



## Empirical study on design and development of hand-crafted footwear

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**Abstract:** With its enormous potential in terms of employment, growth, and exports, the footwear industry is an important player in the Indian context, and can contribute to the nation's economic development. It is worth noting here that leather footwear in Kolhapuri style has a distinguished history spanning hundreds of years. This craft style is a labor-intensive production process in which the primitive nature of the tools and equipment are used. In the present context, this craft style is about to go extinct because of artisans' declining interest. The present study reports an attempt to improve the manufacturing procedure and productivity without changing the fundamental nature of the craft (its actual essence). The study reports on the local craft cluster's efforts to rethink the craft style in terms of technological interventions, skill development, product diversification, commercial opportunities, etc. Further, the study reports the necessity of conducting social workshops on design innovations. The study advocates the revitalization of Kolhapur's identity and the need for acceleration of this dying craft.

### Introduction

Next to China, India is the country that produces the most footwear. India has a diverse footwear sector spread across the nation. The Indian footwear market is divided into two groups: organised and unorganised. The organised markets are the same as the other FMCGs. On the other hand, the unorganised footwear market is primarily craft-based and offers a wide range of products. Kolhapuri-crafted footwear (Figure 1) stands out among these footwear crafts and is named after its location of origin, Kolhapur, Maharashtra, in the western region of India. The domestic and the international market are both heavily reliant on this particular craft.

Even as a nation, India is one of the biggest exporters of handcrafted goods. The manufacturing process for handcrafted items necessitates an excess of labor (Guo and Xiong, 2017). The art of producing such handicrafts

is passed down from generation to generation and is represented by a variety of Indian artisans. In handicrafts, both the urban and rural sectors are vital to the survival of the handcraft industries (Ramsey et al., 2022). More than six million craftspeople rely on the handcraft sector for their livelihood or employment (Burute, 2014; Anderson et al., 2022).

In India, artisans who work in the handcraft sector are mostly from economically disadvantaged backgrounds. Furthermore, women artisans make significant contributions to the handcraft industry. This sector is also classified as a cottage industry, and this craft-based enterprise typically involves the entire family.

Over the years, the handcraft and leather footwear industries have made important contributions to employment and bringing in foreign funds (Chakrabarti, 2013; Kodrat et al., 2020). The Kolhapuri footwear (as



shown in figure 1) is one of the pioneers in the crafts made by hand. This industry is relying on manual labour for intensive process involved in making handcrafted shoe. The process includes making the bottom sole, skiving, punching, polishing, cutting patterns, attaching heels, preparing the upper strip, sewing, finishing, and final assembly.



**Figure 1. Kolhapuri crafted footwear**

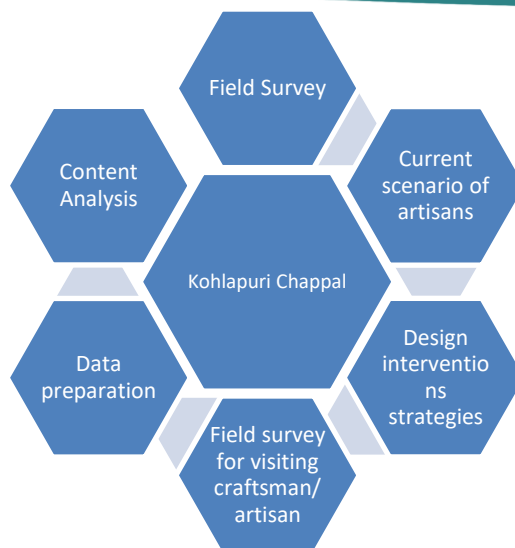
In accordance with the level of work required for each job category, these tasks are split between the male and female employees. The majority of stitchers, veni (leather braid) makers, decorators, and accessory preppers are female. The production of footwear made in Kolhapuri takes a long time. Depending on the design, there are roughly seven to eight different sorts of jobs are required to make the Kolhapuri footwear. The manufacturing workstation has a fairly undeveloped aesthetic.

The footwear made in Kolhapuri is regional or indigenous to this region of India. Consequently, it is uncommon to find scientific publications with a direct connection to this industry, but there is still very little literature related to marketing product brand names, training, and technical intervention that may have a significant impact on the unorganized footwear industry in India (De Almeida et al., 2017). The majority of the research doesn't report on specific methods, kinds of interventions, case studies, etc. Therefore, it is a critical necessity to comprehend the current situation surrounding Kolhapuri-made footwear as well as opportunities for improvement. As a handicraft and cottage-based industry, the processes and tools used, as well as the methods of customer communication and product promotion, are all very traditional and conventional in character. Regardless of its location, environment, or types of finished products, the handmade footwear business employs traditional production techniques. For the purpose of learning the necessary skills, techniques, tools, and equipment, as well as the manufacturing process, craftsmen and artisans rely heavily on their ancestors.

Any handmade item is tightly linked to the local culture, resulting in originality, beauty, etc., which discourages artists from incorporating new technological advancements into the production process (Ghosh, 2012; Mravlinčić et al., 2019; Choffin et al., 2021). However, there is evidence to support the claim that all technology interventions improve production-related characteristics, even though it is difficult for researchers to maintain the distinctiveness of individual crafts (Giri et al., 2012). Literature depicts that the revival of craft can benefit from creative ideas and alterations, as well as variations on current classic designs (Giri et al., 2012). To resuscitate and reinvent numerous fading crafts, the Indian government has launched a number of programmes (Gupta et al., 2007; Mohan et al., 2008). Many studies have been reported on how technological innovations could revitalise handicrafts in different areas, especially in the Indian context (Haik et al., 1997). In light of the aforementioned, it has been determined that the best method to preserve or revive any craft is perhaps to fulfil a unique necessity, such as a context-specific design intervention. Every handicraft industry should be aware of design automation methods and equipment throughout the first design stages (Hani et al., 2017). The Kolhapur footwear manufacturing business is so important to the socioeconomic growth of Kolhapur and Maharashtra that it is regarded as the state's pride (Hazara, 2017). However, the Kolhapuri footwear industry is currently seeing a decline in sales, and not even a single piece of research has been done by an individual or any research organisation on a thorough investigation of declining sales (Jadhav et al., 2019; Jadhav et al., 2019). Although there are many technological innovations in the organised footwear industry, their uptake in the unorganised sector is minimal. These actions are currently needed in the unorganised sector. Additionally, it is stated that any craft must be modified or novel in order to survive in the contemporary market. The purpose of this work is to make society aware of the design interventions in Kolhapuri footwear manufacturing, in particular, while making shoes by hand, by demonstrating various equipment and procedures in the initial design stage. The present study seeks to suggest several design interventions that could help revive the Kolhapuri footwear craft business in the long run (Kamble, 2002).

### Methodology

In the present study, methodology adopted is as follows: At first stage, the actual circumstances and issues faced by the traditional craftsmen engaged in the



**Figure 2. Steps were undertaken during the research**

production of Kolhapuri footwear, should be understand. For this a field survey will be conducted. Further, the various design intervention tactics, concepts, and ideas will be developed to address the challenges that have been discovered at the first stage. On the rebirth of the craft, an analysis of the effects of stakeholders' proposed interventions will be performed. The data is collected to gain insights on the well-being and productivity of Kolhapuri footwear artisans. For this purpose, the field assessment is done through unstructured interviews with artisans. Direct observations, videos, photographs, and work measuring methods are used to study and analyse the data. The steps for this present work is shown in figure 2. The participants were selected from taluka places randomly. The unstructured interview was organized.

**Results**

**Field survey of Kolhapuri footwear industry**

In order to understand the full process of making Kolhapuri footwear, the current state of the craftsmen/artisans involved in it, and the challenges they confront, field research was conducted in the Kolhapur area. A thorough examination of manufacturing procedures and their techniques was done, and craftsmen were subjected to a series of unstructured inquiries about their line of work and businesses. The amount of formal and organised information about the footwear business in Kolhapuri is limited. The primary goal of this study was to gather and organise such data. The Chairman of the Cobbler Community, as well as numerous traders, shopkeepers, and small business owners as stakeholders, who were all directly involved in the Kolhapuri-crafted footwear sector, were all interviewed informally as part of the field survey. It has been discovered through

inquiries into these interviews that there is a significant demand for the handcrafted shoes but an inadequate supply. It was determined that a shortage of raw resources, poor daily labour earnings, a lack of skilled labour, inadequate technology assistance, inadequately supportive government policies, and other factors were to blame for this mismatch. Table-1 below reveals the declining turnover in past two decades. The data listed in table 1 reveals that the year by year annual turnover is reducing. Due to the beef ban policy in the Maharashtra state the tanned leather is currently importing from nearby states.

**Table 1. Sales and Turnover data**

Data	Years		
	2000	2010	2020
<b>Pairs/year</b>	1,70,000	1,65,000	1,62,000
<b>Turnover in Rs.</b>	1,80,56,000/-	1,70,30,000/-	1,95,2000/-

Source: Data compiled by Cobbler Community, Maharashtra

**Current Scenario of Kolhapuri Footwear Manufacturing  
Current status of tanning industries in Kolhapur**

The primary raw ingredient for any leather product is tanned leather. Easy access to tanned leather is crucial. In recent years, state government laws have changed, and now fully forbids the tanning industry. A variety of tanning businesses are discussed, as well as the workforce that works in it (Table 2).

**Table 2. Tanning units in the Kolhapur district**

Data	Years			
	1948	1985	2012	2018
<b>Units of the tanning industry</b>	40	80	10	0
<b>No. of people engaged</b>	150	1400	75	0

Source: Data compiled by Cobbler Community, Maharashtra

Due to the aforementioned facts, artists are compelled to purchase tanned leather from other adjacent states in order to make handcrafted footwear. Due to high transportation costs, the price of leather per kilogram has dramatically increased.

**Table 3. Cost enhancement summary for footwear preparation**

Make of Leather from various animal skins					
	Buffalo	Cow and Bullock	Calf	Sheep and Goat	Animal Tails
2010	Rs 160/-	Rs 180/-	Rs 130/-	Rs 100/-	Rs 50/-
2013	Rs 190/-	Rs 220/-	Rs 150/-	Rs 140/-	Rs 80/-
2018	Rs 280/-	Rs 320/-	Rs 200/-	Rs 170/-	Rs 100/-
Uses	Used in lower sole preparation	Used in upper sole preparation	Used in upper side belts	Used for various parts preparation	Used for threads making

**Source:** Data compiled by Cobbler Community, Maharashtra

However, the final shoe cost has not increased substantially during this time. The information is shown in table 3. The documentation from communities of cobblers indicates that the number of artisans is dwindling. In contrast to the 21,000 people active in this craft in 2000, just 10,000 people were involved in it in 2012. The causes of this drop have not yet been determined. It is evident from the literature that this kind of deterioration was caused by “a lack of technological intervention due to insufficient financial assistance.”

**Table 4. The data compilation for factors based of stakeholders' feedbacks**

Factors	Various Stakeholders				
	Craftsmen (N= 15)	Entrepreneurs (N=15)	Distributor (N=10)	Traders (N=10)	Customers (N=15)
The quality of raw material used	Yes	Yes	NA	NA	NA
Making of foot wears by conventional processes	Yes	Yes	NA	NA	NA
Creative designs availability for alternative options	NA	Yes	Yes	Yes	Yes
Trends / Modernization in footwear designs	NA	No	Yes	Yes	Yes
Standardization of sizes for foot wears	NA	Yes	No	Yes	Yes

Added to this, the technological advancements had boosted the production of shoes in other cities (Kapur, 2014). The stakeholders identified a number of contributing factors, including the quality of the raw materials, the availability of contemporary trendy footwear styles, the continued use of conventional

manufacturing processes and practices, the lack of footwear size standardization, and the absence of alternative designs (Kaur, 2011). Table 4 indicates the effect of the contributing elements.

Table 4 above reveals the factors based on the verbal descriptions held with the various stake holders. The table also reveals that the acceptance is given to the alternative designs except the craftsman which means they still believe that the craft design is having their own significance (Kaur, 2011).

### Analysis and recommendation's Craft promotion

As stated earlier, majority of the artisans are dependent upon this Kolhapuri crafted footwear fabrication. These artisans are acquiring footwear manufacturing skills from their ancestors. They are using old manufacturing style of footwear manufacturing. Now a day's a lot of technological intervention happens in the footwear sector therefore it is required to use modern tools and techniques in current practice. There is a need of some design intervention in terms of technological, aesthetical and marketing aspects in Kolhapuri crafted footwear. In order to promote this old ancient craft, IIT Guwahati and Maharashtra Khadi Gramodyog Mandal (MKGM) had taken an initiative (Kumar, 2022; Luo et al., 2019; Salvi et al., 2018; Salvi et al., 2017). MKGM decided to develop 'Kalatmak -Kolhapur' brand in order to promote this old ancient craft. The meaning of this brand name is to develop innovative footwear designs in today's era of mass customization. The main intention to establish this brand is that original craftsmen should get benefited from it. Therefore, MKGM invited many expert persons from footwear sector such as Agra, Delhi, Kanpur etc. The footwear production largely takes place in the above-mentioned cities. There were 4 workshops arranged to promote this craft. Majority of the artisans and entrepreneurs from Kolhapur district were invited for this Kolhapuri craft promotion workshop as shown in figure 3. The main purpose to arrange such kind of workshops is to encourage the artisans associated with Kolhapuri footwear manufacturing (Szubert, 2001).

Another reason to arrange these awareness workshops is to find out ways in which the current Kolhapuri footwear craft can be enhanced using various design intervention techniques. Several ideas/recommendations from the awareness workshop might be helpful to uplift this craft (White, 2006).

### Recommendation of cushioning effect in Kolhapuri crafted footwear

The majority of the stakeholders experienced that the Kolhapuri footwear feels very hard to wear. They suggested that there is a need for cushioning effect in the base sole of the footwear to feel comfortable during their regular use. Therefore, they observed the current

Kolhapuri crafted footwear and recommended using foam material between two layers of the footwear as shown in figure 4.



Figure 3. Craft promotion workshop pictures



Figure 4. Opening of two layers in Kolhapuri crafted footwear



Figure 5. Foam material inserted in two-layer in Kolhapuri crafted footwear

Figure 5 represents the foam material used between two layers of the crafted Kolhapuri footwear. Foam material (poly synthetic leather) is a very soft material and has a very nice cushioning effect. After the use of foam material in footwear, regular artisans also accepted this change. These artisans are ready to implement this change in their regular footwear manufacturing.

**Recommendation of Veni making style in Kolhapuri crafted footwear**

The various types of hand-woven Veni can be made in easier ways figure 6. This process of making Veni in a simpler way may reduce time by 50% of their traditional Veni-making method without affecting the main essence of their original craft. Earlier, the craftsmen were using their traditional method of making Veni. Initially, they

were making only one type of Veni the making for all types of Kolhapuri footwear (Jadhav, 2021).

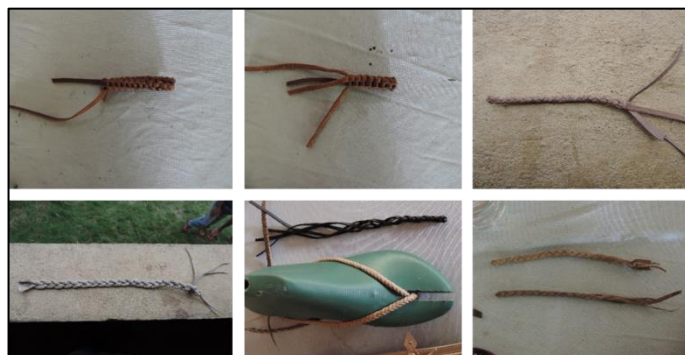


Figure 6. Different types of hand-woven veni Opening of two layers in Kolhapuri crafted footwear

**Recommendation for use of different colors in Kolhapuri crafted footwear**

Initially, various artisans from the Kolhapuri clusters were using only one or two colors for traditional footwear manufacturing as shown in Figure 7. During the workshop, people from other clusters suggested that use of different colors (other than regular colors) in Kolhapuri crafted footwear. These colors presently many artisans from Agra, Delhi, and Kanpur are using in their footwear production. The use of these different colors will make the footwear aesthetically appealing. Customers are given more choice in this way thereby increasing their acceptability based on match with personal preferences.



Figure 7. Traditional color of Kolhapuri footwear



Figure 8. Original footwear



**Figure 9. Colored footwear**



**Figure 10. Different colors for footwear**

Figure 10 represents the variety of color bottles available in Agra, Delhi, and Kanpur footwear sectors. The various experts recommended that the use of such kinds of colors may add value to the crafted Kolhapuri footwear. These colors will definitely help to attract others to buy these footwear products. There is a variety of shades are available in various color combinations. These colors are durable in use. The cost of the colors is very less compared to their traditional powders. Due to the competitive nature of the market, such kind of techniques is necessary to uplift the craft. A note on sources of these dyes and their least impact on the skin will be worth mentioning.

#### **Recommendation of use Veni designs on the upper strap of Kolhapuri crafted footwear**

Different Veni combinations may be useful for an aesthetical appearance on the Kolhapuri crafted footwear. These new designs (Figure 11 and Figure 12) were made during the workshops.

The goal of the workshop was to teach the new methods of Veni making.

#### **Recommendation to use diversification of product from raw leather**

During the workshop, it was recommended that use of remaining leather of crafted footwear (wasted leather) can be used to build other products such as leather purses (figure 13 and figure 14), photo frames etc. These products were produced using artisan's traditional and

conventional tools during the workshop. Some various attractive design was also made from these remaining leather as shown in figure 15. These designs may be fitted on upper strips of the footwear. Figure 16 represents some purses made from wasted raw leather.



**Figure 11. Different Veni combinations**



**Figure 12. Different Veni design combinations**



**Figure 13. Leather purse Small**



**Figure 14. Photo frame from leather**



Figure 15. Attractive designs from remaining wasted leather



Figure 16. Attractive purses made from remaining wasted leather



Figure 17. New designs of Kolhapuri footwear

Figure 17 shows that the new design implemented on the upper part of the Kolhapuri footwear. During the workshop, it was conveyed to the artisans that such kinds of variations may be done in the Kolhapuri footwear sector.

**Recommendation to use stone and embroidery design on Kolhapuri crafted footwear**

During the workshop, it was recommended that stone design on the upper part of the footwear (Figure 19) may help to attract customers. The various patterns of the stone design on the Kolhapuri crafted footwear may help to enhance the aesthetical look of the footwear.



Figure 18. Stone design used on the footwear

Figure 18 represents the use of embroidery design applied on the upper part of the footwear. This kind of design intervention were suggested by the various expert craftsmen from Agra, Delhi, and Kanpur footwear sector.

As we conducted these workshops in Kolhapur district, the artisans were very happy with such kind of interactions. They had given affirmations that there is need for these kind of design intervention workshops, so



Figure 19. Embroidery design used on the upper part of the footwear

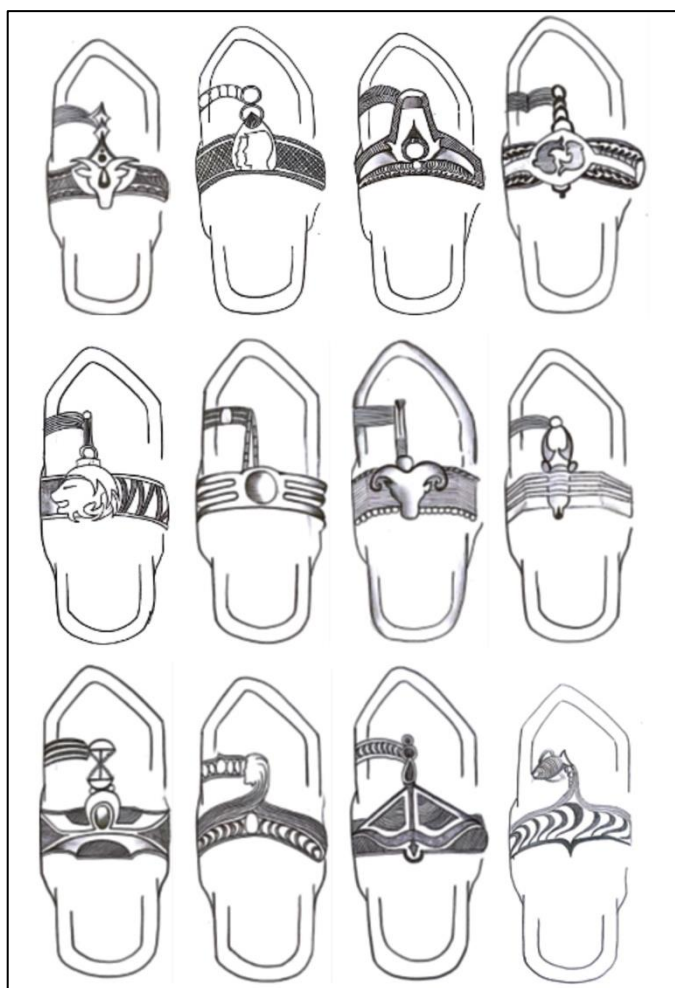


Figure 20. Use of horoscope symbol in the upper part of the footwear

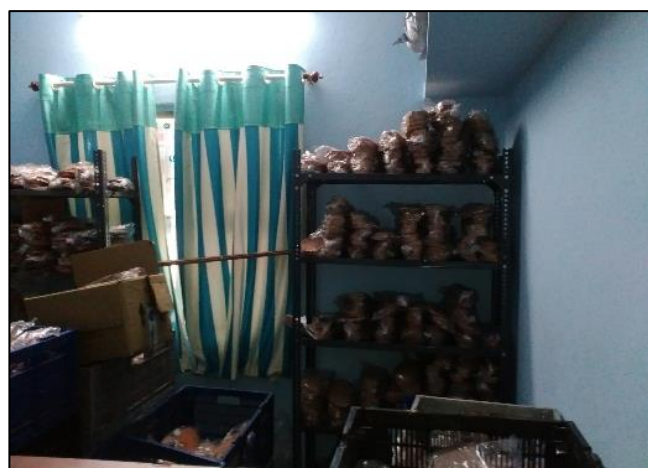


Figure 21. Kolhapuri footwear kept in plastic bags



that they can exchange their ideas with the artisans. These traditional artisans were also happy because of these interventions. One good thing which was observed during the workshop is that crafted footwear artisans are ready to implement these changes in their occupation.

Types of Participants	Participation in workshops conducted at various locations			
	Kolhapur	Panhala	Kale	Gadhinglaj
No. of Craftsmen	80	57	72	72
No. of Entrepreneurs	24	22	31	21

**Recommendation to use of proper packaging system for footwear packing**

The Kolhapuri crafted footwear after manufacturing is kept in the store or shops (Figure 22). If we provide a good attractive kind of packaging then customers will attract towards the footwear. Now a day’s mass customization trends came into the market. Many people are buying products online. Therefore, there is a need for a good packaging design for Kolhapuri-crafted footwear.

society, a local state government policymaker named Maharashtra Khadi Gramodyog Mandal (MKGM) was contacted to support in conducting of social workshops. These workshops are organized in order to benefit the artists and society as a whole. The role of MKGM was to disseminate the new interventions that are fully comprehended in terms of operational involvement, functionality, operating procedure, space requirement, impact on the essence of craft, quality and quantity of the product, productivity, worker efficiency, personal comfort, cost involvement, etc. The dissemination of information allows the artisans to re-think and prepare the footprint to revive this ancient craft. It also helps them penetrate the national and international markets.

Though, it is the challenging task to confirm the aforesaid objective accomplishment without any longitudinal study on the consumer behaviour. That’s-why, it is assumed that the end users will response to the understanding of the level of acceptance of these interventions.

The features of the participants are shown in table 5.

Because my ancestor has started this occupation. Everyone is doing this task in our area so am doing this business. I like to manufacture crafted footwear by using modern technology. The use of new techniques in crafted footwear will help to preserve this craft so that many artisans can join this business. This sole cutting machine is very much useful for Kolhapuri footwear craft and due to such kind of machine the exact shape of base footwear can easily produce. If we will use such kind of techniques the main essence of craft cannot be changed it will remain as it is. I was feeling boring by doing same activity (sole cutting). With the help of sole cutting machine our task becomes easier and also force exertion can be minimized. Sole cutting intervention we can use in our craft community cobbler cluster. “We are planning to use this machine in our various clusters so that every artisan can take benefit of this facility”. The cost for per pair cutting is very less so that we can invest our time in doing other activities for craft modernization. Stitching and vena (braid) making intervention will definitely help to reduce our awkward working posture during work. The cutting dies developed will help to produce exact replica of lower base so that standardization in Kolhapuri footwear attract more customer for revival of craft. The various proposed interventions will help to young generation to come into this old ancient business.

Theme	Code
Craft modernization	Blue
Less force exertion	Orange
Easy to use	Grey
Impact on craft	Yellow
Affordability	Light Blue
Helpful for continuing job	Green

**Figure 22. Color coding of content to the analysis of collected data**

**Analyzing the impact**

This section of the study discussed the framework that helps in communicating the involvement of technological intervention in present-day crafts. To create an impact on

Because this manufacturing process is primarily cottage or home-based in character, it was difficult to differentiate between the different stakeholder types. For instance, a craftsperson with strong financial credentials

might operate as an entrepreneur. If two people are equally passionate about doing good for the community, they can both join a cooperative group or organization. The two major stakeholder categories (craftsmen and entrepreneurs) were taken into consideration when analyzing the responses. In order to identify everyone, a thorough registration procedure was maintained.

In the present study, the content analysis approach was used to get the responses from the stakeholders in a coherent manner. The content analysis method is used for qualitative research, in which a questionnaire is designed to get the conclusion in a specific context (Kaur, 2011; Kumar et al., 2022). The question addressed in the present work is on the construction, compactness, cutting efficacy, quality, accuracy, price, etc. The respondents were approached to get input based on an unstructured interview. The detailed responses by the respondents are shown in figure 23.

for less force, affordability, maintenance, safety, and quality of the finished product, among others, etc. The answers were analysed to assign a grade to the three variables stated above. The sentence that elicits the most “wow” and widespread admiration for the intervention was deemed excellent, the second, which elicits a feeling of moderate acceptance, was deemed good, and all critical remarks were deemed to be bad (deplorable). The results are shown in figure 24.

The findings of the text analysis reveals that the majority of artisans and entrepreneurs stated their broad acceptance of all the interventions. They were grateful for the research team's efforts in showing interest in ancient craft (this old boat). The involvement of the government agency demonstrated that the suggested interventions directly affect the craft and the associated society. The government organization also acknowledged the initiatives and took the initiative to host them all in a

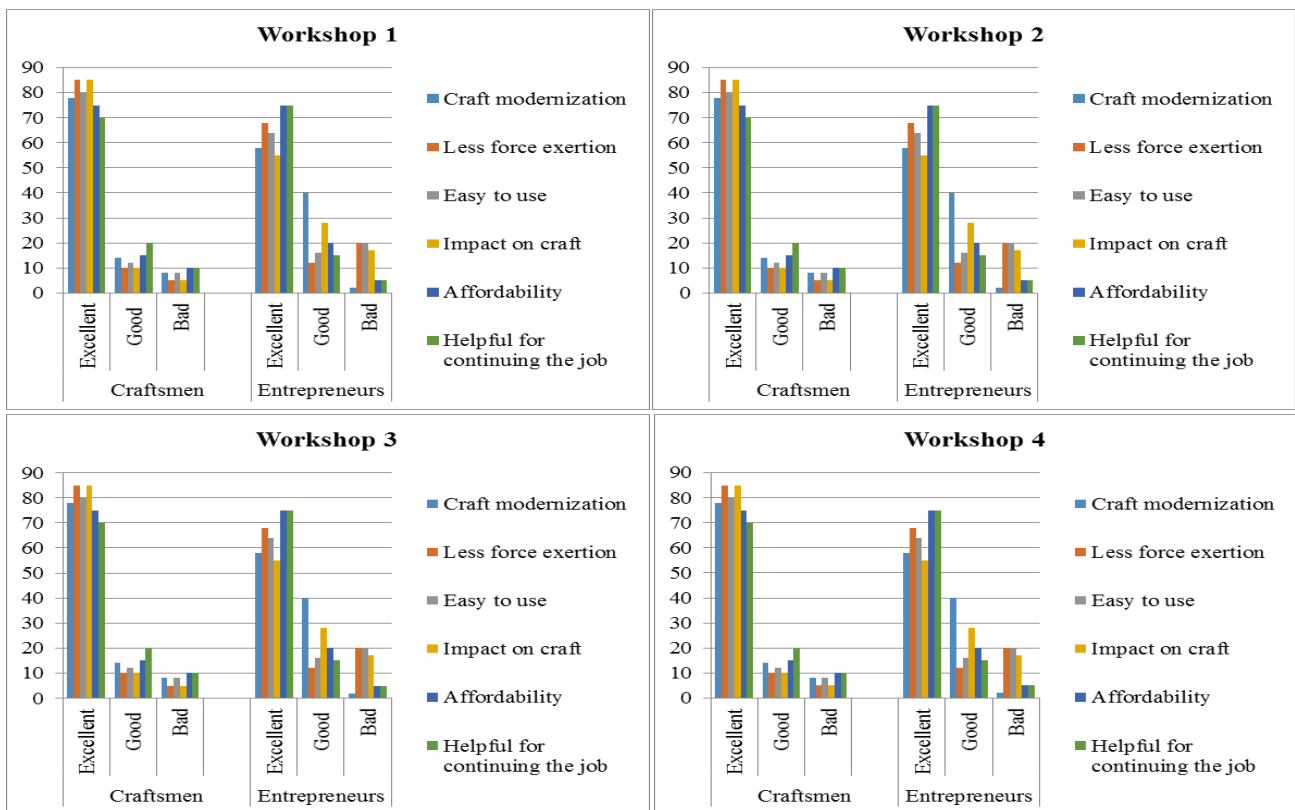


Figure 23. Feedback of different interventions.

Eighty-two percent of workshop attendees took part in the survey on a volunteer basis. They were identified as the respondents because they had undergone all interventions comprehensively. Common inputs in text forms were extracted from the descriptive responses and organized logically to interpret the participant's perspective on all of these interventions. The intervention was interpreted using a number of different words. The following ways in which the phrases are helpful for their craft include: modernity of the craft, ease of use, impact on the craft, assistance with carrying out the task, need

single resource hub. Many business owners showed an interest in organizing these interventions at their locations for their own businesses as well as to pay to share their expertise and knowledge with other artisans. The required standard time has been greatly shortened, as per the time-study, which was conducted in accordance with accepted norms and rules. It is also observed that adoption of suggested interventions lowered the basic time for a single piece by 70% while maintaining the original handcrafted craft's core values. All of the aforesaid data suggest that all of the interventions will assist the

community of craftsmen in reviving their traditional craft. Although it is impossible to examine the actual implementation of interventions due to time restrictions, this can still be viewed as a study limitation.

### Discussion

The present study is not the first one to demonstrate the use of technology as a strategy for the resurrection or revitalization of any craft or kind of traditional production. Numerous studies have shown that using technology to help revive handicrafts in the Indian environment is critical. However, the use of technology for interventions is still a long way off. The goal of the present study is to comprehend the many justifications for introducing changes to the traditional Kolhapuri footwear production process. The study includes both the quantitative and qualitative assessments of the research data were included in the study. During the data collection for the study, the numerous causes and obstructions were reported, and the technical intervention was suggested as a potential remedy. To restore and redesign a variety of Indian crafts that are in danger of fading out, the government has created many programmes. Majority of the researchers are identified that there was need of some design interventions for revival of this old ancient craft (Jadhav et al., 2020, 2021, 2022).

In the handicrafts, it is difficult to get a thorough account on technological advancement because of the nature, procedures, operations, tools/equipment in use etc. that provides the unique essence to the craft. Even, in few crafts the specific requirements based on customized production also bond the craft to go with technological adaptation. The study reports that the Technological advancement play an important role not only in improving the manufacturing process but also alternative or replacement designs that result in higher-quality products. The artisans' knowledge of design automation methods and resources is a crucial issue in this context. Various design interventions have been offered in this particular context-specific study. In order to restore any craft-related dying sector such as the Kolhapuri foot wears, this study has been informative in terms of different innovative interventions and methodology descriptions.

### Conclusion

The production of footwear in Kolhapuri style is a fine art that dates back to antiquity. The continuous use of traditional manufacturing methods, the rudimentary nature of the tools and equipment, and the declining interest of the artisans are the identified causes having a

direct impact on their extinction. The present work reveals that manufacturing processes and productivity are both enhanced by ergonomic design interventions without changing the true nature of the craft. The improved manufacturing methods provide an opportunity for the artisans to rethink their craft. In addition, social initiatives such as skill development programmes for product diversification might give people access to economic opportunities. The study also demonstrates the need for design modifications to enhance the craft. The study focuses on how promoting the footwear style in both domestic and international markets may revitalise Kolhapur's identity. The study does not take into account all actions, such as aesthetics, packaging, supply chain, marketing, etc., despite its useful conclusions.

### Conflict of interest

Regarding the publishing of this work, the authors have no competing interests.

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