Vernacular Heritage and Craft Traditions: The Case of Handcrafted Athangudi Tiles in Chettinad, India

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Abstract

India is renowned for its diverse traditional building crafts, passed down through generations. These traditional building crafts have a rich heritage and craftsmanship. However, they are encountering challenges due to declining artisan communities, modernization and economic pressures favoring mass-produced materials. Athangudi tiles, a 100-year-old traditional building craft from southern India, exemplify this trend. The craft's quality is declining due to the shortage of experienced craftsmen caused by urbanization and modernization. Hence, this study investigates the processing techniques involved in Athangudi tile making, the relevance of these tiles to heritage and the present condition of the craftsmen community.

The research employs field observations to document the processing techniques and a questionnaire survey to identify the problems faced by the tile manufacturers and craftsmen. The sample included 150 people: 110 natives and 40 from the neighboring villages. Data was collected from January to March 2022, using both in-person and online questionnaires.

Findings show that very few native people are currently involved in manufacturing Athangudi tiles. A significant percentage of these craftsmen also belong to the retiring age group. Migration of Athangudi residents to other jobs and urban sectors is reducing the labor force and continues to have an impact on tile manufacturing. However, manufacturers report that there is a demand for Athangudi tiles in most parts of India as well as in Southeast Asian and European countries. This study therefore recommends actively procuring a Geographical Indication (GI) tag for the Athangudi tiles to encourage the involvement of native people and thus support the progress of this centuries-old craft and its craftsmanship.

Keywords: Athangudi Tiles, Handmade Tiles, Heritage, Vernacular Craft. Chettinad Region, Tamil Nadu, India

Introduction

India, a country known for its diverse cultures and rich heritage is home to unique indigenous crafts which are spread across Twenty Eight states. These crafts are diverse owing to different origins, and the influence and patronage they are subjected to within the diverse fabric of the Indian Sub-Continent. These crafts can be further categorized as handicrafts, textile crafts and building crafts (Kamal et al., 2023). Each of the Twenty Eight states of India is pioneers to a considerable number of crafts from all the above-mentioned categories. Athangudi Tiles are one such craft from Tamil Nadu; a State from southern India.

Athangudi is a medium-sized village in Tamil Nadu located in the Karaikudi taluk of the Sivagangai district. Athangudi is a part of a cluster of towns and villages which are collectively referred to as the Chettinad region. The Chettinad region is very rich in its heritage and culture. It is home to many handicrafts and traditional building crafts which reflect in its astounding architecture. The Athangudi tiles; a craft practiced locally in Athangudi are seamless flooring tiles with repetitive patterns that make for interesting designed surfaces.

The Athangudi tiles can be seen in the palatial houses of Chettinad. The tile manufacturing has been practiced in Athangudi for nearly four generations tracing back its origin to the 18th Century. For more than 100 years, their predecessors in Athangudi have been producing handcrafted colorful tiles that come in a variety of colors and patterns and are made through a unique process that employs local soil and glass plates. Athangudi tiles are similar to Morocco tiles, which date back to the late 10th century in Morocco (North Africa). Moroccan tile building is a talent passed down through generations in Morocco. Traditional Moroccan tiles are manufactured by blending natural water with clay. It is now considered a forgotten art form (Haddar et al., 2018; Hajjaji et al., 2002; Antonio, 2015). However, Athangudi tile making is still being practiced craft in southern India.

These tiles are used to decorate the interior surfaces of a house, predominantly as flooring and sometimes as wall finishes. Traditionally called "pookal," or flower tiles, Athangudi tile making is one of the few vernacular crafts practiced in this region. It is predominantly developed by Chettiars; a migratory, well-travelled mercantile community. They were a culturally rich and wealthy community, which is evident in their palatial homes, which stand to this day in the main towns in the Chettinad region.

Athangudi tiles can be seen in many of these grand residences built by the Chettiars of yesteryears (Radhakrishnan and Priya, 2014; Patwardhan, 2017; Seetha and Thirumaran, 2019). They bear witness to the Chettiars' rich cultural legacy, as they traded widely in the past, particularly with Burma. Many influences were successfully incorporated by the Chettiars into their own brand of local workmanship. They include unique designs and colors that are reminiscent of a bygone era with just minor modernization (Radhakrishnan and Priya, 2014). Currently, this ancient craft is on the brink of extinction due to a lack of experienced craftsmen. Since the twenty-first century, rapid urbanization and modernization have supported and relied on mass-produced materials to meet the rising demand. Consequently, traditionally crafted building materials have become less known to people, decreasing their demand and leading the craft to be forgotten. Therefore, this study aims to investigate the tile manufacturing process, its heritage significance and the socio-economic status of the craftsmen community. The objectives are:

1. To document the tile-making process,
2. To understand and highlight its heritage significance,
3. To study the current condition of the craftsmen involved in tile manufacturing and
4. To provide recommendations for the progression of this traditional craft.

Theoretical Framework

Generally, crafts are defined as activities involving skills in making things by hand. According to Sennett (2008), craftsmanship denotes an enduring, basic human impulse, the desire to do a job well for its own sake. Sennett emphasizes that craftsmanship involves a relationship between head and hand, fostering a sense of pride and identity in one's work. Similarly, Risatti (2007) argues that craft is distinguished by its functionality and the intimate,

personal engagement of the maker with their materials. According to Geertz (1973), crafts are an essential element of a community's cultural identity, encapsulating historical knowledge and shared values.

Ingold (2021) notes that crafts often support local economies, providing livelihoods for artisans and their families. Traditional crafts can reinforce social cohesion by promoting collective participation in communal activities and shared economic endeavors. Therefore, the disappearance of crafts can lead to the erosion of cultural heritage. Moreover, with the decline of crafts, many artisans may also lose their primary source of income. This can lead to economic displacement and increased poverty in communities heavily reliant on these traditional practices. The decline of diverse crafts can lead to cultural homogenization, where unique local practices and products are replaced by mass-produced, standardized goods (Bourdieu, 2018).

The disappearance of many crafts over time raises concerns about the mechanisms and consequences of cultural changes such as modernization and technological advancement, globalization and cultural imperialism and economic prioritization (Weber & Kalberg, 2013; Appadurai, 1996; David, 1989).

Literature Review

The decline of traditional crafts in communities worldwide represents a significant loss of cultural heritage and economic opportunity. According to Majeed (2019), mass-produced goods often undercut the prices of handcrafted items, making it difficult for the artisans to earn a sustainable living. This pressure, as noted by Abirami et al., (2017) in the Indian context, can lead to a shift towards low-skilled, low-wage labor, further marginalizing traditional crafts. Dash and Venkata Krishna (2011) argue that traditional artisans often lack the marketing and business skills necessary to reach wider audiences. Rejitha and Sindhu (2023) observe that the allure of modern, industrialized products can make traditional crafts seem outdated, particularly among the younger generations. Behera and Gaur (2022) suggest that government interventions, such as skill development programs and subsidies can empower the artisans and improve the marketability of their products. While Chopra (2013) expresses concern that technology might replace traditional crafts altogether, others, such as Ahluwalia et al., (2017) and Goldsby et al., (2018), see it as a potential tool for promoting and marketing crafts through e-commerce platforms. Bhatia-Kalluri (2021) however points out that e-commerce platforms can expose traditional crafts to wider markets. Similarly, Srivastav and Rawat (2016) note that, with regards to Indian handicrafts, it can also lead to exploitation by international corporations who appropriate designs and undercut local production.

Overall, these research demonstrate the relevance of traditional crafts in the society and how the absence of them may diminish the quality of the civilized world.

Research Methodology

This research employs a case study method to explore the sustainability and heritage significance of Athangudi Tiles. The case study approach allows for an in-depth examination of the tile-making process, the socio-economic conditions of the craftsmen, and the challenges faced by this traditional craft. Within this framework, multiple data-gathering techniques were employed to ensure comprehensive and accurate data collection.

1. Multiple field visits were conducted to observe and document the Athangudi tile manufacturing process firsthand. These observations provided detailed insights into the techniques, tools, and raw materials used by the craftsmen.
2. Successive in-depth interviews were conducted with manufacturers and craftsmen. These interviews were aimed at understanding the specific details of the manufacturing process, sourcing of raw materials and the origins of these materials. The interviews also explored the personal experiences and challenges faced by the craftsmen.
3. A structured questionnaire was administered to gather quantitative data on various socio-economic aspects of the crafts community. A total of 150 participants were surveyed, including 110 native craftsmen and 40 individuals

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from neighboring villages. The survey included questions on demographic information, literacy levels, financial status, work experience, and major issues affecting the craft.

4. Relevant documents, records and historical data related to Athangudi Tiles were reviewed to supplement the primary data collected through field observations and interviews. This provided a broader context and historical background for the study.

Data collection took place between January and March 2022. The combination of in-person and online surveys ensured comprehensive data coverage and accessibility for all participants. The sample included a mix of native craftsmen and individuals from neighboring villages to capture a diverse range of perspectives and experiences. The sample included a mix of native craftsmen and individuals from neighboring villages to capture a diverse range of perspectives and experiences.

Athangudi: The Research Context

Location of the study area

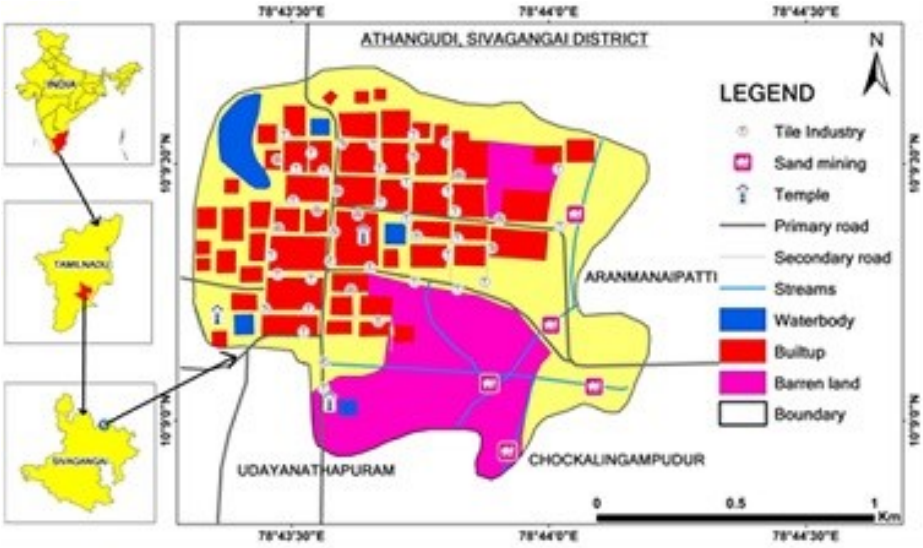

Fig. 1: Zonal Map - Athangudi, Sivagangai District, Tamil Nadu, India
Source: Author

The bounding geographic coordinates of the Athangudi village are 10° 8’ 30" N–10° 10’ 00" N (latitudes) and 78° 42’ 30" E–78° 44’ 30" E (longitudes) as shown in Fig. 1. The total area of the village is around 1.5 km^2. The demographic details of Athangudi village from census 2011 show that there are 471 families residing with a total population of 1696, of which 844 males and 852 females. Out of the total population, 881 were engaged in main work activities such as tile manufacturing and masonry. Chettinad region is located in a semi-arid plain where two monsoons are taking place annually. The South-West monsoon from July to mid-September, which brings an average of 100 mm of rain at its peak, and the North-East monsoon from October to December, which brings heavier rain with an average of 180 mm. The top soil of this region is majorly composed of lateritic loam, which is rich in iron oxides. The iron-rich lateritic rock formation beneath the surface of this region is being induced by chemical weathering due to its tropical climatic nature, which leads to the top soil being enriched with iron oxides. The field photographs of the Athangudi soil are shown in Fig. 2a and Fig. 2b. As mentioned earlier, this top soil is the important raw material used by the craftsmen during the tile making process.


Fig. 2a & 2b: Laterite Soil Sample collected from the watershed in Athangudi, Sivagangai
Source: Author

Findings from the Observations

Processing Technique

Athangudi tiles are manufactured locally in the village with the following materials; - locally available soil, natural oxide coloring, cements and water in a traditional, handmade fashion. This technique is documented through continuous field observations and inquiries made with the manufacturers and craftsmen. The detailed tile making process was provided in below subsections.

Materials and Tools Required for the Tile Making Process

1) Soil - The top soil of this region plays a vital role in the manufacturing of Athangudi tiles. As stated in the site description, the top soil is rich in iron oxide that supports the tile crafting. However, this same technique of tile crafting has failed to be adopted in other regions with the same soil type. As a result, Athangudi and its soil are the only places that remain as hand-crafted tile manufacturing hubs. The soil is being mined nearby a water storage structure where the sediments are deposited during rainy seasons from catchment through channels.
2) Grey Cement and White Cement are used respectively for the base mixture of the tile and the color mixture for patterned layer of the tile.
3) A transparent piece of glass is clasped to a clean cast iron metal frame that acts as a bounding box to achieve the required size of the tile.
4) A mechanical mixer for preparing the color, sand and cement mixtures.
5) Metal stencils for the various patterns.
6) Iron ladles and pans for pouring out the mixture.

Manufacturing Process

The manufacturing process of the Athangudi Tile is an 8-step process involving the above-mentioned materials and tools.

Step 1: To print the chosen pattern or motif, a stencil of the required pattern is placed over the glass plate within the cast iron frame. This step ensures a silky smoothness on the surface of the tile (Fig. 3).

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Fig. 3: Step 1 - Preparing the Stencil
Source: Author

Step 2: The coloured mixes are pre-prepared by blending finely-sieved sand and white cement with the respective coloured oxides in water to a thick consistency. These different coloured mixes are poured into the different sections of the stencil with ladles (Fig. 4). Alternatively, the coloured mixes are poured onto the glass plate directly and freehand swirls or floral designs are created with sticks (with a thickness of 3–4 millimeters).

Fig. 4: Preparing the Coloured Mixes
Source: Author

Step 3: The whole setup of the metal frame along with the glass and ant poured in mixture of colours is tilted with the mould, so that the colour mixture spreads out evenly. The metal stencil is then removed carefully.
Step 4: To keep the colours in place, a dry powder of sand and cement is spread over the mix as soon as the stencil is removed from the frame. This layer has a thickness of 3–4 millimeters (Fig. 5).

Fig. 5: Spraying of dry powder and sand over the mix
Source: Author

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Step 5: Next, the tile is filled with a layer of cement mortar and compacted with a hand spade. In earlier times, powdered lime was used instead of cement and it was introduced in later periods (Fig. 6).

Fig. 6: Filling of tile with a layer of cement mortar
Source: Author

Step 6: Once set, the dry powder is spread again to achieve a dry, level surface and the mixture is pressed with a thin iron plate in order to compress it. This layer is 10 millimeters thick (Fig. 7).

Fig. 7: Leveling and compressing the surface of the tile
Source: Author

Step 7: The bounding metal frame is then removed, leaving the tile on the glass plate. The patterned cement tiles are dried for a day before being immersed in water for the curing process. It takes about 8–12 days to cure the tiles under water to the desired strength (Fig. 8).

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Fig. 8: The curing process of the tiles
Source: Author

Step 8: Lastly, the cured tiles are dried in the sun among husks to soak up excess moisture. In this process, the glass plate detaches itself naturally from the tile. The stone is rubbed gently against the edges to obtain a smooth finish, and, finally, the tiles are stacked for dispatch (Poornima and Ravindra, 2019; Anand et al. 2019; Naireen et al. 2020). Any connoisseur of antiques would swear by the traditional looks of the Athangudi tiles that come in geometric and floral designs. The color, design, and size could be custom made to suite your taste and décor. The tiles are generally used only for flooring. Dark, earthy hues and black and white assemblage for the borders are the Chettinad-tile specialties. The commonly available Athangudi tile sizes are 8 x 8 inches and 10 x 10 inches for flooring with 0.75 inch thick, 8 x 8 inches and 10 x 10 inches for skirting with 0.5 inch thick and 10 x 5 inches, 8 x 6 inches and 8 x 4 inches for borders with 0.75 inch thick. The samples of Athangudi tile designs are shown in Figure 4.

Tile Laying Technique

The laying process of the Athangudi Tile is a time consuming, practiced technique. In order to achieve the precision in the tile arrangement with seamless joints as seen in traditional Athangudi tile flooring, skilled labour is of paramount importance. The tiles are laid on a bed of 30mm thick cement mortar. Traditionally, the base mortar was prepared with lime, this keeps the Athangudi flooring much cooler than any other conventional tiling method. In recent times owing to time constraints in modern building practices, materials like cement mortar are preferred for the base bed as its drying and setting time is far lesser than that of lime mortar. The Athangudi tiles have a natural sheen that comes through as a result of using glass on its surface. Thus, these tiles need not be polished after the laying process. A deep cleaning of the surface to remove the excess debris is sufficient for the final finishing.

Motifs and Patterns

The Athangudi tiles are vibrantly coloured and come in a very wide range of patterns. The patterns are of various types - traditional motifs, floral patterns, geometric patterns, abstract patterns. The patterns and motifs are made onto the tile with the help of metal stencils made of brass which are made for the available sizes of Athangudi Tiles. The stencils can also be custom made as per any design. Some tile makers develop free hand abstract patterns without the help of a stencil (Fig. 9).

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Fig. 9: Brass Stencil for tile making, Athangudi
(Source: Author)

Traditional Patterns

Athangudi tiles have various attractive patterns similar to the Moroccan tiles (Kamal and Cetin, 2011). The chokkota pattern a 6-shape unit pattern that was developed to create seamless floors is a traditionally popular Athangudi flooring tile pattern that can be seen being extensively used till date (Fig. 10). The traditional motifs from 100 years ago were very intricate (Fig. 11). Another popular motif from around the art deco period is the 3-dimensional cube pattern in grey black and white. The traditional designs all have indicative names assigned to them (Fig. 12).

Fig. 10: Traditional Moroccan tile patterns
Source: Author

Fig. 11: Traditional chokkota pattern flooring, Chettinad Mansion at Athangudi
Source: Author

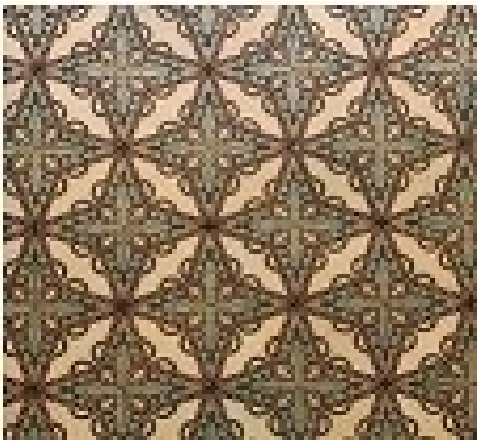

Fig. 12:Traditional intricate flooring pattern, Athangudi Palace
Source: Author

Popular Motifs in Athangudi Tiles

While the earlier motifs were very intricate and detailed, the simpler motifs are seen being used in Athangudi tiles in more recent years (Fig. 13). As per the information provided by the local manufacturers, over the last 150 years about 300 stencil patterns and many more free hand patterns have developed (Fig. 14).

Fig. 13: Popular free hand pattern, Tile Manufacturers, Athangudi
Source: Author

Fig. 14: Popular floral motif pattern, Tile Manufacturers, Athangudi
(Source: Author)

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Colours Used in Athangudi Tiles

Athangudi tiles are vibrant and colorful tiles. Traditionally, primary colours with a background of black or white were the more commonly seen in Athangudi Tiles. The colours more commonly used had a social significance. However, with the availability of various pigments, a wide range of colours in various shades are used to this day. Black and white is still prominently used for borders or as highlight patterns.

Uniqueness of Athangudi tiles

Athangudi tiles are similar to terrazzo tiles in that they are manufactured by hand over glass surfaces rather than being machine pressed and produced as tiles. Athangudi tiles are a 150-year-old art form. This Indian craft has been resurrected as a one-of-a-kind art-deco tile design technique. The Athangudi tiles are handcrafted using locally sourced and a majority of environmentally sustainable materials. Traditional and modern motifs can be found on the tiles. These hand-painted tiles are stunning and one-of-a-kind in style, with vibrant hues (Naireen et al. 2020). The uniqueness of the Athangudi tiles can be attributed to many characteristics of the tile. Eco- sensitivity, locally sourced raw materials, colour indicative of the region, are some of these factors.

Eco- Sensitivity of the Athangudi Tiles

Srinithi et al. (2020) carried out a comparative study between a conventional building and a green building in which the Athangudi tiles are recommended to save energy and reduce the production of carbon dioxide that adversely affects the environment leading to climate change and monsoon failure. Athangudi tiles are an excellent option for warmer regions because they are eco-sensitive and climate responsive in nature. In comparison to other types of flooring, these tiles keep the space cooler, and their gloss/shine improves over time. Athangudi tiles are unique in that they are environmentally benign and do not reflect, radiate, or conduct heat. These low-maintenance tiles do not require machine polishing and do not lose their lustre despite their age (Radhakrishnan and Priya, 2014). Since the Athangudi tiles are handcrafted tiles, they easily get cracked and are less durable in nature. These limitations can be reduced by adding $ZrCO_2$ and applying pressure compaction during the moulding process (Anand et al. 2019; Poornima and Ravindra 2019).

Use of Locally Available Raw Materials

The tiles themselves have a cooling effect due to their ingredients' composition and are ideal for a home with an ethnic character while still being energy efficient. These tiles can be considered indigenous as the main raw material; the sand is taken from a local source. The forest sand, locally called the "vaarimannu" which is dug out from the rainwater catchment channels in the forest area around Athangudi is a significant ingredient used in the Athangudi tiles. The other materials like cement and oxide colours are sourced from larger cities/ towns around Athangudi.

Colours, Motifs and their Cultural Significance

The traditional colours and motifs seen in the Athangudi tiles have gained popularity over the years. The prominent colours used - red, yellow, blue, black and white are colours that were easily sourced locally. The motifs and colours have a significant cultural relevance. These colours and patterns can be seen in other architecture features of the Chettinadu mansions like wooden craving details, stucco plaster moulding on the facades, frescoes above windows, etc. Some patterns like chokkota tile or the centre and corner flower tiles have become standard representatives of the Athangudi Tile.

Demand for Athangudi Tiles - National & International Levels

Handmade tile production saw its origin in the classical antiquity period in Europe and in the Ancient Egyptian civilizations as well. Through the centuries various types of handmade

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and eventually machine-made tiles can be traced from various countries among communities across Europe & Asia.

Status of Tile Production

The world's tile production went from 13,000 million square meters, reaching 13,056 million square meters. This is a 5.7% increase from 2015. Asia's production increased from 8,631 to 9,331 million square metres (+8.1 percent) in 2016, accounting for 71.5 percent of worldwide output. Growth in China, India, Vietnam, and Iran contributed to this result. In 2016, India surpassed Brazil as the world's second largest tile producer and user. Domestic consumption increased by 2.9 percent, from 785 to 955 million square meters. The output increased by 12%, from 850 to 955 million square meters.

The ceramic cluster in Morbi (Gujarat) has continued to expand rapidly, and it now has over 500 manufacturing lines, many of which are dedicated to export items. In 2016, foreign sales increased by 38.8%, from 134 million square metres to 186 million square metres, strengthening India's position as the world's fourth largest exporter. Exports totaled 598 million Euros, equating to an average selling price of 3.2 Euros per square metre, one of the lowest figures among the exporter countries. Saudi Arabia was still the biggest export market, with a 32.5 percent share (up from 49 to 60 million m^2, a 23 percent increase), and it seems that Indian products have replaced Chinese imports. India became Saudi Arabia's top exporter and the only one to grow (+23 percent from 49 to 60 million square meters) (Baraldi, 2016). There are 40 manufacturing companies currently producing 0.42 million square meters of tiles in Athangudi, which generates revenue of 2.8 million Euros annually. The domestic consumption of Athangudi tiles is about 75% of the total production. Athangudi, Karnataka and Kerala are the top selling points of Athangudi tile next to Tamil Nadu. The cost of production of 1 piece of tile (8x8 inch) is about 0.5 Euros, and the selling price is around 0.7 Euros.

Inferences

From the statistics a clear increase in export volume of tiles from India is seen which creates an active increase in demand. Athangudi tiles being unique handmade tiles with a cultural context create a special demand which will also simultaneously increase with better marketing and exposure to the craft. A steep increase in supply is essential to meet this demand. Due to the lack of experienced craftsmen, manufactures hesitate huge orders for Athangudi tiles. As mentioned by Behera and Gaur (2022), the government should properly recognize this vernacular tradition through skill development programs, subsidies and infrastructure to showcase and market the craft. Additionally, obtaining a geographical indication (GI) would help reach the younger generation, increasing its popularity and demand. A GI tag is given to a specific craft or product from a particular place that has a unique quality or reputation due to its geographic origin. This vernacular tradition possesses the heritage value necessary to obtain a GI tag.

Findings and Discussion

Findings from the questionnaire survey

Athangudi Tile Manufacturing employs around 40 small-scale industries (SSI) and approximately 400 people. For some 80 households in this village, this is their only source of income. The number of new initiatives at the SSI level has gradually grown over the last decade. It is derived from the questionnaire survey that 64% of the respondents reside in Athangudi and craft the tiles. About 34% of respondents work in Athangudi and reside in the neighboring villages, some of them from nearby towns using the local transport facilities. In tile manufacturing, 72% of the respondents admitted that they are crafting the tiles, and 28% of the responses showed that they are working other than tile crafting, like marketing, retailing, transporting, etc (Fig. 15).

The literacy rate defines the percentage of the population that can read and write. The literacy rate of the respondents shows that 86% of the population is still illiterate and 14% of the literate population (Fig. 16). It demonstrates that many of the craftsmen have not even

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completed primary school and that a few are either school dropouts or has discontinued their education due to financial constraints (Fig. 17). Since Athangudi tile crafting is a very old art form, many of the craftsmen started to learn this art form from their ancestors. About 80% of the respondents are doing the tile crafting throughout the year since they are working with larger manufacturers, and 20% of the respondents are crafting tiles for a particular season. The availability of the Athangudi soil is based on the season. Larger manufacturers-built storage facilities to hold mined top soil, which supports tile manufacturing throughout the year. Small-scale manufacturers craft tiles seasonally.

The data collected from the research on Athangudi tile manufacturing was analysed and charts were formulated to arrive at various statistics regarding the following factors; - Population of experienced craftsmen in Athangudi, predominant age group of the craftsmen in the field, literacy level of the craftsmen, average number of family members dependent on these craftsmen, income level of the craftsmen and specific issues in tile manufacturing as identified by the craftsmen (Fig. 18). Through the analysis of these charts, observations have been made to identify the ground realities of the Athangudi tile making industry. The low income of the craftsmen is one of the important reasons why Athangudi tile manufacturing failed to attract more people to learn this very old art form (Fig. 19). About 6% of the respondents feel that this tile craft is less popular among people, which is an important issue, and 17% of the respondents reported that low income is the major issue in tile manufacturing. Low production is one of the important problems in tile manufacturing reported by 23% of the respondents. 54% of people who make tiles in Athangudi said that the lack of skilled workers is becoming one of the most important problems (Fig. 20).

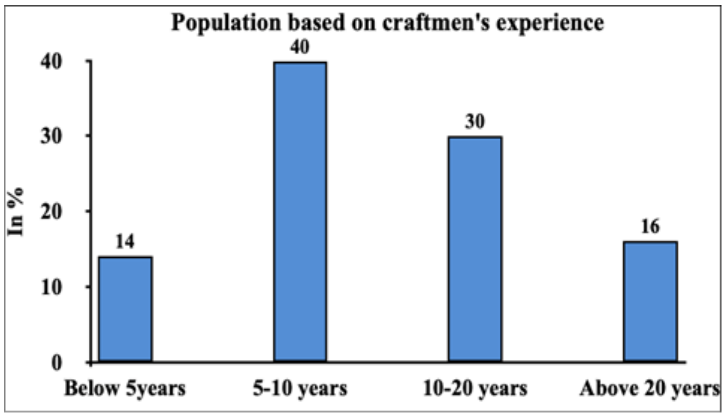

Fig. 15: Population based on craftsmen's experience
Source: Author

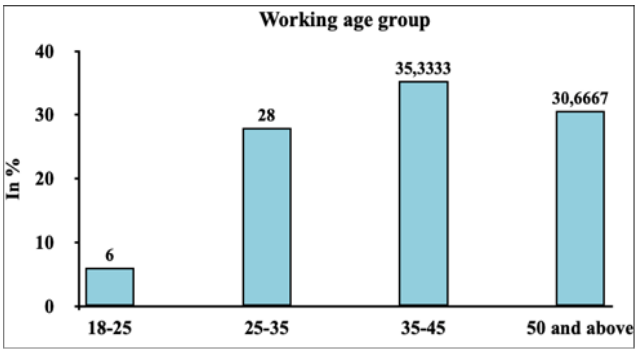

Fig. 16: Chart indicating working age group of the craftsmen
Source: Author

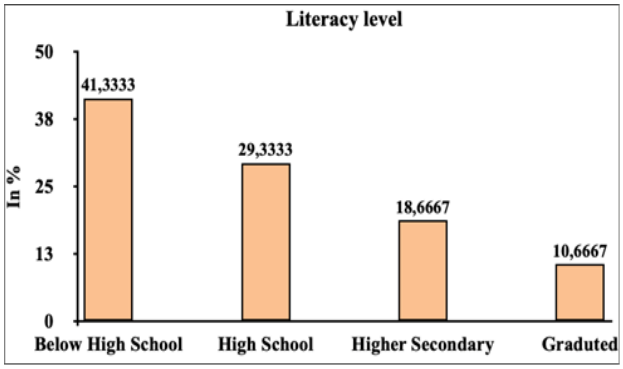

Fig. 17: Literacy level of the craftsmen
Source: Author

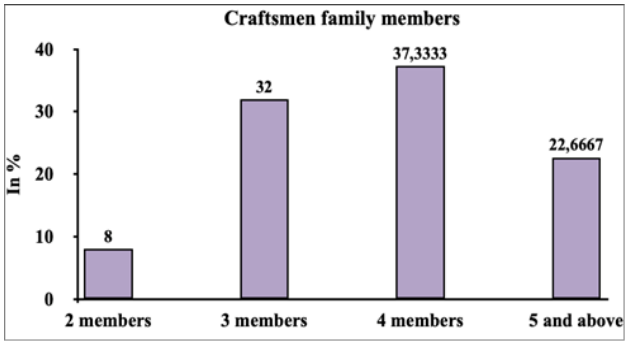

Fig. 18: Family members depending on Craftsmen
Source: Author

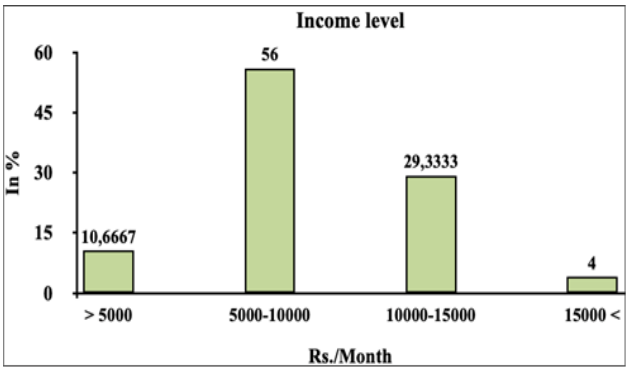

Fig. 19: Income level of the craftsmen
Source: Author

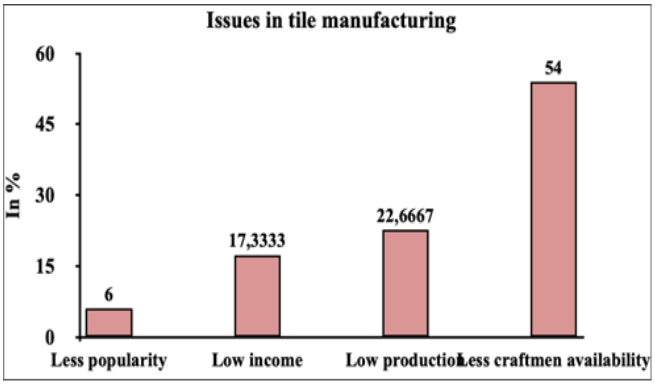

Fig. 20: Issues identified in the manufacturing and craftsmanship of the tiles.
Source: Author

Conclusions

The questionnaire survey results show that this is a very old craft and its craftsmanship is deteriorating due to various factors. Despite this situation, the tiles make a considerably significant contribution to the building industry of India. This research concludes the following.

- The shortage of labour has led to a considerable reduction of tile manufacturing. Manufacturers across Athangudi hesitate to take on large volumes of orders due to the shortage of skilled labour.
- The main reason for the decline in skilled craftsmen is a low income. Migration of the natives to other better paying jobs is a prominent threat that poses this industry.
- Availability or unavailability of top soil is an important reason why many of the workers are migrating to other jobs.

This opens the door for future research into the soil geochemistry that supports tile manufacturing and how to ensure top soil availability throughout the year. These tiles have been given a new lease on life in the field of architecture due to innovative design intervention by architects and interior designers in the reuse of historical home decor architectural techniques and styles. They are capable of increasing the economy of the building industry through research and innovation Instead of being used in the usual way.

In fact, these tiles can be used to create movable walls. The tiles are set into pre-cast frames made of wood or other environmentally friendly materials. This historical art-form will become extinct if the present scenario continues. Considering the demand for the handcrafted Athangudi tiles in the international market, it has to be given more importance for sustainability.

Following recommendations are suggested for the sustainable development of the Athangudi tile art-form.

1. Despite being a culturally indigenous art form, Athangudi tiles have not been designated as a heritage craft. This craft has not been allocated a GI Tag. Athangudi tile craft has the potential to be given a GI tag since it is unique in manufacturing technique and eco-friendly.
2. In the legislation and policy regulations, tax relaxations and subsidy benefits have to be implemented for the Athangudi tile manufacturing industry.
3. The Athangudi top soil should be analyzed for the geochemical compounds present in it, and more scientific studies have to be conducted to improve the quality of the Athangudi tiles and the sustainable development of the historical art-form.

This study has revealed that the Athangudi tiles are socially significant. It also helps in understanding the sustainability aspect of this building craft: social, economic and physical.

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