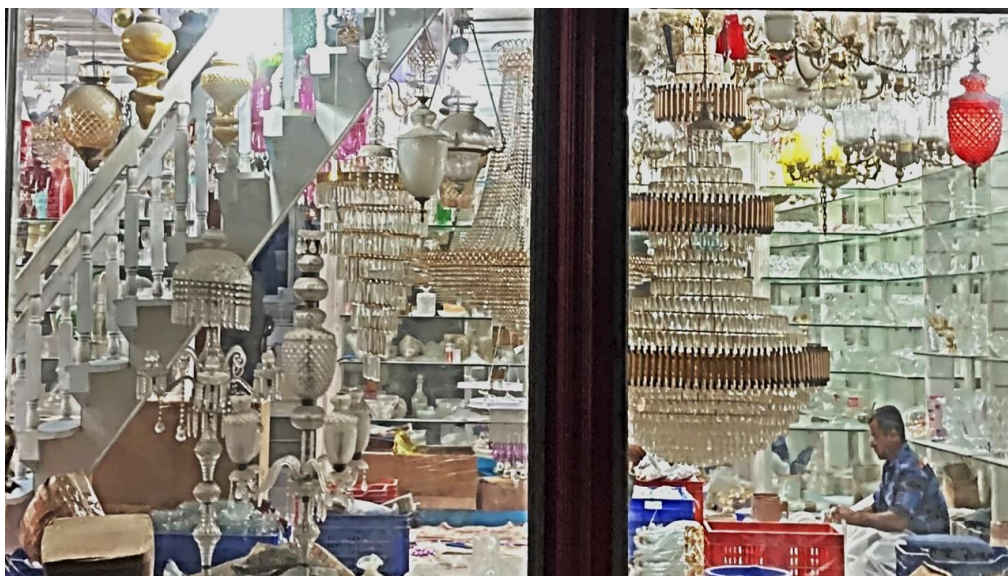


Fig. 1.12 Glass Chandeliers and lights

1.6. Status of Livelihood of Glass Craftsmen:

Undoubtedly Firozabad is the best and presents deep rooted glass handicraft cluster. The craftsmen here are still practicing traditional methods and less new technologies which embark in their work and have uniqueness of handmade qualities. It has so many small glass producers which are involved in glasswork production. Firozabad's craftsmen and their skill make this place competitive

in the market. A huge labour segment is involved in this segment. These labours are local and some also come from other neighbour status. It's interesting to see that manufacturers have the upper hand in their work and livelihood.

As per the demand and supply ratio craftsmen move from one place to another place. In this scenario the rate of work plays a huge role. As these craftsmen work for export manufacturers and from small home base workshops shifting of work happens frequently. In the off season some of them work as self-employed or labour. In the cluster They don't have any organization or body for maintaining the labour force.

It's a traditional craft and craftsmanship transfer from one generation to another. As it's a highly skill-based craft one needs to go through apprenticeship under master craftsmen. After years of practice, they gain this expertise.

Generally, labour doesn't have negotiation power for wages in Firozabad cluster. The wages are not enough to survive hence, many have their own setup to practice the craft which bring freedom and pride to the craftsmen who work in their own workshop. The living standard of these craftsmen depends on the various factors such as years of experience in the field, level of skill and capability to do work, number of family members involved in the home workshop and how long they run the work in the year. The whole thing gives the picture of their annual income. The different kind of work and

outcome creates differences in wages. The average worker earns Rs- 5000/- to 8000/- per month whether unskilled labour gets Rs- 3000/- to 4000/- per month and skilled craftsmen earn Rs- 10000/- to 15000/- per month (Fig. 1.13 to 1.17).



Fig. 1.13 Collage of livelihood of glass craftsmen



Fig. 1.14 Collage of livelihood of glass craftsmen



Fig. 1.15 Collage of livelihood of glass craftsmen



Fig. 1.16 Collage of livelihood of glass craftsmen



Fig. 1.17 Collage of workshop and livelihood of glass craftsmen

1.7. Need of Current Market:

Firozabad glass industry and craft still not able to leave strong image on global market and consumer due to lack of adaptation regarding new technology and product diversification, innovation and contemporary look as per present scenario and modernization. The glass cluster is still highly dependent on traditional way of practice for glass product manufacturing. Industries are not investing enough so that they can compete in the global market. To deal with this situation it's important to build infrastructure, resources and brand creation and recognition. Cost is another factor which needs to be taken into account as

it is getting very tight competition from other Asian countries like China and Thailand.

At present the market has impacted and reduce to Rs. 1crore which was around 30%, Rs. 85 to 100 crores of total market during the period before 2002. From the raw material to finishing goods there is a lot of change required whether it is mixing, creating batches, crucible or pot making or objects. They also need better equipment's to perform and maintain quality with less rejection and for that they must have better furnace for melting to shape making and annealing.

As industries are producing traditional products with very few alternates and not investing on their design and development part hence, they are losing reputation in not only domestic market but also in the global market. According to the market demand they must innovate and create new designs and implementations and for this they need to not only work on infrastructure but also on design and development (Kapur & Mittar 2014; Datta & Bhattacharyya 2016).

The glass craftsmen of Firozabad are still producing the exciting old products which are lacking in terms of design and a contemporary look (Fig. 1.18 to 1.23).

Therefore, looking at the present Firozabad's glasswork it is evident that new designs with the fine material quality and finish are required in the utility,

functional and decorative products. In the whole product manufacturing process around 35% is covered by fuel and raw materials in the operations, remaining amount belongs to the labours and craftsmen involve in the process. Which is also an area of concern for the development of the cluster and livelihood.

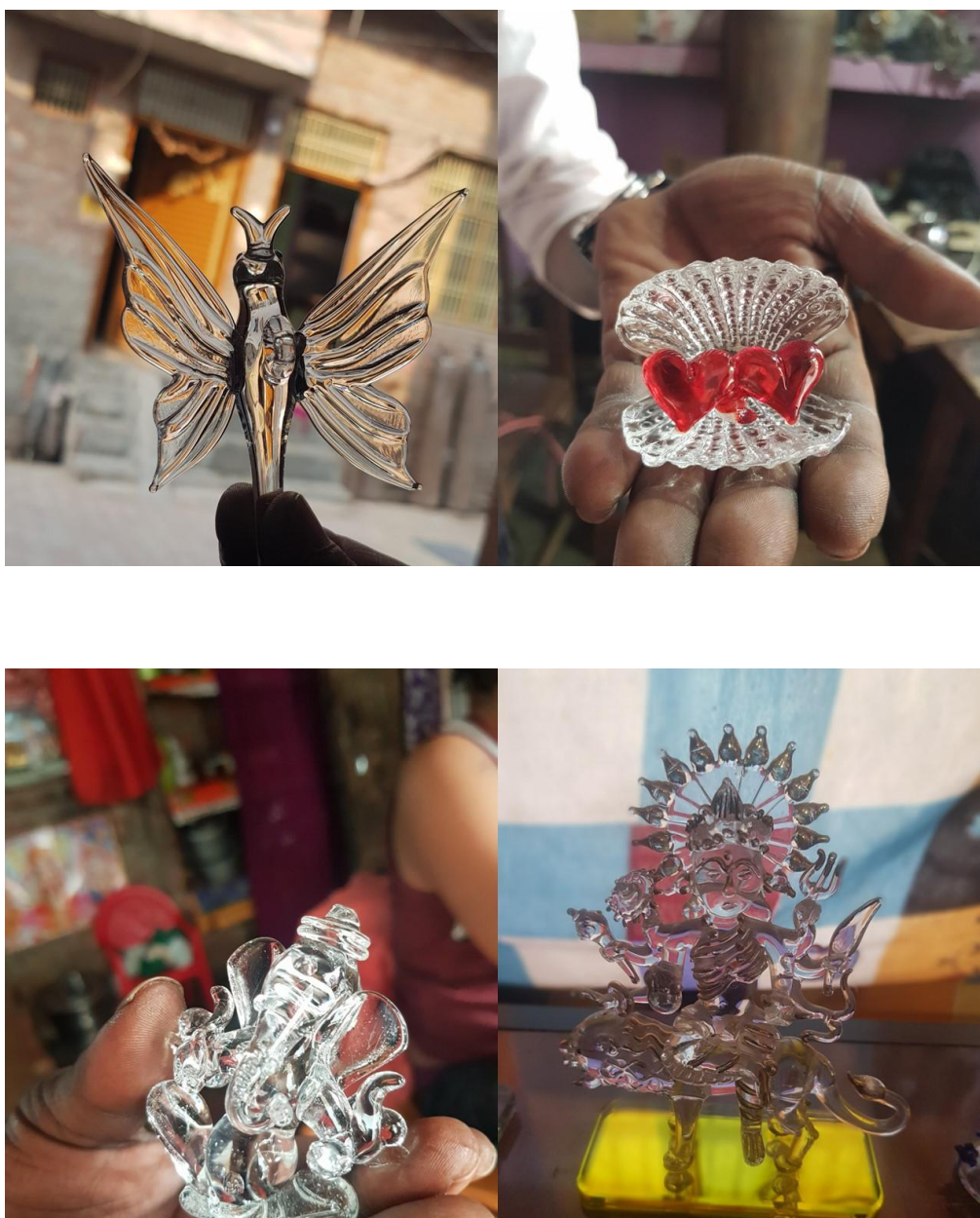


Fig. 1.18 Existing Glass Products



Fig. 1.19 Existing Glass Products

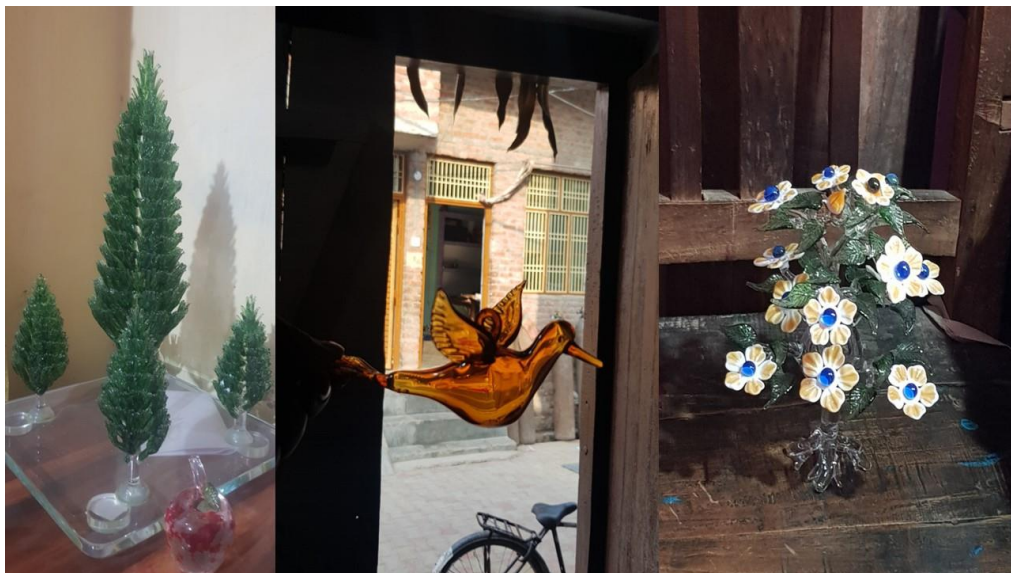


Fig. 1.20 Existing Glass Products



Fig. 1.21 Existing Glass Products



Fig. 1.22 Existing Glass Products



Fig. 1.23 Existing Glass Products

From the above facts it can be concluded that the craftsmen in the present scenario are unable to develop contemporary handmade glass jewellery as per the market and user need. Therefore, evaluation of aesthetic and emotional need of target consumer is important. Parameters for aesthetic and emotional design evaluation of glass jewellery are important.

These parameters include-

- old vs novel
- common vs unique
- non- innovative vs innovative
- visually bad vs visually good
- ugly vs beautiful
- unattractive vs attractive
- fake vs neutral
- mechanized vs handmade
- artificial vs realistic
- inorganic vs organic
- dead vs lively

Therefore, in the subsequent chapters the following questions become pertinent, whose reply will provide an insight into the probable ways of advancement of this unique glass work handicraft and to ensure sustainability as well as improved economic status of these highly skillful craftsmen. The research questions are as follows:

- Whether the craftsmen are still making glass jewellery using traditional approach?
- Does their glass jewellery have a contemporary look?
- Can the design intervention create a better market for glass jewellery?
- Do glass craftsmen require technical knowledge and support for e-business?

Chapter 2

Review of Literature

It has been well established that that people's perception towards craft products and the way they relate to products in their everyday environment are closely related to each other. In the book entitled “The Meaning of Things: Domestic Symbols and the Self”, a finding regarding object belongings comes into the picture when study done on contemporary lifestyle along by attachment, emotion and relationship with objects taken into consideration of their home ecosystem. This result came after an interview conducted with eight families about their feelings on the objects and households. Thus, it presents a unique viewpoint on the relationship between self, culture and materialism (Csíkszentmihályi & Rochberg-Halton 1981). During this social dialogue they discovered that people correlate about their identity, image, social status, community along with pursuit of own, social and cultural involvement.

However, people do not pay attention on products and its handmade perspective or design. It was observed in a study by Verbeek (2005), that it reflects based on the philosophy and viewpoint given by Csíkszentmihályi on relationship between beings and objects. Though further it's observed in Varbeek's thought process that is formed based on objects creation and design process. As a theorist for design Varbeek has inspired and influenced the

thought process behind product lifecycle and why some last for long and some for less. Further he has explained three reasons for product durability and influence upon it. According to Verbeek, semiotics and product semantic relate to additional established industrial design belief that “A product has meaning or sign-value: human-beings are drawn to particular product styles and not to others and use a product to express the lifestyle to which they (want to) belong.” As per Verbeek it’s distinct that material aesthetic is directly impacted due to involvement of people and its relationship with material and things to “the sensorial in the broadest sense”.

Verbeek & Kockelkon have given their view on LAC (Life cycle analysis). According to them it gives a great picture on adopting issues for unsustainable practice instead of the actual reasons behind these kinds of behaviors. “Life Cycle Analysis may make it possible to design products that are friendlier to the environment but leaves a fundamental problem unaddressed: the short lifetime of our products. We live in a throwaway culture - the environmental crisis is not only a technological problem, but a cultural problem as well.” (Verbeek & Kockelkon 1998). Accentuating on the more prominent estimation of human expressions and artworks, according to T.M. Abraham, “the world of art and craft is as valuable as the world of science, philosophy or ethics. Like art, crafts reflect the state of human society through the individual. The craft treasures like art’s, give us a glimpse into the core and kernel of the collective mind and societies

through the mirror of the individual mind that created them” (Abraham, 1964).

After going through this the one thing that comes out really strong is that craft works carry the emotion, feelings and memories due to their physical nature. After understanding the craft, it is important to go through Indian scenario “To write about Indian Handicrafts is almost like writing about the country itself. So vast, complex and colourful, and yet with a simplicity and charm, difficult to attain under comparable conditions” (Upadhyay, 1976). Looking at the history “the workmanship of the Indian craftsmen is so exquisite that throughout the 18th and 19th centuries India was known to other countries on the trade route more by her crafts than by her art, religion and philosophy” (Saraf, 1991).

In the book “Handmade in India: Crafts of India” by M P Ranjan and Aditi Ranjan (2007), they discussed about how cultural diversity, lifestyle, aesthetics plays a vital role and its importance for economy. Craft evolution is the ingenuity of the local craftsman and local leadership, which creates traditional wisdom. Craft has a more extensive scope of information that has business potential in creating nations and carry a monetary measurement into the conversion of conventional information (Liebl and Roy, 2004).

To understand the correlation between visual aesthetics, willingness to purchase and pricing, Mumcu et.al. (2015) defined the relationship between visual aesthetics of products and consumers' price sensitivity. It revealed that visual aesthetics of products and their sub-dimensions including value, acumen, and response create impact on buying and pricing decisions. According to Mugge et.al. (2005) a product's meaning is deeply anchored in a specific product and its meaning is inseparable. Hence the product's irreplaceability by stimulating the formation of memories associated with a product or by creating uniqueness and personal products. To emphasize the importance of aesthetics and customers' intentions to purchase, Toufani et.al. (2017) has presented "the product's aesthetics influences their purchase intention through different dimensions of perceived value drawn from perceptions of the product's aesthetics, or whether there is a direct relationship from aesthetics to purchase intention." Feel's appeal to social and enthusiastic saw esteems, as opposed to functional worth. Further in the research it shows that the aesthetics of environment, where the products or services are rendered and consumed, has a profound influence on consumer behaviour and satisfaction (Bitner, 1992; Donovan et al., 1994; Morrin and Ratneshwar, 2003). "Investigating the role of aesthetics in consumer moral judgement and creativity" has mentioned that humans are attracted to aesthetics, and it influences them to make decision to take the product (Bhaduria et.al. 2016). Aesthetic contemplations are unavoidable as a basic piece of our lives, including utilisation. In the profoundly

aggressive market climate, there is an expanded equality in the usefulness of items, which implies that every product should work true to form. Progressively, purchaser decisions are influenced by the style of a product or then again administration. The surviving writing reaffirms our fondness for a wide range of excellence and that lovely individuals and delightful things have an extraordinary appeal. (Dion et al., 1972; Langlois et al., 1991; Hamermesh and Biddle, 1994; Ramsey et al., 2004; Andreoni and Petrie 2008). A staggering measure of examination upholds our fascination with lovely individuals and excellent things (Dion et al., 1972; Langlois et al., 1991; Hamermesh and Biddle, 1994; Van Leeuwen and Macrae, 2004; Ramsey et al., 2004; Andreoni and Petrie, 2008). Our partiality for magnificence is profoundly established and is reflected in all parts of our conduct, including utilisation. Customers experience a mind-boggling number of decisions as they stroll down store walkways. An item's tasteful allure draws in a buyer, they are bound to approach and investigate it further.

According to the Pleasure Theory proposed by Patrick Jordan (2000), it's zeros in additional on pleasurable parts of our associations with products an elective emotional model. This model thinks about every one of the potential advantages that a product can convey. Like the structure of pleasure given by Tiger (1992), pleasure model proposes four thoughtfully particular sorts of pleasure (Jordan, 2000). These incorporate a) Physio-pleasure; b) Socio-pleasure; c) Psycho-pleasure and d) Ideo-pleasure. Physio-pleasure relates to

real viewpoints which are associated with tangible encounters about product, for example tangible pleasure of holding a cell phone. Socio-pleasure alludes to satisfactions got from associations with others. Products can work with social associations in various ways. For instance, an espresso creator offers an assistance which might go about as a focal point of fascination of little party 'Coffee evening'. Psycho-pleasure is related with mental and enthusiastic responses. A product might require a specific degree of mental capacity to utilize it and the product ascribes/collaboration style might get passionate reaction in light of the experience about the product. Ideo-pleasure alludes to people's comprehension of their own qualities. For instance, a product comprised of biodegradable materials is related with worth of natural obligations of client.

With regards to a progressive system of shopper needs (Fig. 2.1) by Jordan (2000), in this progressive system Jordan put pleasure in the third level after convenience and usefulness according to user's need. As indicated by Jordan, when customers/clients take a buy choice, they are at first worried about usefulness, then, at that point, convenience and ultimately pleasure. While usefulness and convenience of numerous products are comparable, pleasure assumes significant part in product determination. This model discussion results much with regards to product acknowledgment based on pleasure.

In the context of glass jewellery purchase, Psycho-pleasure and Ideo-pleasure might play important roles. For instances, aesthetics of glass jewellery

may evoke Psycho-pleasure and glass jewellery may contribute to Ideo-pleasure of users as they use product made of sustainable material (glass).

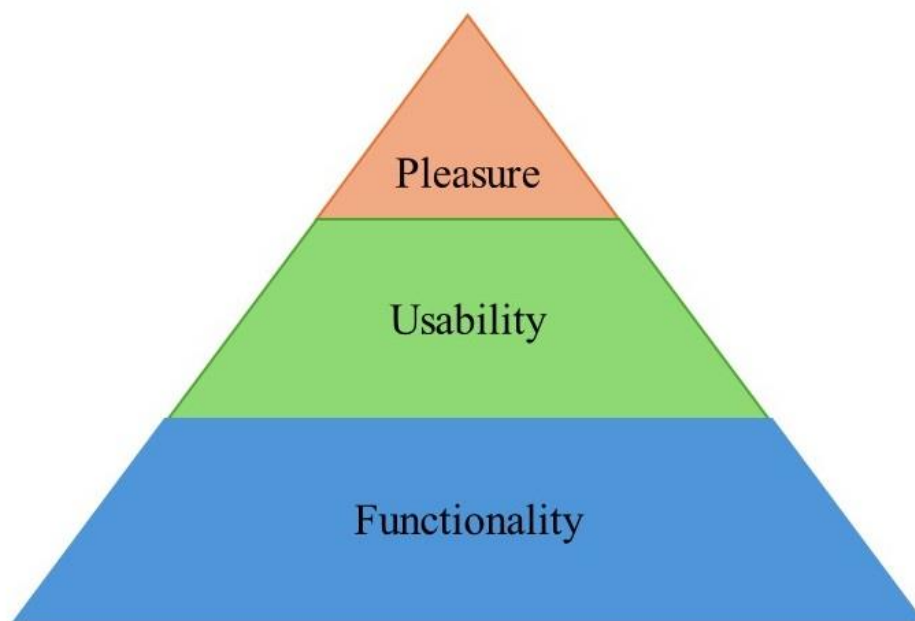


Fig. 2.1 Hierarchy of user needs (adopted from Jordan, 2000)

Product appraisal model was created by Desmet and colleagues (Desmet, 2002; Desmet, and Hekkert, 2002). This model is like Frijda's 'action readiness account' (Frijda, 1986) and mainly founded on evaluation hypothesis of Ortony et al. (1988). As indicated by this model, product appraisal relies upon mental and emotional results, product recognition and the judgment of product plan against a concern, and the evaluation of stimuli of emotion. For instance, if point of view (concern) towards a product (spur) is positive, allure of that

product (appraisal) may prompt inclination (delight/pleasure/satisfaction). According to this theory, this model will be advantageous for originators to clarify how a product might inspire feeling and emotion among consumers.

The emotional design model was explained by Donald A. Norman and his associates, Andrew Ortony and William Revelle (Norman, 2004). It clarifies how emotional signals are processed at various levels in the cerebrum. As indicated by this model, there are three degrees of mind associations which relate to emotion guideline. First level is known as visceral level which is related with intuitive correspondence because of progress in general environment. The subsequent level is behavioural level which is associated with guideline/control of our ordinary conduct. At the topmost level, mind further cycles and expects the signs of behaviour level. This third level is called reflective level. As indicated by Norman's model (Boehner et al., 2007; Norman, 2004), reflective level reacts quickly, making decisions regarding what is positive or negative, protected or perilous, pleasurable or appalling and so on. It likewise triggers different emotional reactions against upgrades, for example, dread, euphoria, outrage, and pity which are a blend of physiological and conduct reactions. These shouting or fleeing are because of the reaction from the behavioural level wherefrom most human exercises are controlled. In reflective level individuals chooses how to control emotion and further decision making.

Following the above conversations, scarcely any inquiries emerge to us regarding use of this hypothesis in product plan. (A) Should designers make products as indicated by differing emotional conditions of the clients/customers? (B) Is it reasonable to conceptualize glass jewellery choice?

Making a product in accordance with differing emotional states or conceptualization of such product is less functional however Norman's model is pertinent in putting an explicit plan into practice. Norman referenced that a product which is expected to be used during recreation time or snapshot of fun, planners need not to stress over the sum and sort of data coming from product interface however they should focus on the best way to make the product more pleasant. Visceral plan is broadly applied for giving product's look, feel and sound great. Aesthetics can be used by designers to make a product emotional for example originators might use clean lines, balance, shading, shapes and surface for this reason.

Norman's model additionally clarifies that individuals are promptly picking an equivalent product to because of positive emotions related with the product (conduct level of handling). The intelligent degree of handling happens when shoppers/clients are choosing to proceed with using a product or to change starting with one product then onto the next product. It tends to be contended that clients will keep getting a kick out of the chance to use a product assuming its design is great. As such, a decent plan might include all degrees of emotional

handling (visceral, behavioral and reflective) through consumer product experience over the long run.

Human perceptual interaction relies essentially upon five modalities. It is feasible to associate prudence to the product qualities using five sensory modalities. Visual, auditory and tactile sensory channels are predominantly related to tangible products in day-to-day existing circumstances (Robinson-Riegler, 2008). Creating new attractive design isn't new; however, there are few issues with visual appeal and attractiveness. Users might buy a product which is attractive and appealing but might not be user friendly. One can be able to understand the actual usability once they buy and use it. In such case it resists "What is beautiful is good" principle (Dion et al., 1972). Subsequently, outwardly engaging or attractive products are not connected all the time with great convenience (Mugge and Schoormans, 2012), much wellbeing and much solace. Vergara et al. (2011) stressed that product's charming appearance should be related with solace and ease of use. The product's visual appearance presents its functionality and usability. It becomes an important factor for perception, choosing a product and its value (Creusen & Schoormans, 2005).

As per the meaning of usability, "when a product or service is truly usable, the user can do what he or she wants to do the way he or she expects to be able to do it, without hindrance, hesitation, or questions" (Rubin & Chisnell, 2008). Product user friendliness can be perceived in two ways: 1) by doing tangible product interaction while using and, 2) by visual appearance of tangible

product. Tangible product appearance becomes important in recent years as apparent usability become the concept of visual presence for product design domain. In the case of e-commerce and online buying apparent usability plays an important role to influence consumers' decision. Apparent usability can be perceived through visual appearance of the product even before using the product. Apparent usability gives the initial idea to consumer about the user-friendliness of the product. Hence, it becomes important for the user in the era of e-commerce when they buy it online or see the product before buying it (Thompson, Hamilton, & Rust, 2005), which becomes important for the user to analyse the usability of the product by its visual appearance. Designers should consider this factor during product development as visual aesthetic of the product might influence the observation and sensitivity regarding the apparent usability of created product by consumers.

Pelzer, Jong, and Kanis (2007) likewise underlined the significance of obvious ease of use and its huge impact on purchasers' inclinations in contrast with intrinsic convenience viewpoints. However, a few separate reports are found on clear ease of use and visual view of product wellbeing solace, discussions between variables should have been assessed all the while with regards to anthropomorphic product design.

Yun et al. (2003) considered appeal as a significant aspect to fulfil the clients through looks of cell phone plan. Numerous different analysts referenced

visual allure as a significant model for improving the marketplace esteem over product's appearance (Bloch 1995; Bloch, Brunel, and Arnold 2003; Creusen and Schoormans, 2005; Hassenzahl, 2004; Moshagen, Musch, and Göritz, 2009) which is equipped for impacting the merchandise buy goal decidedly (Wells, Valacich, and Hess, 2011). Hence, present an open door intended for planners toward satisfy users' passionate requirements via consolidation for engaging quality and sensations of delight utilizing diverse product shapes. Visual outlook is a fundamental variable since it considers related with the object's appearance. It is very much demonstrated that tangible appearance of objects plays a key role in determining users' decision (Creusen and Schoormans, 2005), business achievement and users' life cycle (Crilly et al., 2004).

In another literature, it was observed that the author has drawn attention regarding the growth of handicraft due to globalisation (Vats, 2014). "The growing opportunity for handicrafts in global market is observed when the Indian handicrafts export crossed Rs 1220 crores in 1990-91 from merely 10 crores in the mid-fifties." (Vijayagopalan, 1993). According to handicraft council with the growth of craft and artifacts it seems to reached Rs 52600 crores till 2013.

The situation gives a clear picture regarding the global market of handicraft. According to Bhagwati (2004), the globally famous economic expert, chooses commentators and states about globalisation that if

authority is performed well, it creates powerful impact for societal commodities. Considering his vast expertise and intelligence on world economy and growth, Bhagwati explained the reasons behind "gotcha" the arguments of the experts often not considered as they could have been. With his expertise, intelligence and vocalness, Bhagwati strongly proves globalisation should not be seen as a problem but one should take it as a solution. Pieterse (2004) argued that "we are witnessing the formation of a global *mélange* culture through processes of cultural mixing or hybridization". According to Bhalla and Lapeyne (1999) "social exclusion is the ongoing processes of globalization, deregulation, crisis of the welfare state, and rise of individualism." It is important to understand global situation hence went through "Trends towards global unification and their relation to an economic world-system" (Appadurai, 1990). As per the Indian context the genuine issue emerges when creativity is undermined within the actual procedure for development. Hence, Craftsmen need to upgrade themselves to cater to market need as per the global demands which is remaining. (Subrahmanian, 2006).

Globalization will give a profit-making scenario and may go towards mass production by using machines and reducing handmade essence. As Basu (2004) emphasizes, "though globalization has so far served the handicrafts sector well, there is no denial that some of these products will come under attack and India will not be able to ward that off". On the other hand, in

globalisation period and for the consumers of the country it is not that important to extend service and presence of international brand McDonald's and Kentucky but it's important to have local brands which represents local foods such as Dosa, Rajma, Dalma etc. in the global space like USA, Sweden, Canada (Jena, 2008). Going through the literature about globalisation one thing is clear, that it comes with a lot of substance. Hence, Stiglitz (2002) wrote: "globalisation today is not working. It is not working for many of the world's poor. It is not working for much of the environment. It is not working for the stability of the global economy. The problem however is not with globalisation, but how it has been managed" (Stiglitz, 2002). It's also important to go through handmade glass industry in India which leads me to go through glass report (T E R I. 2012). This report highlighted the prospective about glass industry, process and situation. After this I have also went through the study of glass beads by Ulysses R. Gotera and "Glass beads in Ancient India: An Ethnoarchaeological Approach" (Kunango, 2004; Digitise, 2008) to understand the history of glass and glasswork. Finally, after going through all these literature reviews it has given me understanding about craft, market and its situation. Their relation between each other as well as it also gives me the overview of my question that I have been looking for - "The role of design and e-business in the advancement of indigenous craft: A case study of handmade glass industry."

There must be a democratization of technology among all sections of

society in order for anything to grow sustainably (Tanenbaum et al, 2013). Indian crafts for example are complex eco-system of products and people that is being driven to extinction due to these newer e-commerce platforms not able to accommodate the indigenous goods produced by them (Kotipalli, 2018).

Assessing and understanding the decolonisation of our Heritage in our crafts needed to be understood for us to take on this endeavor (Greru, 2018). Different craft documents helped us design a system that took the cultural and creative identities of artisans under consideration and their backgrounds as well to design a system that suited them well (Greru, 2018; Ghosh and Cheruvalath, 2007).

Arts and crafts are a huge economic booster both in the public and private sectors, they are essentially a competitive advantage when it comes to both education and commerce, now considering the future viability is also crucial to create both an established framework and scalable platform (Murzyn- Kupisz and Holuj, 2021; Chatfield, 2012; Chudasri et al, 2020; Chutia and Sarma, 2016).

So, hereby, it is concluded from the literature review that from the heritage India has lots of crafts which is involve in our day-to-day life. Though craftsmen and cluster are suffering in the present scenario due to traditional business approach and being not comfortable to use new technology and e-commerce business platform (Ray, 2011; Kulhar, 2019). Our craft sector plays a vital role in our economy and its growth. Hence it is

important to bridge the gap between craftsmen and users by using e-commerce portals as an unconventional business strategy.

Eglash et al. (2020) in his paper says that with the onset of AI driven e-commerce platforms, the growth rate has been tremendous for sellers that have the necessary skills to take advantage of these features, but it has proven rather non-productive for the artisans that relied on in-person sales. For this, there are people actively working to find a sustainable way to carry the forward. Literature suggests that website quality influences product purchase intension from the e-commerce website. Website quality refers to visual appeal, online purchase experience, product presentation style and adequate product information etc. (Wells et al, 2011). Chowdhury et al. (2013) suggested that graphic user ratings are a more important element for understanding of product qualities than retain user reviews provided there is a time pressure.

Role of AI and its relevance in e-commerce

Artificial Intelligence or AI has a revolutionary impact on e-commerce that greatly improves several key aspects in the world of online shopping from customer interactions to backend processes. Today, with businesses of all types and sizes turning to data analytics for more efficient operations, a hyper-personalized customer experience and the ability to adapt faster than ever before in this age-defining digital era, its relevance is even higher. Some

important areas of e-commerce where AI is creating an impact are user experience enhancement, customer journey and service, virtual assistance, SEO, Personalization, Search optimization, content and marketing, dynamic pricing and demand forecasting.

Relevance in current scenario

Speeding up Digital Transformation: The e-commerce sector, following the post-pandemic world era, has increasingly leaned on digital commerce. This shift has made AI in E-commerce indispensable to meet expanding customer needs and preferences.

First of all, More Competition: AI generates competitive advantages for businesses through improved services and costs (cost gain or cost out) to attract and keep customers.

Data-Driven Choices: AI's lifeline of analysing vast data at faster speed in real-time is a must to aid the business decision in today's world driven by DATA.

Sustainability: AI has great potential to empower e-commerce businesses for embracing sustainable practices, including logistics optimization (which results in less pollution), decreased waste due to predictive analytics recommendations of what is the best-selling and cost-efficient product, which should be stock or not; supply chain visibility etc.

From providing the most accurate recommendations, to outperforming their competition with new features and best customer experience in that space; AI has become an essential part of e-commerce making businesses operate more intelligently. This area is gaining in importance as companies think about how to use technology for competitive advantage.

This is the era of application of artificial intelligence (AI) in the context of e-commerce and other types of web application design. (Rakhra et al, 2021; Kandhari et al, 2018; Bawack et al, 2022). It is now possible to understand buying behavior of users using various web analytics methodologies. As demonstrated by various authors (Zara et al, 2012; Smith, 2019; Koufaris, 2002; Cummins et al, 2014), the product information can be displayed in the e-commerce platform as a suggestion for purchase based on such behavior of users. In addition, related products offered by different e-retailers can also be suggested by cloud-based e-commerce system in an efficient way using the concept of AI and data analytics (Khrais, 2020; Almarabeh and Majdalawi, 2019; Song et al, 2019). In a similar manner, it might be possible to implement these advanced technologies for promoting hand crafted products to increase the possibility of consumer acceptance and, thus, the selling of handmade products in e-commerce platforms. There is huge potential for these technologies to be adopted and do really good in the long run trickling down to the most niche sectors (Gupta and Reisman, 2022).

Chapter 3

Methodology

3.1. Selection of Participants:

A total of 194 Indian citizens were involved in the user survey after product development. The participants' age varies between 16 years to 58 years ($M_{age} \pm SD = 28.29 \pm 6.69$). Among them 4.6% were male and 95.4% were female. They were from different states of India such as Delhi NCR, Karnataka, West Bengal, Uttarakhand, Maharashtra, Uttar Pradesh, Bihar, Madhya Pradesh, Gujrat, Telangana, Chennai, Haryana, Punjab, Kerala etc.

3.2. Measures:

A total of 11 parameters were taken in consideration to measure aesthetics and apparent usability of handmade glass jewelleryes.

3.2.1. Assessment of Aesthetic Quality:

Following factors were used to evaluate aesthetic quality of handmade glass jewelleryes. These items are –

- 1) old vs novel
- II) common vs unique
- III) non- innovative vs innovative
- IV) visually bad vs visually good
- V) ugly vs beautiful
- VI) unattractive vs attractive

VII) fake vs neutral

VIII) mechanized vs handmade

IX) artificial vs realistic

X) inorganic vs organic

XI) dead vs lively.

The first three items define the level of innovativeness, and these items were adopted from Mugge et.al. (2005). Item number four to six refers to attractiveness of the product and these items were adopted from Chowdhury et. al. (2018). Item number seven to eleven represents anthropomorphic (human like) nature of the product (Chowdhury et. al., 2014; Chowdhury, 2016; Chowdhury et. al., 2018). Seven-point visual semantic scale (VSS) was applied to take user ratings for all the above-mentioned items. To measure the reliability of aesthetic scale, Cronbach's alpha was calculated. The calculated alpha value is 0.92 which is greater than the acceptable value 0.70 (Field, 2009). Therefore, the aesthetic scale is reliable.

3.2.2. Assessment of Usability of Handmade Jewellery:

The usability of the handmade glass jewellery was measured using seven-point Likert scales. Items for Likert scale are –

I) this jewellery meets my style needs;

II) this jewellery is easy to wear;

III) this jewellery is effortless to wear;

IV) this jewellery clasp is user friendly.

To test the reliability of the usability scale alpha value was calculated, noticed alfa value presents 0.79 which can be considered acceptable value (0.07) as suggested by Field (2009).

3.2.3. Assessment of Willingness to Purchase Handmade Jewellery:

The willingness to purchase glass jewellery was measured using seven-point Likeart scale with two items –

I) I would love to own this jewellery

II) I am willing to purchase this jewellery.

As two items were used to measure willingness to purchase, the Pearson's framework on correlation coefficient (r) was calculated for checking the reliability regarding the scale. (Chowdhury et. al., 2014, Field, 2009). The observed inter-item correlation coefficient is 0.84 which is above the benchmark value 0.5. Hence, the willingness to purchase scale is reliable.

3.2.4. Nature Inspired Design

Nature is the ultimate creation and source of inspiration for craftsmen, designers and artisans. With current scenario and environment concerns, it's become important for everyone which leads to sustainability and emulate aspect of nature. It involves not only natural material but also form and function. Nature inspired design is often considered as green design or eco-friendly design. It has

a wide range of applications and possibilities to create design and implement to enhance the natural environment, the efficiencies and aesthetics of natural processes to enhance performance or functionality (Singh, 2017).

AS per the trend (Fig- 3.2) it is evident that in the current situation and scenario within modern design nature inspired bold and clean design are in demand and preferred by users.

To create a nature inspired design following process carried out: -

- 1- Case study, market research and trend analysis conducted for the user liking and preferences. For this both primary and secondary research are done to understand the overall situation.
- 2- Based on the analysis an inspiration board created (Fig- 3.3). From which several key features become clearer in terms of form, colour texture, size etc.
- 3- After drawing inspiration many concepts explored and developed in terms of different designs such as different forms, colour combination, texture, shape and size.
- 4- Within all the concepts only a few (06) concepts got selected based on feedback received from user, craftsmen as well as looking at the possibility to create in glass, available resources and skill set of the craftsmen.
- 5- Further, all the selected concepts are converted into actual prototypes.

3.2.5. Design and Development of Handmade Glass Pendants:

For the development of the product, the design process was followed. Craftsmen's skill and locally available materials were kept in mind for the new glass jewellery development. Based on the survey present and future mood board created (Fig. 3.1 & 3.2) along with inspiration board



Fig. 3.1 Present Trends- Mix of sustainable and other materials: stones, pebbles, fabric, shells, terracotta and metal



Fig. 3.2 Future Trends-sustainable, natural, eco-friendly and recycled materials

Concepts are inspired by nature (Fig. 3.3) and concept sketches were created to arrive with final form of the product. A total of six pendants were selected for this study through ideation and conceptualization process after exploring thirty concept sketches (Fig. 3.4)



Fig. 3.3 Inspiration Board for designing Glass Jewelleries (Pendant)

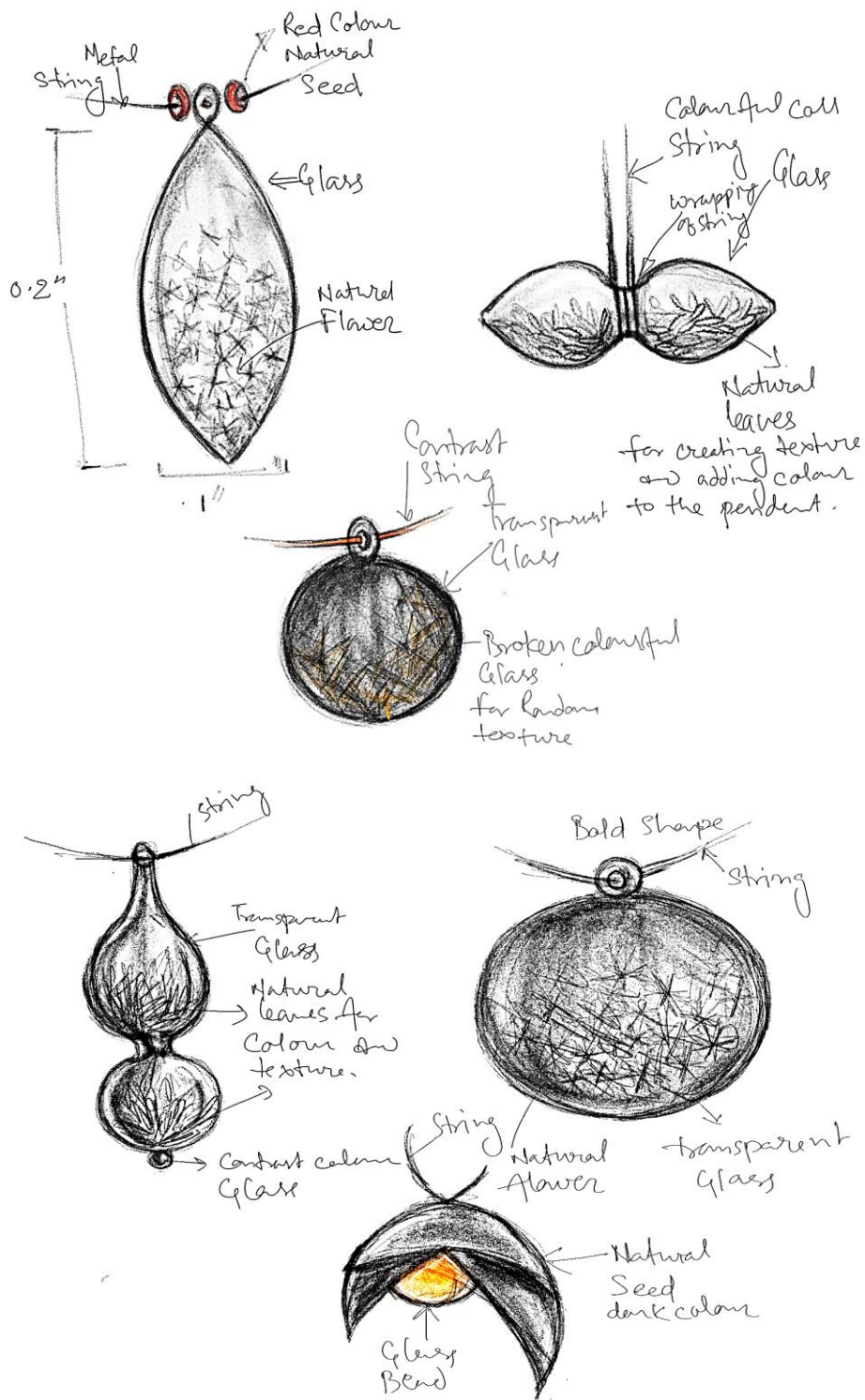


Fig. 3.4 Concept Sketches for Glass Jewelleries (Pendants)

The pendant concepts have sustainable, natural, eco-friendly and recyclable features. It's easy to wear and can maintain a unique aesthetic appeal by using locally available resources. To create the product glass flame work technique is used. A glass pipe heated manually and blown air into it to give the desired shape (Fig.3.5 to 3.10). Once it is done the natural material is inserted to create designs.



Fig. 3.5 Cleaning and heating the glass pipe



Fig. 3.6 Heating till it softens to blow air



Fig. 3.7 Blowing air to create desire shape

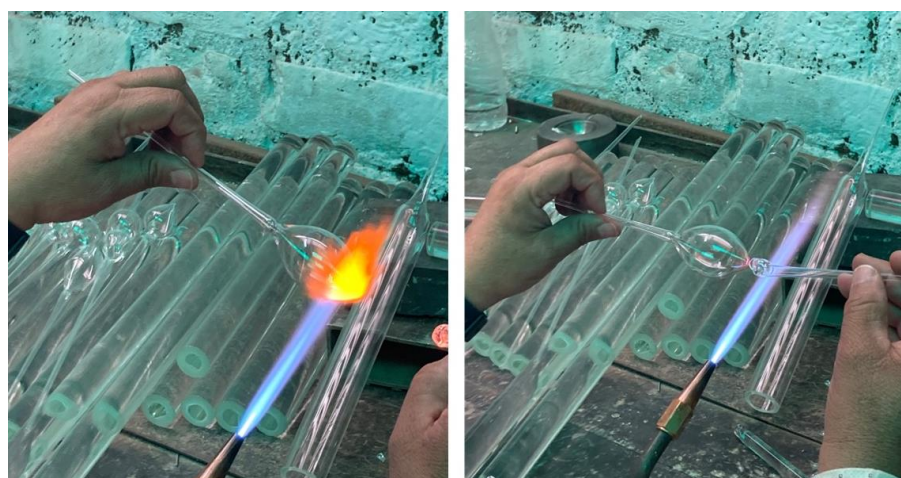


Fig. 3.8 Closing and finishing the shape from one side



Fig. 3.9 Inserted natural material in the glass and proceeded to close the opening



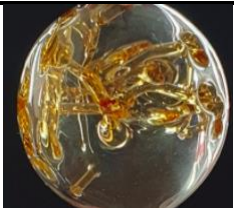
Fig. 3.10 Finishing the jewellery and final prototype

Concept Prototypes:

After the exploration of concepts in terms of sustainability, eco-friendliness, usage of natural materials and to make the products recyclable, six (06) concept prototypes were designed (Table 3.1). The characteristic features of each concept or product have been depicted in an elaborate manner below.

Table 3.1 Concepts / Products Prototype and Characteristic Features of Glass

Pendants

	Pendent	Details	Clasp	
Product 1				Product-Pendant Material- Glass String- Nylon Clasp- Metal “s” Hook Specialty- Handmade textured glass
Product 2				Product-Pendant Material- Glass String- Nylon Clasp- Magnetic Clasp Specialty- Handmade with natural flower
Product 3				Product-Pendant Material- Glass String- Cotton Clasp- Lobster Clasp Specialty- Handmade with natural seed

Product 4				Product-Pendant Material- Glass String- Nylon Clasp- “s” Hook Specialty- Handmade with natural flower
Product 5				Product-Pendant Material- Glass String- Nylon Clasp- Magnetic Hook Specialty- Handmade with natural flower
Product 6				Product-Pendant Material- Glass String- Metal wire Clasp- Magnetic Hook Specialty- Handmade with natural flower

3.2.6. Survey Procedure

A questionnaire was prepared for a user survey to measure aesthetics, usability, and willingness to purchase handmade glass jewellery using items as depicted in the above-mentioned sections of methodology. Demographic information was also collected through the questionnaire. All images of product concepts were embedded into the online Google form. The online questionnaire

was sent to individual target user and simple random sampling technique was applied to float the questionnaire for the user survey.

3.2.7. Statistical Analysis of Survey Data

All the demographic information and variations of design qualities were analyzed applying descriptive statistics such as mean, standard deviation, frequencies, and percentages. The ANOVA(s) was conducted to check the significant mean variations in aesthetics, usability, and willingness to purchase due to various design concepts.

In order to ascertain the relationship among usability, aesthetics and willingness to purchase glass jewellerys, Pearson correlation coefficients were calculated. The simple and multiple regression analysis was performed to predict the willingness to purchase handmade glass jewellery. The partial correlation coefficients were conducted to understand the level of influence of aesthetics and usability.

3.2.8. Design of the e-commerce Platform for selling Handmade Products:

The interface was designed for both the craftsmen and consumers considering simplicity, user friendliness, language (Hindi and English), aesthetics, and trustworthiness. As craftsmen are not highly educated, they only have primary education in National language (Hindi) and they understand

symbolic languages: the interface of the dash-board for craftsmen is designed using infographics and Hindi language. On the other side, a minimalistic visually good interface language was designed for target consumers. The trustworthiness of the e-commerce portal was planned through implementation of following features –

- I) Time to Time notifications for product delivery.
- II) Cash on delivery option.
- III) Doorstep replacement guarantee.
- IV) Product insurance option
- V) AI based chatbot for handcrafted product stories and purchase assistance
- VI) Within domain craft product search product optimization and AI based handcrafted product suggestion, etc.

3.2.9. Testing of Usability of the Designed Interface using Heuristics

Heuristic analysis is a process of evaluating the usability and user experience of a website or application by applying heuristics principles. In short, these heuristics are in the form of general rules or guidelines that assist to find possible usability concerns, which create problems for user interaction with the system. This analysis helps to make the platform more natural and user friendly. Further, it creates an impact on better conversions and user satisfaction.

For the heuristic analysis few key points were considered such as information architecture, navigation and flow of the structure, visual clarity,

indication and process indicator for user, control of tool whether user can select or reverse their decision, infographic and visual standardization, error identification and prevention, language, recognition, efficiency and aesthetics.

For the E-commerce platform 07 experts from 10 to 20 years of experience were invited to conduct the heuristics analysis (keeping in mind Nelson's usability heuristic principles for interface design).

Following process conducted for the heuristic's evaluation: -

- For the heuristics evaluation each expert went through e-commerce platform and checked usability, and its flow based on different situations such as product selection to check out from the cart. It helps to correct and improve the user experience.
- After the analysis each issue categorizes to see its impact and severity level based on the user flow and experience as well as structure and visual narrative, which may influence the experience or business goals.
- Based on the findings expert suggested and given recommendation on steps to complete task such as some change in icons and visuals as well as to integrate more language, which may create impact on user experience and conversion.
- As per the expert's recommendation the changes implemented on e-commerce platform and did pilot testing to validate the effectiveness and enhancement.

As it's continuous process hence, it's important to conduct the evaluation on time to time basis to maintain and upgrade the platform based on user experience, review, trend and technological development. Further, with positive changes it will provide great experience for the user, which will lead to engagement and sales (Emmanuel & Musingi (2010).

The Heuristics Evaluation Method was used to determine usability of the designed interface prototype for the e-commerce platform. Nielsen's heuristics were used in the usability evaluation of designed interfaces for the desired application (Nielsen, 1994; Rubin and Chisnell, 2008; Barnum, 2010).

Chapter 4

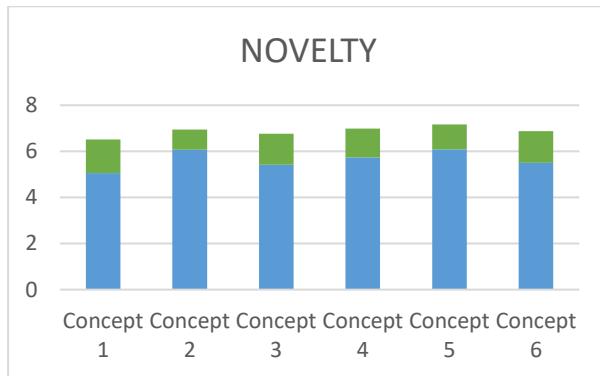
Result and Discussion

In this chapter the result is discussed after the survey and analysis conducted upon different users. The results present that apparent usability, aesthetic and usability plays vital role for willingness to purchase. On the other hand, digital space will be useful for the e-business and to avoid middleman as well as to expand and grow the business.

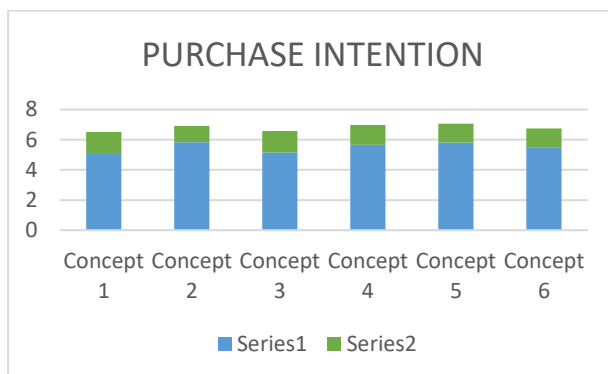
4.1. Novelty and Purchase Intentions of the Concept Prototypes:

The data were analyzed based on the feedback of 194 users or participants. In the novelty scale, Concept 5 got the highest rating whereas Concept 1 got the least rating. Upon comparison with purchase intention, novelty scale has created an impact towards purchase intention. Consequently, most of the users wanted to buy Concept 5 and least of them wanted to buy Concept 1 (Fig.4.1).

DATA ANALYSIS



NOVELTY		
Concept 1	5.06	1.45
Concept 2	6.07	0.87
Concept 3	5.42	1.34
Concept 4	5.74	1.25
Concept 5	6.08	1.09
Concept 6	5.5	1.38



PURCHASE INTENTION		
Concept 1	5.11	1.39
Concept 2	5.83	1.08
Concept 3	5.16	1.42
Concept 4	5.67	1.31
Concept 5	5.8	1.26
Concept 6	5.49	1.25

Fig. 4.1 Novelty and Purchase Intention of the concept prototypes

We have analysed this data based on 194 users' feedback. In this novelty scale is showing concept 5 got the most rating and concept 1 got less rating, when comparing with purchase intention it shows that novelty scale impacting the purchase decision. So, concept 2 and 5 most people want to buy and concept 1 least.

4.2. Variations of Mean Values of Aesthetics, Usability and Willingness to Purchase:

After conduction of repeated measure ANOVA, it was observed that it mean aesthetics values are significantly altering due to variations in jewellery design [$F(5) = 28.95$; $p < 0.000001$, $\eta^2 = 0.13$, $OP = 1.00$]. The mean aesthetics value was lowest in case of jewellery concept one ($M_{\text{aesthetics}} \pm SE = 5.29 \pm 0.08$) and it was highest in case of jewellery concept five ($M_{\text{aesthetics}} \pm SE = 5.99 \pm 0.07$) (Fig. 4.2). However, all the mean values for aesthetics of product concepts are greater than five on a seven-point scale, which means all designs concepts are good. The concept five stands best among all the glass pendant concepts.

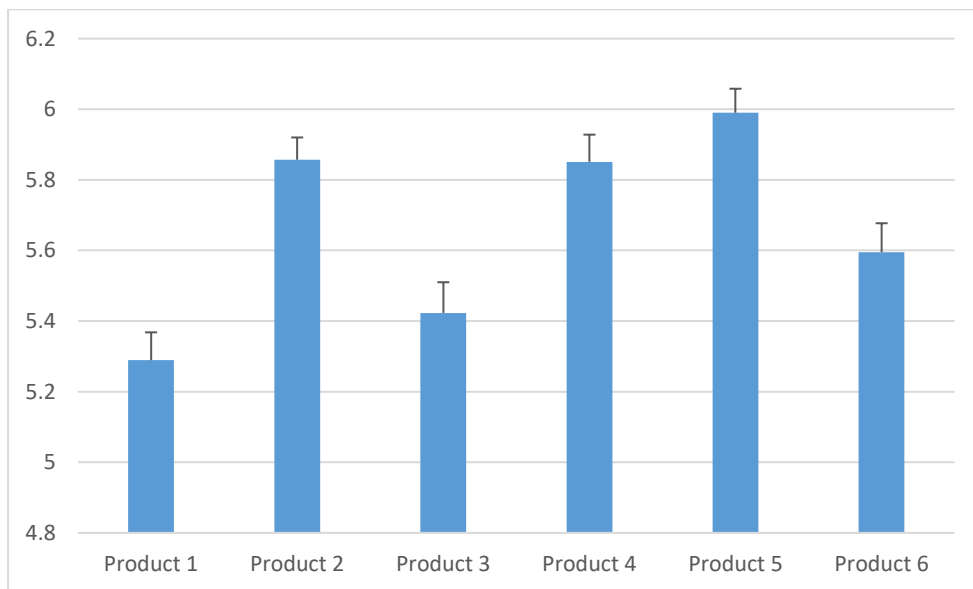


Fig. 4.2 Mean variations in aesthetics perception

In Product 1, the form of the jewellery is circular; it has transparency due to material but as another coloured glass is inserted abstractly; hence, the transparency is not very clear. On the other hand, Product 5 has multiple curves which make the form attractive. It has contrasting colour and clear transparency which reflects sustainable natural material. Therefore, it becomes more interesting, attractive and triggers the emotional point of the user which is the reason it's accepted by most users. Miesler et. al. (2011) has found that curviness has an impact on product choice (e.g. people accepted toaster which is curvier than the others and choose juicers which is less curvy). Karkun, Chowdhury and Dhar (2018) have studied newborn like creation qualities on observed desire in the context of coffeemaker, people prefer and connect to the product which is curvier. Chowdhury, Chakrabarti and Karmakar (2018) have found that the effect of novelty, pleasure, curviness and attractiveness in the context of anthropomorphic television (user attracts towards product, which is novel, curvy, pleasurable and based on anthropomorphism). Hence, it's identified that the Product 5 got highest rating due to curvier form, as it has an anthropomorphic (human like) attribute and novelty in design.

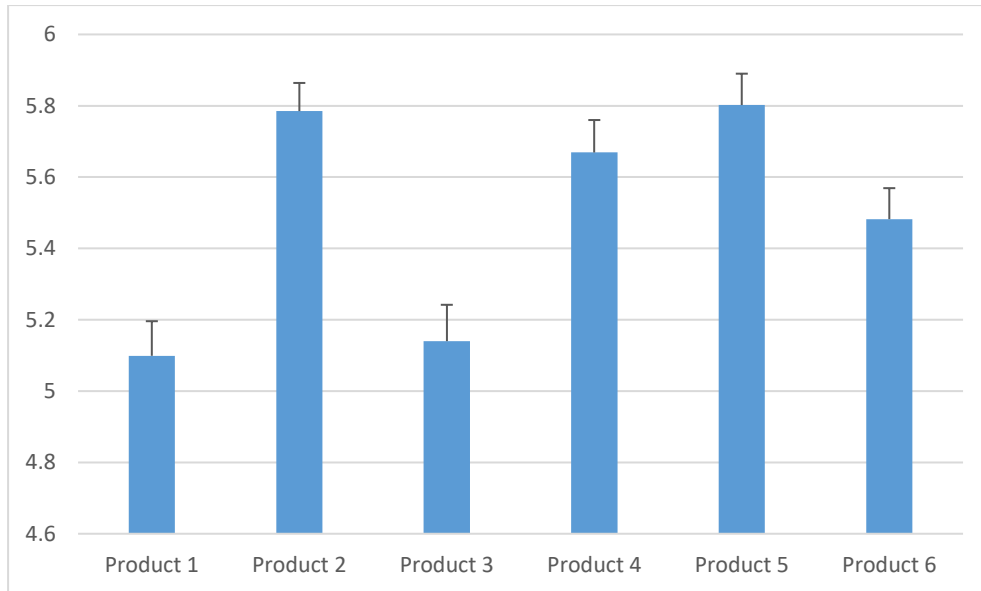


Fig. 4.3 Variations in usability perception

The repeated measure ANOVA revealed that the mean usability values are significantly altered due to variations in jewellery design [$F(5) = 20.61$; $p < 0.000$, $\eta^2 = 0.09$, $OP = 0.99$]. The mean usability value was lowest in case of jewellery concept one ($M_{\text{usability}} \pm SE = 5.01 \pm 0.1$) and it was highest in case of jewellery concept five ($M_{\text{usability}} \pm SE = 5.80 \pm 0.08$) (Fig. 4.3). However, all the mean values for usability of product concepts are greater than five on a seven-point scale, which means all designs concepts are good. The concept five stands best among all the glass pendant concepts.

When comparing the design of product 1 and product 5, we found differences in the way of usage of pendants. Product -5 had magnetic clasp

which is easier to use than metallic ‘S’, present in Product- 1. Literature suggests that the functionality of the product contributes to usability of the products (Chihara and Seo, 2014; Chowdhury et al. 2014; Jorden, 2000; Rubin and Chisnell, 2008). In addition, apparent usability generally perceived from novelty in product appearance influences product appraisal; thus, it affects the product choice (Mugge and Schoormans, 2012). In this study, it is also evident that the target users have had a good understanding of apparent usability of the product as they perceived from shared images of various products.

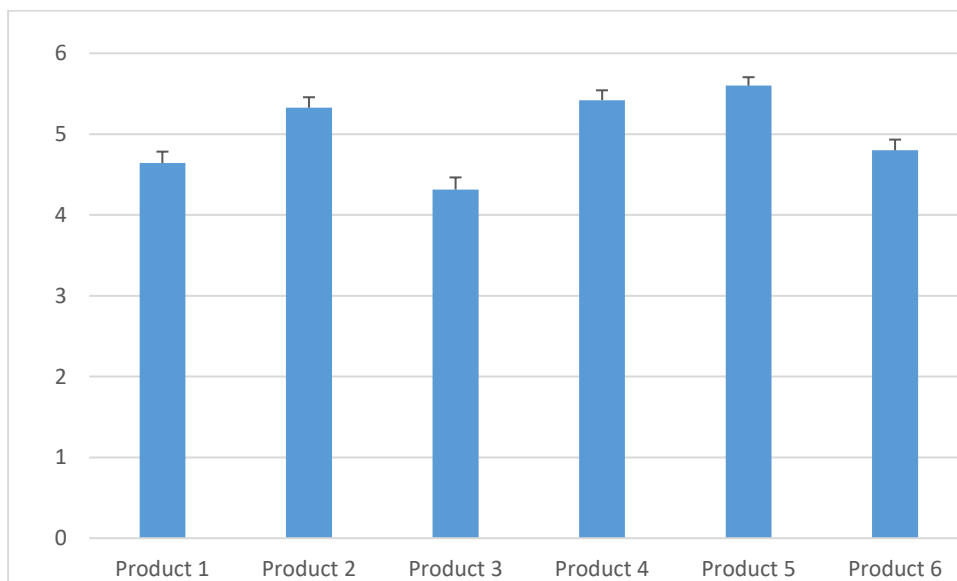


Fig. 4.4 Variations in willingness to purchase

The repeated measure ANOVA revealed that the mean willingness to purchase values are significantly varying due to variations in jewellery design [$F(5) = 25.69$; $p < 0.00000$, $\eta^2 = 0.05$, $OP = 0.92$]. The mean willingness to

purchase value was lowest in case of jewellery concept three ($M_{\text{willingness to purchase}} \pm SE = 4.31 \pm 0.14$) and it was highest in case of jewellery concept five ($M_{\text{willingness to purchase}} \pm SE = 5.60 \pm 0.11$) (Fig. 4.4). However, all the mean values for willingness to purchase product concepts are greater than five on a seven-point scale, which means all designs concepts are good. The concept five stands best among all the glass pendant concepts.

Table 4.1 Mean variations of aesthetics in multiple comparison test

Aesthetics	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
Product 1	-	0.001	ns	0.001	0.001	0.001
Product 2	-	-	0.001	ns	0.013	0.001
Product 3	-	-	-	0.001	0.001	0.031
Product 4	-	-	-	-	0.047	0.001
Product 5	-	-	-	-	-	0.001
Product 6	-	-	-	-	-	-

ns : no significant difference observed.

When mean values of aesthetics were compared multiple times in various combinations, significant differences are observed in most of the cases. Aesthetics mean value of 'Product 5' is significantly higher than all other

products (Table 4.1). The aesthetic value of ‘Product 5’ is the highest among all products. When mean values of aesthetics of ‘Product 1’ has been compared to ‘Product 3’, no significant difference is observed ($p > 0.05$). Similarly, when mean values of aesthetics of ‘Product 2’ has been compared to ‘Product 4’, no significant difference is observed ($p > 0.05$).

Table 4.2 Mean variations of usability in multiple compression test

Usability	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
Product 1	-	0.001	ns	0.001	0.001	0.001
Product 2	-	-	0.001	ns	ns	0.001
Product 3	-	-	-	0.001	0.001	0.001
Product 4	-	-	-	-	ns	0.040
Product 5	-	-	-	-	-	0.001
Product 6	-	-	-	-	-	-

ns: no significant difference observed.

When mean values of usability were compared multiple times in various combinations, significant differences are observed in most of the cases. Usability mean value of ‘Product 5’ is significantly higher than most of the products [Product 1, Product 3 and Product 6] (Table 4.2). Product 6’ is

significantly different from the other 4 designs except the product 4 because easy to operate the magnetic clamp. Usability value of 'Product 5' is highest among all products. When mean values of usability of 'Product 2' has been compared to 'Product 5', no significant difference is observed ($p > 0.05$). Similarly, when mean values of usability of 'Product 5' has been compared to 'Product 4', no significant difference is observed ($p > 0.05$). No significant difference is observed ($p > 0.05$), when 'Product 1' was compared with 'Product 3' and 'Product 2' was compared with 'Product 4'.

Table 4.3 Mean variations of willingness to purchase in multiple compression test

Willingnes s Purchase	Produc t 1	Produc t 2	Produc t 3	Produc t 4	Produc t 5	Produc t 6
Product 1	-	0.001	0.025	0.001	0.001	ns
Product 2	-	-	0.001	ns	0.008	0.001
Product 3	-	-	-	0.001	0.001	0.001
Product 4	-	-	-	-	ns	0.001
Product 5	-	-	-	-	-	0.001
Product 6	-	-	-	-	-	-

ns: no significant difference observed.

When the mean values of willingness to purchase were compared multiple times in various combinations, significant differences are observed in most cases. Willingness to purchase mean value of 'Product 5' is significantly higher than most of the products (Table 4.3). Willingness to purchase value of 'Product 5' is highest among all products. When mean values of willingness to purchase of 'Product 4' has been compared to 'Product 5', no significant difference is observed ($p > 0.05$). Similarly, when mean values of willingness to purchase of 'Product 1' has been compared to 'Product 6' and 'Product 2' has been compared to 'Product 4' no significant difference is observed ($p > 0.05$).

4.3. Correlation Among Aesthetics, Usability and Willingness to Purchase:

A significant relationship is found between aesthetics and usability in the context of jewellery (pendant) design ($r = 0.78$, $p = 0.01$). A significant relationship is found between aesthetics and willingness to purchase in the context of jewellery (pendant) design ($r = 0.78$, $p = 0.01$). Significant relationship is found between usability and willingness to purchase in the context of jewellery (pendant) design ($r = 0.79$, $p = 0.01$) (Table 4.4)

Table 4.4 Regression constants and co-efficient(s) along with model summary

Model	Parameter	Co-efficient (SE)	t- Value	Level of Significance
1	Constant	-2.56(0.183)	-14.002	0.001
	Aesthetics	1.34(0.032)	42.227	0.001
2	Constant	-1.26(0.146)	-8.659	0.001
	Usability	1.14(0.026)	44.213	0.001
3	Constant	-2.73(0.016)	-16.954	0.001
	Aesthetics	0.71(0.044)	15.965	0.001
	Usability	0.68(0.037)	18.350	0.001

Dependent variable: willingness to purchase

4.4. Prediction of jewellery purchase based on aesthetics and usability:

In this section, based on user's feedback prediction of jewellery purchase has been analysed. During this process aesthetics and usability were kept in mind.

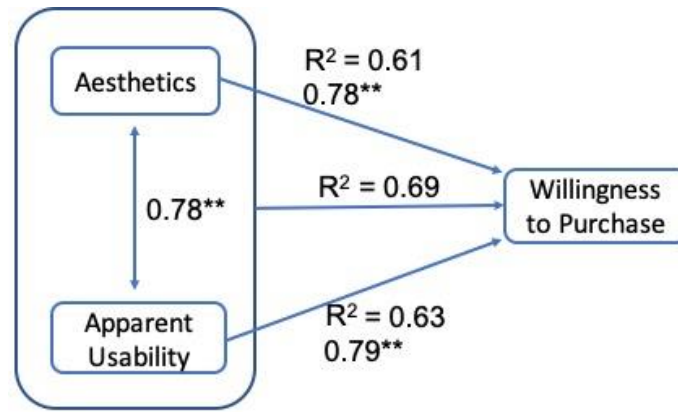
4.4.1 Prediction of Willingness to purchase based on Aesthetics:

Willingness to purchase jewellery was predicted on the basis of aesthetics and it was observed that aesthetics has the ability to predict willingness to purchase [$R = 0.78$, $R^2 = 0.61$, $SE = 1.178$, $F(1) = 1783.140$, $p < 0.001$]. The regression constant for the equation was -2.558 ($t = -14.002$; SE

= 0.183; $p < 0.001$), aesthetics coefficient was 1.34 ($t = 42.227$; $SE = 0.032$; $p < 0.001$).

Willingness to purchase jewellery was predicted on the basis of usability and it was observed that usability has been able to predict willingness to purchase [$R = 0.79$, $R^2 = 0.63$, $SE = 1.145$, $F(1) = 1954.762$, $p < 0.001$]. The regression constant for the equation was -1.264 ($t = -8.659$; $SE = 0.146$; $p < 0.001$), usability coefficient was 1.14 ($t = 44.213$; $SE = 0.026$; $p < 0.001$).

Willingness to purchase of jewellery was predicted on the basis of aesthetics and usability it was observed that aesthetics and usability are able to predict willingness to purchase [$R = 0.83$, $R^2 = 0.69$, $SE = 1.1037$, $F(1) = 1317.499$, $p < 0.001$]. The regression constant for the equation was -2.733 ($t = -16.954$; $SE = 0.161$; $p < 0.001$), aesthetics coefficient was 0.71 ($t = 15.945$; $SE = 0.044$; $p < 0.001$) and usability coefficient was 0.68 ($t = 18.350$; $SE = 0.037$; $p < 0.001$) (Fig. 4.4).



**Significant at the level 0.01

Fig. 4.5 Aesthetics and usability predict willingness to purchase jewellery

4.4.2. Apparent usability is partially mediating the influence of aesthetics on willingness to purchase:

Coefficient for aesthetics ($\beta = 1.34$) was higher than the coefficient of apparent usability ($\beta = 1.14$) when the willingness to purchase was solitarily predicted by each of these factors. However, the coefficient of aesthetics ($\beta = 0.71$; $t = 15.945$, $p < 0.001$) was comparatively lower than the solitary aesthetic coefficient, when the willingness to purchase was predicted by both aesthetics and usability ($\beta = 0.68$). This kind of result refers to the mediation effect of usability on prediction of willing to purchase based on aesthetics, although the mediation effect is not that significant. Hence, it can be ascertained that usability is partially mediating the influence of aesthetics on willingness to purchase (Fig. 4.5).

Literature suggests that apparent usability and aesthetics significantly influence the user preference and decision (Lee and Koubek, 2010). In addition, apparent usability and aesthetics gives an idea to the consumer about the look, feel and functionality of the product which attracts or hold consumer for purchase (Keinonen, 1999; Kurosu and Kashimura, 1995; Tractinsky, 1997). In this study, it is also evident that the user understands apparent usability and aesthetics which attract and influence willingness to purchase from the shared images of various products.

4.5. Digital space for Indian craft to create e-business:

Designing the user interface of an e-commerce portal for selling handmade glass products of India is very imminent in the present scenario. After the pandemic (COVID) lots of businesses, including craft, got impacted and suffered to sustain as they were using traditional way of doing their business (Pavithra & Jacob 2018). The data was obtained from the analysis of surveys among the users and clusters. Hence, the need for online presence and involving technology for sustainability and growth becomes the key factor.

The selling of handcrafted products on e-commerce platforms is not new. However, crafts- men are not getting much benefit after selling products in online platform because of middlemen. These middle men are purchasing the handcrafted products from artisans for a very low cost and selling the

same at a high price through retail store and online platform to get the maximum benefit. Now the question is - can we remove the middlemen and design a portal for craftsmen to sell their product directly to the consumers? By doing this both craftsmen and consumers will be able to connect better. It will also allow them to grow the business and get maximum profit which will further make their livelihood better. In an improved eco system the whole clusters economic status, work, business and living conditions will be enhanced. (Ranjan et.al 2021; Christine and Singh. 2022; Chanda et.al 2024)

Literature suggests that if we design the e-commerce portal considering aesthetics, usability and trustworthiness by reducing the complexity of the system, there is a chance to enhance the sale of products through online platform. It also disrupts the market to enhance business (Konradt et al, 2012; Nathan and Yeow, 2011; Cooper and Vlaskovits, 2013; Schneider et al, 2018).

Chapter 5

E- Business platform

The digital reforms and growing economy in India make it essential to offer a platform for Indian craftsmen to expand their business (Sharma, A., Bhowmick, B., & Patnaik, J. 2020). By starting an online platform where those Indian craftsmen can showcase their products to potential customers (Kesaboina, V. M., Tiwari, V., & Gupta, P. K. 2022). In addition to enabling customers with a digital space to browse through crafts, review them and experience the beauty of traditionally made items using AR, the global marketplace will give Indian craftsmen an opportunity to widen their reach while increasing sales. This digital platform will also tackle the problems faced by Indian artisans such as no marketing networks for them, copyright protection of their products and uniformity in prices even with same handicrafts and research and development needed for India's art and craft sector. With the usage of digital marketing techniques and technology, we can help Indian artisans to overcome these problems so they can start knocking viral in this digital market. Secondly by promoting collaborations and partnerships between design experts, artisans and enabling foreign direct investments can help in enhancing innovation through skills development in the handicraft sector that would enable further economic

activity contribute to the overall growth of Indian economy specifically in backward areas where employment is a challenge.

In addition, this digital space will harness the immense market potential in India - with over a billion population and one of the fastest growing numbers of internet users (Durai & King 2019). The e-commerce platform will not only connect the glass craftsmen with consumers around India and across the globe, but also transition to a potent online payment gateway (Gopish, 2019). We guarantee that by offering a user-friendly system along with secure payment services and logistic support to make the experience both for the craftsmen as well as their clientele. In summary, the digital space will act as an enabler for Indian craftsmen to grow and succeed in business through technology and digital marketing, which offer chances to thrive; reach more customers, preserve the heritage of Indian handicrafts across global markets (Durai & King 2019). This would not only help to provide craftsmen with a user-friendly digital platform to connect with potential customers, display their authentic and unique products among wider audience base but also by this means they can create sustainable livelihoods for themselves as well as the communities who are involved and by its way it will aid in survival and reviving of traditional crafts system prevalent across India. To sum up, this digital space designed for Indian craftsman provide them an opportunity to defeat all their hurdles and take off as well as enhance their sale (Gopish 2019). To create a digital space exclusively for Indian craftsmen would help to eliminate many of these problems and

provide for the marketing networks, copyright protection, price uniformity, and research and development requirements. Which will help the designers and craftsmen to work and surely in FDI thereby creating innovate and skill development market in handicraft. This idea, of embracing digital marketing and making it easier than ever, for Indian craftsmen to both market and sell their products, can be revolutionary. If we can leverage the internet itself to cater to the issues and help strengthen the craftsmanship of these Indian artisans, it will provide them with the ability to address some of the challenges they experience, expand their national and international reach, and increase their sales.

Creating a digital hub for Indian craftsmen to flourish would incorporate digital technologies with traditional craft sector, which would open various marketing capabilities, widened reach for craftsmen allowing to flourish their business. Integrating digital technologies into the existing practice of the craft sector in India will not only strengthen the marketing network and exposure for the craftsmen but also helps in optimizing the production process and quality of products. Indian craftsmen can digitize their creations and use such digital tools to display them in a virtual world and show every detail and complexity of what they have produced to their customers.

In addition to this, adopting a data-driven approach and deploying customer insights through digital can act as constructive criticism to craftsmen by making them aware about what the market and consumers are looking to buy. A data-

centric approach will help artisans to make products that are rooted in legacy, nevertheless also aligned with modern trends and catered towards a global palate. Further, by bringing e-commerce functionality to the digital realm, craftsmen can reach and sell directly to a broad customer demographic without involvement of traditional middlemen and retail chains. It is to pay our craftsmen fairly and to stay as close as possible to those who use our products, through a direct-to-consumer connection (Ray 2011).

5.1. Design of an e-commerce platform for selling handmade products:

Innovation is the process of making (something) new or doing something in a new way. In business, innovation also has to include the concept of improvement; to innovate in business is not just to do something differently, but to do or make something better. E commerce innovation involves developing new products or improving existing technologies, processes, designs and marketing to solve problems and reach new customers. There may be other methods or approaches to solve the issues related to loss of sales but to change in human psychology & behavior and Investment of more time in mobile and remain online and try to explore other ways of shopping.

For users it is a new enticing channel available to transact online. Moreover, there is enough freedom as well as privacy in online shopping. Users can surf the internet and look for products, make comparisons of different models and

evaluate their prices. They can also go to other online product review sites and discuss them in various social network forums. Once the customer likes a product after all research, sitting in the comfort of his home, he can order it online. E-commerce has also made it easy to make payments using various options such as credit cards, debit cards, direct online money transfers, etc. (Wadhawan N & Munjal M. 2011).

The primary objective is to design a simple, user friendly, bilingual (Hindi and English), visually good and trustworthy e-commerce platform for selling handmade glass products. As craftsmen are not highly educated, they only have primary education in National language (Hindi) and they understand symbolic languages: the interface of the dash-board for craftsmen is designed using infographics and Hindi language. On the other hand, a minimalistic visually good interface language was designed for target consumers. The trustworthiness of the e-commerce portal was planned through implementation of following features –

- I) Time to Time notifications for product delivery
- II) Cash on delivery option
- III) Doorstep replacement guarantee
- IV) Product insurance option assistance

V) Within domain craft product search product optimization and AI based hand crafted product suggestion, etc. (Fig. 5.1). Fig. 5.2 is meant for sample screens of the designed interface.

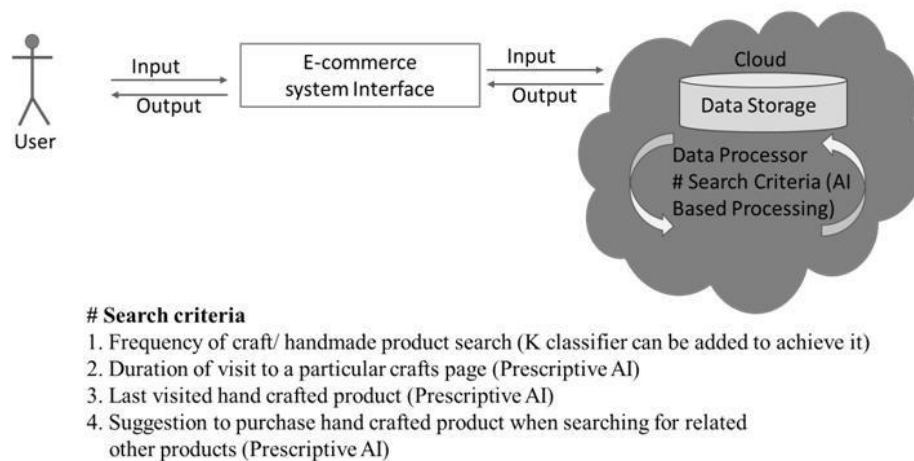


Fig. 5.1 AI based e- commerce system for suggesting and presenting hand crafted products

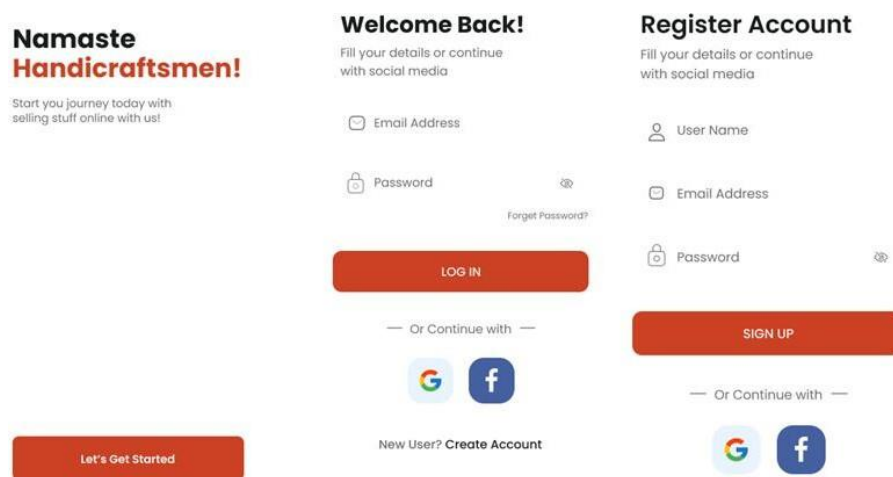


Fig. 5.2 The Greeting Screen (Far Left), The Login Screen (Middle) and The Sign-up Screen (Far Right)

5.2. Analysis of Heuristic Evaluation Method:

The usability of the designed interface prototype for the e-commerce platform was assessed by Heuristics evaluation method. The proposed design has a clean and standardized look which is helpful for both the customer and the sellers, to navigate the app back and forth. The visibility of system status at all given times using primary colour to determine next steps helped to keep streamlined user flow in the interface. This helped users further in recognizing the user interface and building consistent mental models for them. The feature called assisted flows proved great support for users in order to prevent errors and pitfalls as it assisted users in completing the task at hand and redoing certain tasks in case of wrong routes. The UX writing done reflects the real terminology and linguistics making it easier to understand for the core audience of the chatbot based assistance. The product stories told by using chatbot motivate consumers to purchase hand crafted products. In addition, the AI based hand crafted product suggestions might help user easily to search products and reduce the search time. These features made the app more interactive and interesting for the consumer as suggested by experts during heuristics evaluation.

Thus, it is revealed that the planned interface is simple, user friendly, bilingual (Hindi and English), visually good, and trustworthy in

nature (Fig. 5.3). Craftsmen and consumers can utilize the e-commerce platform for selling and purchasing the process of handmade glass products and more.

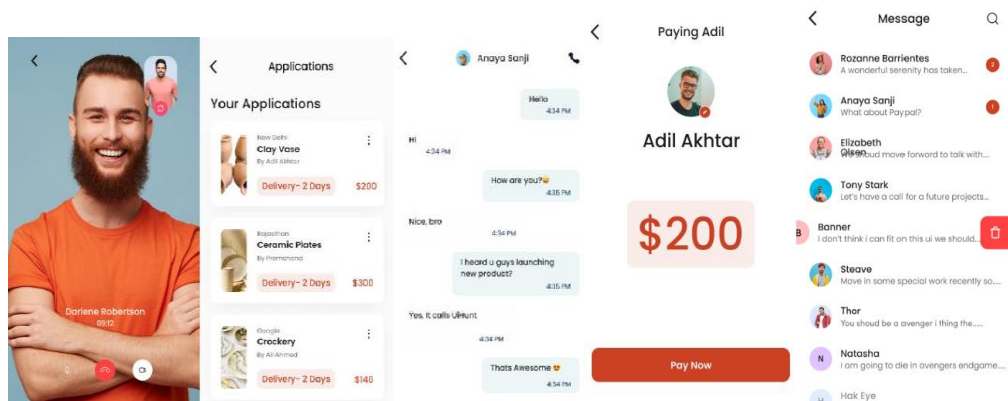


Fig. 5.3 Various UI screens of the designed application

5.2.1. Practical Implications

This section deals with practical implications for craftsmen to function e- business platform effectively.

For Craftsmen

For craftsmen, the platform will serve as a way to uplift their craft products for sale at online avenues. It caters to the customers that are the core audience for handmade products, the user's flows have been set up in a way to avoid failure points and pitfalls, it will serve as a platform for their digital journeys.

For Organizations

Organizations can also use this platform to showcase their products and not only sell them; the platform encourages anyone especially non-profit to showcase the work they are doing with physical goods.

For Volunteers

Volunteers who wish to make a change can also signup on the platform and work as, help to fulfil their goals, and help the artisans in the process as well.

Chapter 6

Conclusion

The study was undertaken to bring to the forefront the dwindling scenario of one of the indigenous crafts of India that is handmade glass works. It is true that in an era of stiff competition, these appalling workers are constantly exerting their wholehearted effort to ensure that their business can sustain, and they can eke their livelihood out of their profession. However, it is very much pertinent that in modern times of globalization, the handmade glass workers must focus on the design of their products- the design should be user friendly and aesthetically pleasing.

Here comes the role of design experts and consultants who can enumerate the influence of aesthetics and usability on these workers so that they can develop new designs. The collaboration between craftsmen and design experts / consultants will open new doors in the market. It will further help them not only to develop products, create uniqueness, standardization, quality control, durability, functionality as per the market and users need but also reduce the limit of the risk of failure and rejection.

By connecting professional along with craftsmen, it will embark new journey for innovation, creativity, and sustainability for the handmade glass cluster of Firozabad, India. Also help them to tackle new challenges in the market dynamics with more meticulousness and anticipation. Further this will

unfold a new epoch for growth and prosperity for the glass craft cluster and enable them to shape an apparent place in the market with better connection with the consumer.

On the other hand, appropriate marketing of these user centric designed glass products will create new image and identity for glass cluster. The immense role of E-commerce platform needs to be explored to the core for optimum business growth. In fact, glass clusters require an online platform along with digital support for their widespread expansion to the buyers. In such instances the role of middleman, who otherwise reaps the maximum benefits and monopolies the transactions, will become redundant or miniscule. In the study the following salient features observed: -

1. Provision for design development using designers and others.
2. Business opportunity through digital mode.
3. Development issues should stress the varied target user needs with their specific use and fitting in their context (this approach has been implemented and developed via few designs).
4. Identified design experts to involve with cluster to develop work via local/gov. initiatives to update the product and business.
5. A consortium may be created with the representative of artisans and relative stockholders for periodical evaluation for practice and promotion

Thus, it can be concluded that user friendly design along with versatile and full-blown use of E-commerce platforms will help craftsmen to sustain their livelihood and grow their business manifold in the present situation.

Limitation and Future Research

The present study has some limitation like:

1. More craft clusters could have been covered to get the representation from the different perspective of the Indian clusters.
2. The study involved communication with remotely located craftsmen and a lot of this happened virtually (due to Covid), it affected the smooth and prompt development of the research. In conducting focus groups and interviews over digital platforms, sometime struggled to establish a personal connection with the participants and explore their responses in depth.
3. During the development of the website, card-sorting and heuristic analysis was done and only the pilot phase was executed with minimum number of user involvement as a focus group.
4. The website testing and application of AI need to include with others analysis parameters including larger craftsmen's and user's participations.

Further study has shown positive indication for growth, development of the craft cluster in India and peoples are interested to buy the product online:

1. In the near future, other new mediums and business models can be explored to enhance craft business.
2. Different levels of craftsmen could have been covered for further study including the stakeholders like NGOs or government bodies' involvement through development and implementation of policies.

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Appendix

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- 1) “The Influence of Aesthetics and Apparent Usability on Jewelry Design Preference”

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The Influence of Aesthetics and Apparent Usability on Jewelry Design Preference

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ABSTRACT

Over the last two decades scholars have studied the relationship between product usability and consumer purchase intentions. It has been established that perceived usability is valuable for predicting intentions to purchase water bottles, kitchen appliances, smart devices, etc., but there has been little research on the role of usability in jewelry purchase decisions. Product aesthetics is also an important factor in consumers' purchasing decisions; aesthetics creates attraction, evokes emotions and satisfaction in shoppers. This article aims to investigate the role of aesthetics and usability in jewelry purchasing decisions in India. A survey of 194 potential jewelry customers was undertaken, with respondents asked for their opinions on six product concepts for handmade glass pendants. Our results show that aesthetics, usability and willingness to purchase handmade glass pendants are strongly and significantly related to each other. When correlation and multiple regression analysis were performed on the survey data, it was found that both usability and aesthetics positively influence purchase intention. This study finds that aesthetics and apparent usability are both valuable predictors for purchase intention of glass pendants.

Keywords: Aesthetics, Craft, Design, Apparent usability, Craft cluster.

INTRODUCTION

Craft artisans in India continue their traditional craft practices generation after generation. Craft practices have a huge impact on the country's society. Craft products are generally designed and developed using hand tools and represent either national or otherwise regional cultural values. Craft products require the dexterity and intense concentration of their artisans. They have distinct valued qualities and play a vital role in the economic development of India. Craft products are also a prominent source of

foreign exchange and revenue generation. Craft practices require low capital investment and enable employment opportunities. They also act as status symbols owing to their uniqueness, usage of natural materials, and their inherent essence as representing the vibrant art and culture of India.

In the recent past, there has been little study of craft practices in India as they relate to jewelry design, especially from a design thinking approach (Manavis et al., 2020). Some studies from a sustainable design approach do exist. Recently, Atamtajani & Putri (2020) discussed the design of jewelry made from pineapple skin. Such entrepreneurial and creative jewelry work has become a trend in the western world (Brandão et al., 2021). However, there is very little exploration of creative entrepreneurship that utilizes glass jewelry in India. In another context, scholars discussed designing jewelry manufactured through the additive process (Fatma et al., 2021).

There are traces indicating India has a history of glass jewelry of over 2,000 years. Glass making is practiced by several communities across the country. Firozabad is famously called “the city of glass” as well as “Suhag Nagri”. People there have high skills in making glass jewelry and other products. This skill contributes to the economy, employability and livelihood of craftsmen, which sustain and grow themselves. Most glass products used in the country are from there. When it comes to glass jewelry, product aesthetics and usability play a vital role in attracting and influencing consumers. People’s perception of craft products and the way they relate to products in their everyday environment is closely related: “the meaning of things” deals with “social conversations” about status, identity, social cohesion, and the pursuit of personal and cultural meaning (Csíkszentmihályi & Rochberg-Halton, 1981).

To understand the correlation between visual aesthetics, willingness to purchase and pricing, Mumcu & Kimzan (2015) define the relationship between visual aesthetics of products and consumers’ price sensitivity. They claim the visual aesthetics of products and their sub-dimensions (including value, acumen, and response) have an impact on purchasing and pricing decisions. As per Mugge et. al. (2005), a product’s meaning is deeply anchored and is inseparable from it. The product can be rendered irreplaceable by stimulating the formation of memories associated with it or by creating uniqueness and personal products. To relate aesthetics with the customers intentions to purchase, Toufani et al. (p. 1, 2017) has argued that “the product’s aesthetics influences their purchase intention through different dimensions of perceived value drawn from perceptions of the product’s aesthetics, or whether there is a direct relationship from aesthetics to purchase intention” Other research shows that the aesthetics of the environment, where products or services are rendered and consumed, has a profound influence on consumer behavior and satisfaction (Bitner, 1992; Donovan et al., 1994; Morrin & Ratneshwar, 2003). Bhadauria et. al. (2016) mention that humans are attracted to aesthetics and it influences their purchasing decisions. Contemplating aesthetics is unavoidable and is a fundamental part of our lives. In a profoundly aggressive market climate, there is expanded equality in the usefulness of items, which implies that every product should work true to form. Purchase decisions are being progressively influenced by the style of a product: lovely individuals and delightful things have an extraordinary appeal (Andreoni & Petrie, 2008; Dion et al., 1972; Biddle & Hamermesh, 1994; Langlois et al.,

1991; Ramsey et al., 2004; Van Leeuwen & Macrae, 2004). Our partiality for magnificence is reflected in all parts of our conduct. Customers experience a mind-boggling number of decisions as they stroll down store walkways. On the off-chance that an item's tasteful allure draws in a buyer, they are bound to approach and investigate it further.

Based on this, the aim of the current study is to find out the role of aesthetics and usability in purchasing decisions of glass jewelry in India.

RELEVANCE OF AESTHETICS AND EMOTION IN JEWELRY DESIGN

As a general rule, comprehension coordinates the emotions of day-to-day existence, and there are various reasons for emotion other than cognizance. All things considered, aesthetics and emotions are related to one another, and the way that a product change can prompt various fundamental emotions in potential customers. Positive emotions can be felt by customers when interacting with product design. For many years, product designers have considered aesthetics and emotion, in India and abroad. They are attempting to construct procedures for aesthetics and emotional product design. There are a few models related to jewelry purchase intentions that are therefore important for this article to discuss.

PLEASURE THEORY

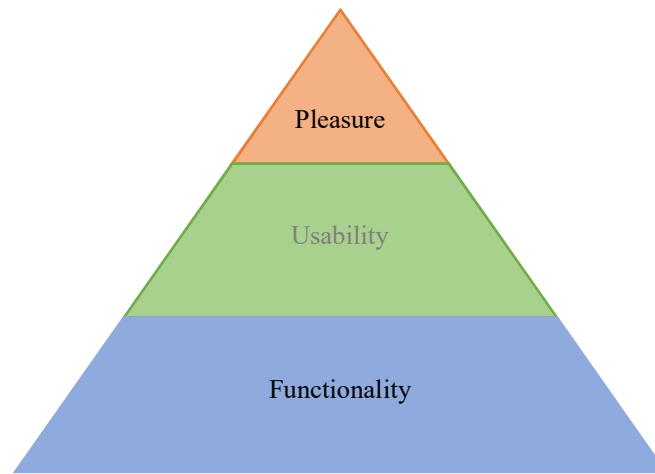
This elective emotional model, proposed by Patrick Jordan (2000), zeros in on additional pleasurable parts of our associations with products. It thinks about potential advantages that a product can convey. Like the structure of pleasure given by Tiger (1992), the pleasure theory proposes four particular sorts of pleasure: a) Physio-pleasure; b) Socio-pleasure; c) Psycho-pleasure and d) Ideo-pleasure (Jordan, 2000). Physio-pleasure concerns tangible encounters about products, for example, holding a cell phone. Socio-pleasure alludes to satisfactions received from associations with others. Products can work with social associations in various ways. For instance, a barista offers assistance in the way of being a point of fascination for a coffee gathering. Psycho-pleasure is related with mental and enthusiastic responses. A product might require a specific degree of mental capacity to utilize it and customers may have a passionate reaction to the product. Ideo-pleasure alludes to people's comprehension of their own qualities, for instance, a product comprised of biodegradable materials connecting to the ethical consumerism ideals of the customer.

Related to this, Jordan puts pleasure in the third level of his hierarchy of needs, after convenience and usefulness (see figure 1). When customers decide to purchase, they are first worried about usefulness, then, convenience, and ultimately, pleasure. While the usefulness and convenience of numerous products are comparable, pleasure assumes a significant part in product determination.

In the context of purchasing glass jewelry, psycho-pleasure and ideo-pleasure might play important roles. The aesthetics of glass jewelry may evoke psycho-pleasure and glass jewelry may contribute to the ideo-pleasure of users as they use a product made of a sustainable material (glass).

Figure 1

The hierarchy of user needs adapted from Jordan (2000).



EMOTION AND PRODUCT APPRAISAL

A product appraisal model was created by Desmet (2002) and Desmet & Hekkert (2002). This model is like Frijda's "action readiness account" (1986) and is mainly founded on the evaluation hypothesis of Ortony et al. (1988). Product appraisal relies upon mental and emotional results producing recognitions, the judgment of a product plan against a concern, and the evaluation stimuli emotion. For instance, if point of view (concern) toward a product (spur) is positive, allure of that product (appraisal) may prompt inclination (delight/pleasure/satisfaction). According to this theory, such a model is advantageous for originators to clarify how a product might inspire feeling and emotion among consumers.

The emotional design model is well explained by Norman (2004). It clarifies how emotional signals are processed at various levels in the cerebrum. As indicated by this model, there are three degrees of mind associations which are connected to emotion guideline. The first level is known as the visceral level, which is related with intuitive correspondence, because of progress in the general environment. The subsequent level is the behavioral level which is associated with the guideline/control of our ordinary conduct. At the topmost level, the mind further cycles and expects signs from the behavior level. This third level is called the reflective level. Norman's model (Boehner et al., 2007; Norman, 2004) shows the reflective level reacting quickly, making decisions regarding what is positive or negative, protected or perilous, pleasurable or appalling and so on. It likewise triggers different emotional reactions against upgrades, for example, dread, euphoria, outrage and pity. Shouting or fleeing are behavioral reactions. At the reflective level, individuals choose how to control emotions and further decision making.

Following the above conversations, scarcely any inquiries emerge in regard to the use of this hypothesis in product plans. We wonder, (a) Should designers make products as indicated by differing emotional conditions of the clients/customers? And (b) Is it reasonable to conceptualize glass jewelry as a choice?

Norman says that for a product which is expected to be used during recreation time or in a snapshot of fun, planners do not need to stress product interface data.

They should instead focus on the best way to make the product more pleasant. A visceral plan should be broadly applied for making the product's look, feel and sound great. Aesthetics can be used by designers to make a product more emotional: for example, originators might use clean lines, balance, shading, shapes and surfaces for this reason.

Norman's model additionally clarifies that individuals may purchase a competitive product because of the positive emotions related with the product (the conduct level of handling). The intelligent degree of handling happens when shoppers/clients choose to proceed with using a product or change from one product to another. It tends to be assumed that clients will keep getting a kick out of the chance to use a product if the design is great. As such, a decent plan might include all degrees of emotional handling (visceral, behavioral and reflective) through a consumer product experience over a long period.

THE ROLE OF APPARENT USABILITY AND APPEARANCE IN PRODUCT ACCEPTANCE

Human perceptual interaction essentially relies upon five modalities. Visual, auditory and tactile sensory channels are predominantly related to tangible products in day-to-day existence (Robinson-Riegler, 2008). Creating new attractive design is not new; however, there are a few issues with visual appeal and attractiveness. A user might buy a product which is attractive and appealing but that might not be user friendly. One is able to understand actual usability only once they buy and use a product. In such case, it resists the "what is beautiful is good" principle (Dion et al., 1972). Subsequently, outwardly engaging or attractive products are not always convenient (Mugge & Schoormans, 2012a) or associated with wellbeing and solace. Vergara et al. (2011) stress that a product's charming appearance should be related with solace and ease of use. A product's visual appearance presents its functionality and usability. It is an important factor for perception, choosing a product and its value (Creusen & Schoormans, 2005).

As per the meaning of usability, "when a product or service is truly usable, the user can do what he or she wants to do, the way he or she expects to be able to do it, without hindrance, hesitation, or questions" (p. 4, Rubin & Chisnell, 2008). Product user-friendliness can be perceived in two ways: 1) Tangible product interaction through use, and 2) Visual appearance of a tangible product. Tangible product appearance has become important in recent years as apparent usability becomes the concept of visual presence in the product design domain. In the case of e-commerce apparent usability plays an important role in influencing consumers' decisions. Apparent usability can be perceived through the visual appearance of the product even before its use. Apparent usability gives an idea to the customer about the user-friendliness of the product. Hence, it becomes important for the user in an era of e-commerce, when they are buying it online, or seeing the product before buying it (Thompson et al., 2005). Designers should consider this factor during product development. The visual aesthetic of a product might influence how people perceive its usability.

Pelzer et al. (2007) likewise underlined the significance of ease of use and its impact on purchase intention in contrast with intrinsic convenience. However, a few

separate reports also exist on clear ease of use, and the visual view of product wellbeing and solace, which are actually discussions about variables that should always be assessed in regard to anthropomorphic product design.

Yun et al. (2003) considered appeal as a significant aspect to fulfill clients through the look of cell phone plans. Numerous analysts referenced products' visual allure as a significant model for improving market esteem (Bloch, 1995; Bloch et al., 2003; Creusen & Schoormans, 2005; Hassenzahl, 2004; Moshagen et al., 2009) and purchase intentions (Wells et al., 2011). Therefore, planners can fulfill consumer's needs through consolidating the engagement of quality, and sensations of delight utilizing diverse product shapes. Visual product appearance is fundamental (Creusen & Schoormans, 2005) and assists business achievements and consumers' life cycles (Crilly et al., 2004).

DESIGN AND DEVELOPMENT OF HANDMADE GLASS PENDANTS

A total of six pendants from thirty concept sketches were selected for this study. The concepts were inspired from nature (see figure 2) and the concept sketches were created to show the final form of the product. Please refer to figure 3 for sample concept sketches related to the forms of the pendants. These pendants are sustainable, natural, eco-friendly and recycled using locally available resources. It is easy to wear them and maintain their unique aesthetic appeal. To create the product, the glass flame technique was used. A glass pipe was heated manually and air was blown into it to give the desired shape. Once this was done the natural material was inserted into the blown pendant to create particular designs. After the concept explorations, a total of six concepts were selected for this study (see table 1).

Figure 2

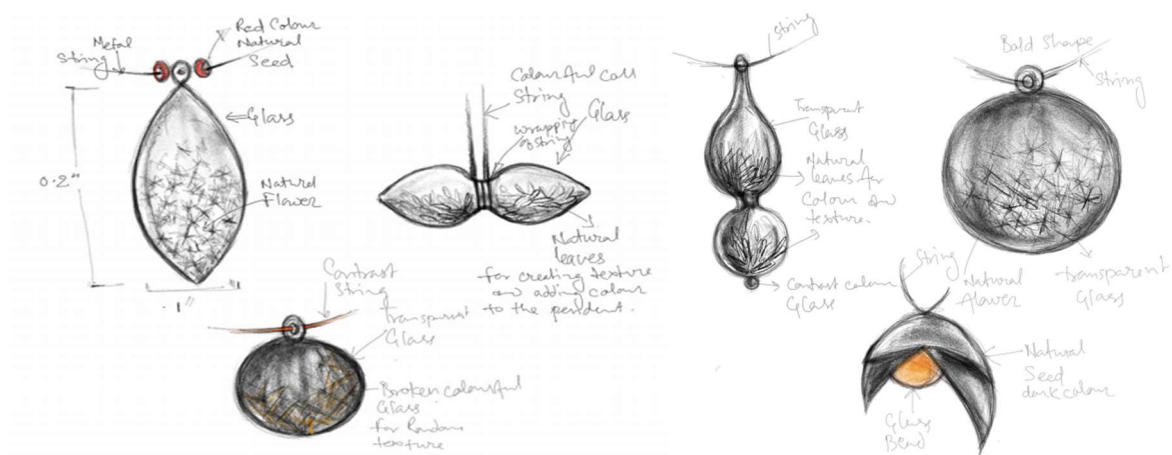
Inspiration board for designing a glass pendant.



Figure 3

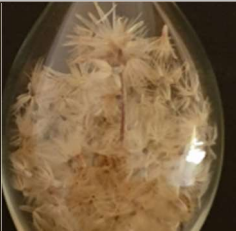
Concept sketches for a glass pendant.

CONCEPT SKETCHES

**Table 1**

Concept prototypes and characteristics of glass pendants.

	Pendant	Details	Clasp	
Product 1				String: Nylon Clasp: Metal "s" Hook Specialty: Handmade textured glass
Product 2				String: Nylon Clasp: Magnetic Specialty: Handmade with natural flower
Product 3				String: Cotton Clasp: Lobster Specialty: Handmade with natural seed
Product 4				String: Nylon Clasp: "S" Hook Specialty: Handmade with natural flower
Product 5				String: Nylon Clasp: Magnetic Hook Specialty: Handmade with natural flower

	Pendant	Details	Clasp	
Product 6				String: Metal wire Clasp: Magnetic Hook Specialty: Handmade with natural flower

SURVEY PROCEDURE

A questionnaire was prepared to measure customers' perceived aesthetics, usability and willingness to purchase the chosen pendants. Demographic information was collected. All images of the product concepts were embedded into the online Google form used to distribute the questionnaire, which was sent to individuals through the simple random sampling technique.

STATISTICAL ANALYSIS OF SURVEY DATA

All the demographic information and variations of design qualities were analyzed by applying descriptive statistics such as mean, standard deviation, frequencies and percentages. The analysis of variance (ANOVA) was conducted to check significant mean variations in aesthetics, usability and willingness to purchase, based on design concepts.

To check the relationship among usability, aesthetics and willingness to purchase, Pearson correlation coefficients were calculated. Simple regression is generally conducted to predict the status of a dependent variable on the basis of another independent variable, sometimes called a factor; whereas, in the case of multiple regression analysis, the value of a dependent variable can be predicted based on multiple factors (independent variable). Simple and multiple regression analysis was performed to predict the willingness to purchase handmade glass jewelry. Once aesthetics and apparent usability independently used as predictor independent variable to predict willingness to purchase or, and then aesthetics and apparent usability together used to predict willingness to purchase. The partial correlation coefficients were conducted to understand the level of influence of aesthetics and usability.

RESULTS AND DISCUSSION

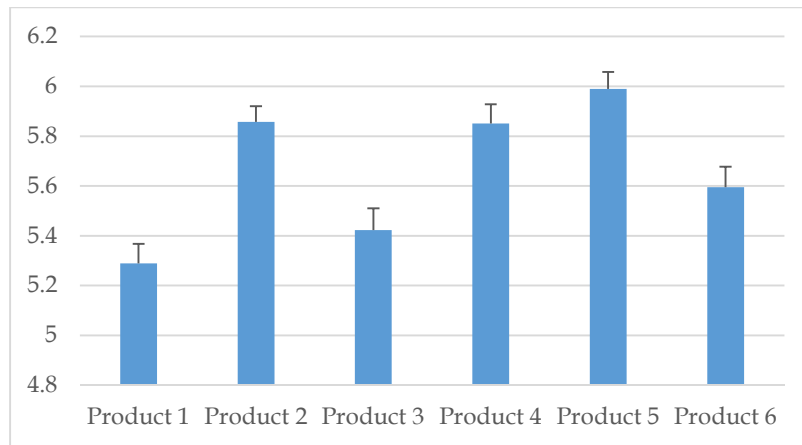
VARIATION IN MEAN VALUES

After repeated ANOVAs, we found the mean aesthetics values significantly varied based on jewelry design ($F(5) = 28.95$; $P < 0.000001$, $\eta^2 = 0.13$, $OP = 1.00$). The mean aesthetics value was lowest in the case of concept one ($Mean_{product-1} \pm SE = 5.29 \pm 0.08$) and it was highest in case of concept five ($Mean_{product-5} \pm SE = 5.99 \pm 0.07$).

However, all mean values were greater than five on a seven-point scale; implying all designs concepts are at least “good”. Concept five had the highest score.

Figure 4

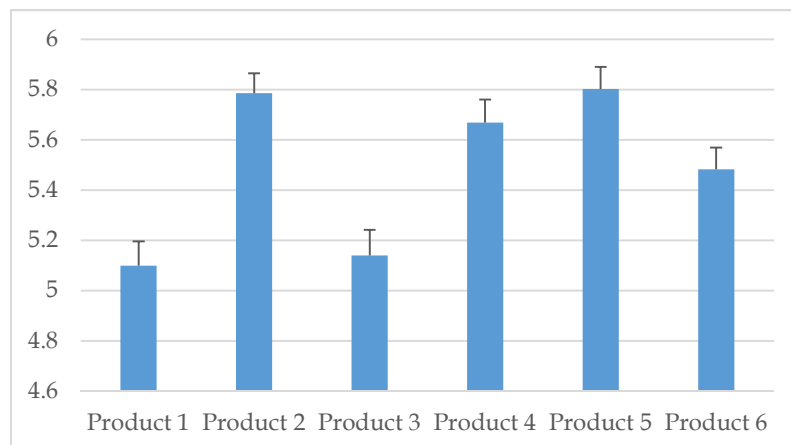
Mean variations in aesthetics perception.



In product concept one, the form of the jewelry is circular, transparent and has colored glass inserted within it; hence, the transparency is not clear. Product concept five has multiple curves, contrasting colors, yet is transparent, showing the inserted sustainable natural material, making it more interesting and attractive, and triggering customers' emotions, which is the reason it was accepted by most respondents. Miesler et. al. (2011) found that curviness has an impact on product choice (E.g., people prefer curvy kitchen appliances). Karkun et al. (2018) found people also prefer curvier coffeemakers. Chowdhury et al. (2018) found that customers are attracted to products which are novel, curvy, pleasurable and based on anthropomorphism, in the context of television sales. Therefore, we can say that product concept five received the highest rating by respondents because of its curvier form, its anthropomorphic attributes and design novelty.

Figure 5

Variations in perception of usability.

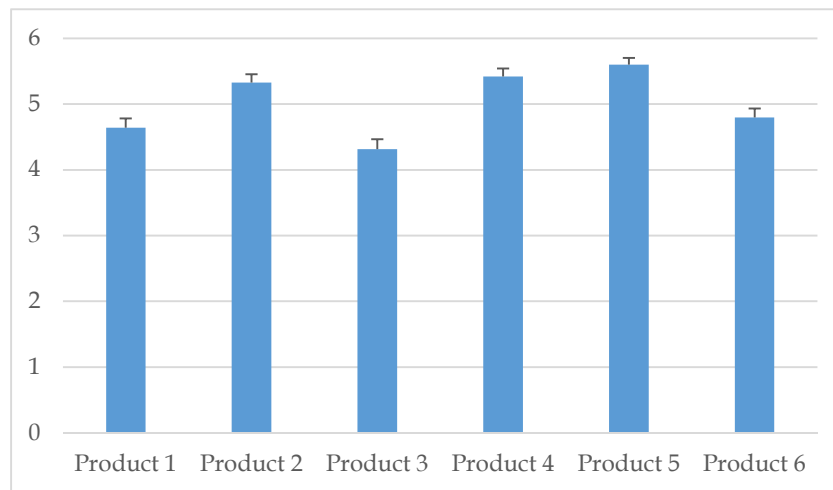


The repeated measure ANOVA revealed that the mean usability values significantly varied based on jewelry design ($F(5) = 20.61$; $P < 0.000$, $\eta^2 = 0.09$, $OP = 0.99$). The mean usability value was lowest for concept one ($Mean_{product-1} \pm SE = 5.01 \pm 0.1$) and highest for concept five ($Mean_{product-5} \pm SE = 5.80 \pm 0.08$). However, all the mean values for usability were greater than five on seven-point scale; which means all designs concepts were considered “good”. Concept five had the highest score.

When comparing the design of product concepts one and five, we found a difference in the way the pendants are used. Concept five has a magnetic clasp which easier to use than the metallic ‘S’ of product concept one. Scholars suggest that the functionality of a product contributes to its usability (Chihara & Seo, 2014; Chowdhury et al., 2014; Jordan, 2000; Rubin & Chisnell, 2008). In addition, the apparent usability is generally perceived from novelty in product appearance and influences product appraisal (Mugge & Schoormans, 2012a; Mugge & Schoormans, 2012b). Our respondents had a good understanding of the apparent usability of the products, as perceived by the images of the product concepts shown to them.

Figure 6

Variations in willingness to purchase.



The repeated measure ANOVA revealed that the mean willingness to purchase values significantly varied based on jewelry design ($F(5) = 25.69$; $P < 0.00000$, $\eta^2 = 0.05$, $OP = 0.92$). The mean willingness to purchase value was lowest for jewelry concept three ($Mean_{product-3} \pm SE = 4.31 \pm 0.14$) and it was highest in case for jewelry concept five ($Mean_{product-5} \pm SE = 5.60 \pm 0.11$). However, all mean values for the willingness to purchase variable were greater than five on a seven-point scale; which means all concepts were considered “good”. Concept five again got the highest score.

When the mean values of aesthetics were compared, multiple times and in multiple combinations, significant differences were observable in most of the cases. The aesthetics mean value of product concept five is significantly higher than the others (see table 2). There is no significant difference (NS) between the aesthetics mean values of product concepts one and three. The same is true for comparing product concepts two and four ($P > 0.05$).

Table 2*Significant mean variations of aesthetics in multiple compression test.*

Aesthetics	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
Product 1	-	0.001	NS	0.001	0.001	0.001
Product 2	-	-	0.001	NS	0.013	0.001
Product 3	-	-	-	0.001	0.001	0.031
Product 4	-	-	-	-	0.047	0.001
Product 5	-	-	-	-	-	0.001
Product 6	-	-	-	-	-	-
Product 6	-	-	-	-	-	-

When the mean values for the usability variable are compared in various combinations, significant differences are observable. The mean value of usability for product concept five is significantly higher than for products one, three and six (see table 3). The usability value for this product is in fact the highest among all products. When the mean value of the usability variable for product concept two is compared to product concept five, no significant difference was observed ($P > 0.05$). Similarly, when the mean value for the usability of product five is compared with that of product concept four, no significant difference is observable ($P > 0.05$). No significant difference is also observable ($P > 0.05$) when comparing product concept one with product three and when comparing product two with product four.

Table 3*Significant mean variations for the usability variable in a multiple compression test.*

Usability	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
Product 1	-	0.001	NS	0.001	0.001	0.001
Product 2	-	-	0.001	NS	NS	0.001
Product 3	-	-	-	0.001	0.001	0.001
Product 4	-	-	-	-	NS	0.040
Product 5	-	-	-	-	-	0.001
Product 6	-	-	-	-	-	-

When the mean values for the willingness to purchase variable were compared multiple times and in multiple combinations, significant differences are observable in most of the cases. The willingness to purchase mean value of product concept five is significantly higher than most of the other products (refer to table 4) and its overall value is the highest of all products. When the mean values for willingness to purchase of product concept four is compared to five, no significant difference is observable ($P > 0.05$). Similarly, when the mean value for the willingness to purchase variable of product concept one is compared to product six and product concept two is compared to product concept four, no significant difference is observed ($P > 0.05$).

Table 4

Significant mean variations of the willingness to purchase variable in a multiple comparison test.

Willingness to Purchase	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
Product 1	-	0.001	0.025	0.001	0.001	ns
Product 2	-	-	0.001	NS	0.008	0.001
Product 3	-	-	-	0.001	0.001	0.001
Product 4	-	-	-	-	NS	0.001
Product 5	-	-	-	-	-	0.001
Product 6	-	-	-	-	-	-

CORRELATION AMONG AESTHETICS, USABILITY AND WILLINGNESS TO PURCHASE

Based on this study, there is a significant relationship between aesthetics and usability in the context of pendant design ($r = 0.78$, $P = 0.01$). There is also a significant relationship between aesthetics and willingness to purchase ($r = 0.78$, $P = 0.01$) and between usability and willingness to purchase ($r = 0.79$, $P = 0.01$).

PREDICTION OF INTENTION TO PURCHASE JEWELRY BASED ON AESTHETICS AND USABILITY

In this study, aesthetics was able to predict willingness to purchase ($R = 0.78$, $R^2 = 0.61$, $SE = 1.178$, $F [1] = 1783.140$, $P < 0.001$). The regression constant for the equation was -2.558 ($t = -14.002$; $SE = 0.183$; $P < 0.001$) and the aesthetics coefficient was 1.34 ($t = 42.227$; $SE = 0.032$; $P < 0.001$). Further, usability was also found to be able to predict willingness to purchase ($R = 0.79$, $R^2 = 0.63$, $SE = 1.145$, $F [1] = 1954.762$, $P < 0.001$). The regression constant for this equation was -1.264 ($t = -8.659$; $SE = 0.146$; $P < 0.001$) and the usability coefficient was 1.14 ($t = 44.213$; $SE = 0.026$; $P < 0.001$). Finally, aesthetics and usability together are able to predict willingness to purchase ($R = 0.83$, $R^2 = 0.69$, $SE = 1.1037$, $F [1] = 1317.499$, $P < 0.001$). The regression constant for that equation was -2.733 ($t = -16.954$; $SE = 0.161$; $P < 0.001$), aesthetics coefficient was 0.71 ($t = 15.945$; $SE = 0.044$; $P < 0.001$) and the usability coefficient was 0.68 ($t = 18.350$; $SE = 0.037$; $P < 0.001$) (refer to table 5).

Table 5

Regression constants and co-efficient(s) along with model summaries for the dependent variable of willingness to purchase.

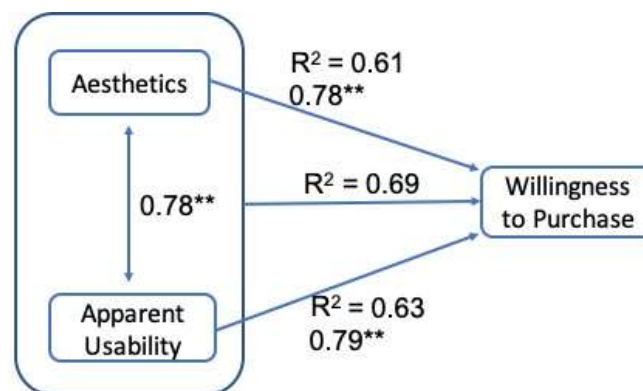
Model	Parameter	Co-efficient (SE)	t- Value	Sig. Lvl.
1	Constant	-2.56(0.183)	-14.002	0.001
	Aesthetics	1.34(0.032)	42.227	0.001
2	Constant	-1.26(0.146)	-8.659	0.001
	Usability	1.14(0.026)	44.213	0.001
3	Constant	-2.73(0.016)	-16.954	0.001
	Aesthetics	0.71(0.044)	15.965	0.001
	Usability	0.68(0.037)	18.350	0.001

APPARENT USABILITY PARTIALLY MEDIATES THE INFLUENCE OF AESTHETICS ON WILLINGNESS TO PURCHASE

The coefficient for aesthetics ($\beta = 1.34$) was higher than the coefficient of apparent usability ($\beta = 1.14$) when the willingness to purchase variable was solitarily predicted by each factor. However, the coefficient of aesthetics ($\beta = 0.71$; $t = 15.945$, $P < 0.001$) was comparatively lower than the solitary aesthetic coefficient when the willingness to purchase was predicted by the both aesthetic and usability ($\beta = 0.68$). This implies a small mediation effect of usability on the prediction of willingness to purchase based on aesthetics, put another way, usability is partially mediating the influence of aesthetics on willingness to purchase (see figure 7).

Figure 7

How aesthetics and usability predict willingness to purchase of jewelries.



**Significant at the level 0.01

The literature suggests that apparent usability and aesthetics significantly influence customer preferences and purchases (Lee & Koubek, 2010) and inspire consumers about the look, feel and functionality of products (Keinonen, 1999; Kurosu & Kashimura, 1995; Tractinsky, 1997). In this study and in the context of pendants it

is also evident that customers with an understanding of apparent usability and aesthetics have higher willingness to purchase.

CONCLUSION

Both aesthetics and usability are valuable predictors for glass jewelry purchase, but given the mediation effect of apparent usability, apparent usability is more important than aesthetics. Similar observations were made by Chowdhury et. al. (2014) in the context of water bottle design and product choice. Also, Mumcu & Kimzan (2015) discuss the co-relationship of the effects of visual aesthetics of products and consumers' price sensitivity.

Measuring apparent usability is particularly important in the context of e-commerce, as many young Indian consumers prefer online shopping for jewelry over physical shopping. The prediction equation derived in this study can be useful to predict the purchase intention of customers shopping for jewelry. Still, we limited this study to handmade glass jewelry rather than that made of other materials like transparent plastics (as demonstrated by Fatma et al., 2021). It is possible to replicate this study to establish the role of apparent usability and aesthetics in customer choice for other types of jewelry (E.g., those with additive manufacturing processes and applying various materials).

PRACTICAL IMPLICATIONS

The method used in this study could be useful for new jewelry design, development and evaluation. We can use a similar statistical method to predict jewelry purchase intentions before launching products into the market; thus, ensuring product acceptance in the market.

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Designing a Digital Space for Indian Craftsmen to Flourish

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ABSTRACT

At present scenario, Indian craftsmen are facing challenges to sell their handmade products as they always don't have opportunities to display their products in appropriate market; as they mostly involve to sell their product through traditional way of business for example craft or general fairs. In addition, middle man or NGOs they work as a mediator to sell products of craftsmen. This article states about the design of user interface of an e-commerce portal for selling handmade glass products of India. Designing assisted interactions that helps user to conduct their business smoothly where they will get support to use the e-commerce platform. The designed interface that re-moves the middle man from the picture and the make the vendors self-reliant.

Keywords: Design, E-Commerce, Handmade, Interface, Trustworthiness

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I. INTRODUCTION

Designing the user interface of an e-commerce portal for selling handmade glass products of India. Selling of handcrafted product in e-commerce platform is not new. However, craftsmen are not getting much benefit after selling products in online platform because of middle-men. These middle men are purchasing the handcrafted products from artisans in low cost and selling the same in high price through online platform to get the maximum benefit. Now the question is - can we remove the middle men and design a portal for craftsmen to sell their product directly to consumers?

Literatures suggest that if we design the e-commerce portal considering aesthetic, usability and trustworthiness by reducing the complexity system, there is a chance to increase of selling products through online platform. It also disrupts the market to enhance business. [1-4]

Aim of this study is to design a simple, user friendly, bilingual (Hindi and English), visually good, and trustworthy e-commerce platform for selling handmade glass products. With this intension, a detailed literature review was conducted on e-commerce web application interface design.

II. LITERATURE REVIEW

2.1 Literature on e-commerce platforms

Eglash et al. in his paper says that with the onset of AI driven e-commerce platforms, the growth rate has been tremendous for seller that have

the necessary skills to take advantage of these features but it has proven rather non-productive for the artisans that relied on in-person sales. For this, there are people actively working to find a sustainable way to carry the forward [5]. Literature suggests that website quality influences product purchase intension from the e-commerce website. Website quality refers to visual appeal, online purchase experience, product presentation style and adequate product information etc. [6] Chowdhury et al. suggest that graphic user ratings are more important element for understanding of product qualities than retain user reviews provided there is a time pressure.[7]

2.2 Literature on Extinction of Indian crafts

There has to be a democratization of technology among all sections of society in order for anything to grow sustainably [8].

Indian crafts for example are complex eco-system of products and people that is being driven to extinction due to these newer e-commerce platforms not able to accommodate the indigenous goods produced by them [9].

2.3 Literature on Current Technologies

This is the era of application of artificial intelligence (AI) in the context of e-commerce and other types of web application design. [10-12]. It is now possible to understand buying behavior of users using various web analytics methodologies. As demonstrated by various authors, [13-16] the product information can be displayed in the e-

commerce platform as a suggestion for purchase based on such behavior of users. In addition, related products offered by different e-retailers can also be suggested by cloud-based e-commerce system in an efficient way using the concept of AI and data analytics. [17- 20] In a similar manner, it might be possible to implement these advanced technologies for promoting hand crafted product to increase the possibility of consumer acceptance and, thus, the selling of handmade products in e-commerce platform. There is huge potential for these technologies to be adopted and do really good in the long run trickling down to the most niche sectors [21].

2.4 Literature on Understanding of Indian Art and Craft

Assessing and understanding the decolonisation of our Heritage in our crafts needed to be understood for us to take on this endeavor [22].

Different craft documents helped us designed a system that took the cultural and creative identities of artisans under consideration and their backgrounds as well to design a system that suited them well [23,24].

Arts and crafts are a huge economic booster both in the public and private sectors, they are essentially a competitive advantage when it comes to both education and commerce, now considering the future viability is also crucial to create both an established framework and scalable platform [25-29].

So, hereby, it is concluded from the literature review that from the heritage India has lots

of crafts which is involve in our day-to-day life. Though craftsmen and cluster are suffering in the present scenario due to traditional business approach and being not comfortable to use new technology and e-commerce business platform. Our craft sector plays vital role in our economy and its growth. Hence it is important to bridge the gap between craftsmen and users by using e-commerce portal as an unconventional business strategy.

III. METHODOLOGY

3.1 Design of the e-commerce platform for selling handmade products

The interface was designed for both the craftsmen and consumers considering simplicity, user friendliness, language (Hindi and English), aesthetics, and trustworthiness. As craftsmen are not highly educated, they only have primary education in National language (Hindi) and they understand symbolic languages: the interface of the dash-board for craftsmen is designed using infographics and Hindi language. On the other side, a minimalistic visually good interface language was designed for target consumers. The trustworthiness of the e-commerce portal was planned through implementation of following features – 1) Time to Time notifications for product delivery; 2) Cash on delivery option; 3) Doorstep replacement guarantee; 4) Product insurance option 5) AI based chatbot for handcrafted product stories and purchase assistance, 6) Within domain craft product search product optimization and AI based hand crafted product suggestion, etc. (see **Fig.1**) Please see **Fig. 2** for samples screens of the designed interface.

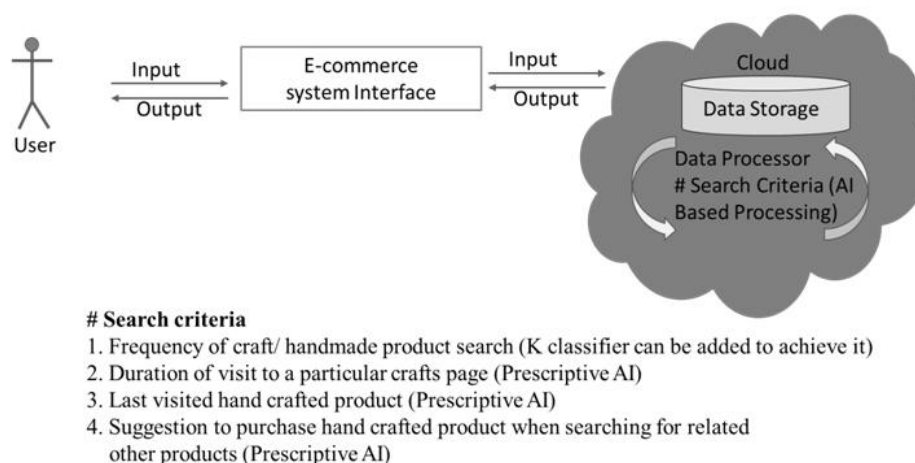


Fig. 1 AI based e- commerce system for suggesting and presenting hand crafted products

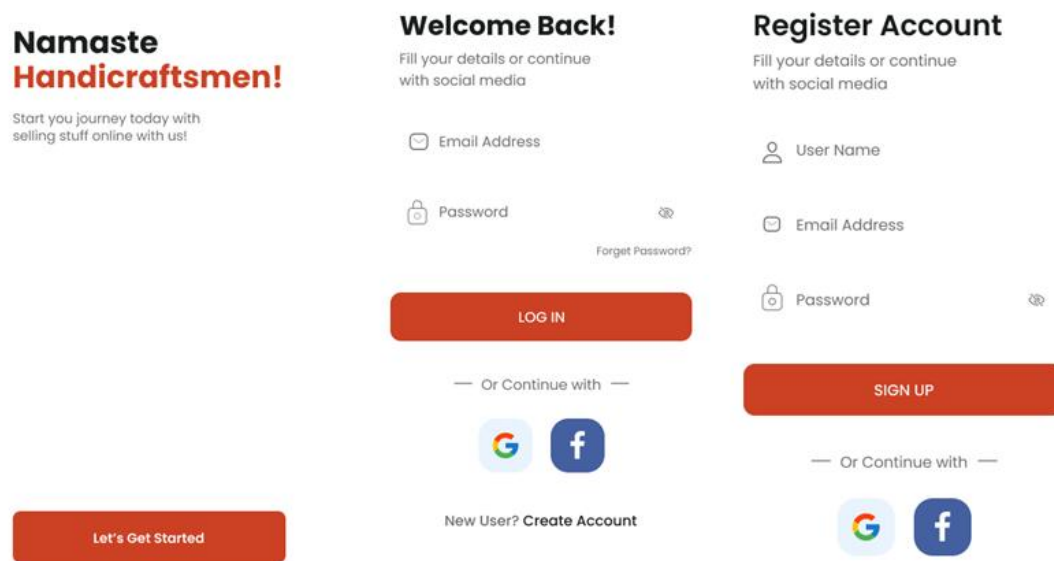


Fig. 2 The Greeting Screen (Far Left), The Login Screen (Middle) and The Sign-up Screen (Far Right)

3.2 Testing of Usability of the Designed Interface using Heuristics

The Heuristics Evaluation Method was used to determine usability of the designed interface prototype for the e-commerce platform. Nielsen's heuristics were used in the usability evaluation of designed interfaces for the desired application [30-32].

IV. Results

The results of heuristics analysis showed there is a consistent design language of the solution followed throughout. The proposed design has a clean and standardized look which is helpful for both the customer and the sellers, to navigate the app back and forth. The Visibility of system status at all given times using primary colour to determine next steps helped to keep streamlined user flow in the Interface. This helped users further in recognizing the user interface and building consistent mental models for them. The feature called 'assisted flows' proved a great support for

users in order to prevent errors and pitfalls as it assisted users in completing the task at hand and redo certain tasks in case of wrong routes. The UX writing done reflects the real work terminology and linguistics making it easier to understand for the core audience of the chatbot based assistance. The product stories told using chatbot motivate consumer to purchase hand crafted products. In addition, the AI based hand crafted product suggestions might help user easy to search products and reduce the search time. These features made the app more interactive and interesting for the consumer as suggested by experts during heuristics evaluation.

Thus, the testing conclude that the planned interface is simple, user friendly, bilingual (Hindi and English), visually good, and trustworthy in nature (see **Fig. 3**). Craftsmen and consumers can utilize the e-commerce platform for selling and purchase process of handmade glass products & more.

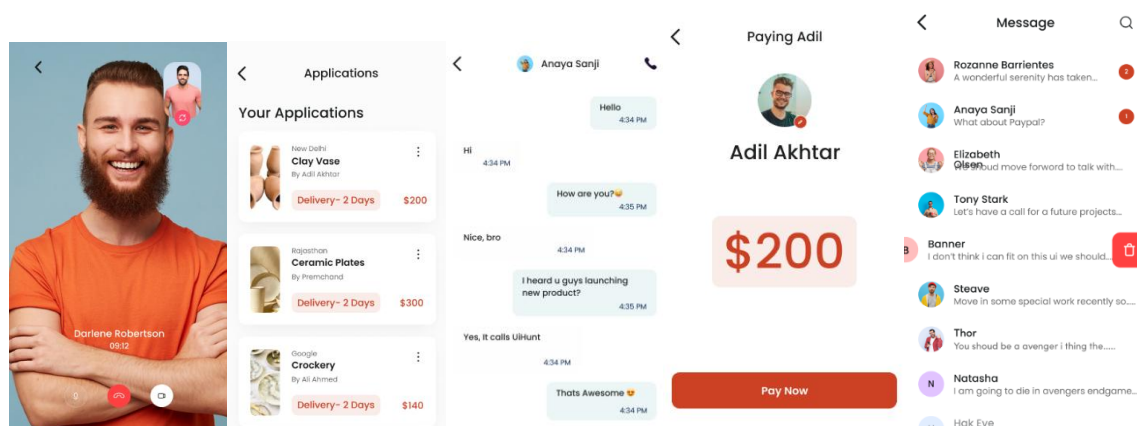


Fig. 3 Various UI screens of the designed application.

V. PRACTICAL IMPLICATIONS

5.1 For Craftsmen

For craftsmen, the platform will serve as a way to uplift their craft products for sell at online avenues. It caters to the customers that are the core audience for handmade products, the user's flows have been setup in a way to avoid failure points and pitfalls, it will serve as a platform for their digital journeys.

5.2 For Organisations

Organisations can also use this platform to showcase their products not only sell them; the platform encourages any one especially non-profit to showcase the work they are doing with physical goods.

5.3 For Volunteers

Volunteers that wish to make a change can also sign up on the platform and work as help to fulfil their goals and help the artisans in the process as well.

VI. Conclusion

This study demonstrates that how a user-friendly e-commerce platform is important for the craftsmen to avoid middlemen. It directly connects them to the users who like to buy product from them by using online platform. It also presents that a business platform may change their business strategy and present scenario of the cluster for its betterment.

This study will help further to improve the e-commerce platform for the craftsmen as well as user friendliness interface and experience for buyer and seller both. Which will create impact on cluster and craftsmen.

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Cbr Number: 201772
Cbr Date: 20/05/2022 12:17:02
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