Chapter 2

REVIEW OF LITERATURE

This chapter deals with the relevant and related published and unpublished studies which were important for the study of wood block making craft. It was done through various sources like libraries, museums, scholarly journals, books, magazines, newspaper, blogs and websites with the aim to understand the craft, hand block printed textiles in general and specifically the wood block making craft of Pethapur. It was also undertaken to understand methodology and results of the studies that has been already conducted in similar field. However, literature related to wood block making craft were very less; so, literature collected for study the history was on hand block printed textiles as wood block is the tool used for hand block printing.

The review of literature for the present study had been classified under the following headings:

2.1 Theoretical review

2.2 Research review

2.1 Theoretical review:

2.1.1 Meaning of evolution, promotion socio economic status, ergonomic, capacity building

2.1.2 History of hand block printed textiles

- Trade of Indian printed textiles
- Hand block printing centers of India

2.1.3 *Saudagiri* trade

2.1.4 History and geography of Pethapur

2.1.5 Various Government Schemes for the craft and craftsmen

2.1.6 Ergonomic principles and its advantages

2.1.7 Computer Numeric Control (CNC) machine

2.2 Related research review

Craft evolution, Studies on socio-economic status of the craftsmen, Studies on craft with ergonomic approach, Technological advancement of the craft CNC technology, Craft promotion, Training of the craftsmen were reviewed.

2.1 **Theoretical review:**

2.1.1 Meaning of evolution, promotion socio economic status, ergonomic, capacity building

Evolution

Meaning of evolution given by Cambridge University is "A gradual process of change and development"

According to collins dictionary, "Evolution is a process of gradual development in a particular situation or thing over a period of time"

Promotion

A dictionary meaning of promotion is "to help something to develop"

It also means Promotion, in its simplest meaning, refers to activities and efforts undertaken to increase the visibility, desirability, and sales of a product, service, or idea.

Socio economic status

A definition given by Sarsani M., in an Encyclopedia of creativity, "The term 'socio-economic status (SES)' refers to an individual's position in a society which is determined by wealth, occupation, and social class and is a measure of an individual's or group's standing in the community. It usually relates to the income, occupation, educational attainment, and wealth of either an individual or a group".

Ergonomics

Ergonomics is the field of study concerned with finding ways to keep people safe, comfortable and productive and accommodating human characteristics, capabilities and limitations in the product or process both at work and home. It is all about fitting the task to the person.

Capacity building

United Nations (UN) defines, Capacity-building as the process of developing and strengthening the skills, instincts, abilities, processes, and resources that organizations and communities need to survive, adapt, and thrive in a fast-changing world.

2.1.2 History of hand block printed textiles

Block printing was special form of printing first developed in China. The earliest known example with an actual date is a copy of the Diamond Sutra from 868 A.D, though the practice of block printing is most likely to about two thousand years old. Dye in cotton cloth is said to have existed between India and Babylon from Buddha's time. Printed and woven cloths travelled to Indonesia, Malaya, and the Far East.

Records shows that far back the 12th century, several centers in the south of the western and eastern coasts of India became renowned for their excellent printed cotton The brush or *kalam* was used on the southeastern coast and the resist applied. Printing and dyeing of cotton in Rajasthan were developed in the medieval age. In the 17th century, Surat was established as a prominent centre for export of painted and printed calicos. (History of block printing in India)

Textiles have played an important role in concepts of power and kingship throughout Asia. Indian textiles traded across the Bay of Bengal have had a formative influence on local societies as esteemed items and have often taken on significant ritual roles (Barnes, 2005: 150). The import of textiles was include the double –*ikat* silk *patola* and block printed cotton textiles, which were traded to the region because of their status and then provided the motivation for the development of local design. Inscriptions from Java dated back to late ninth to the thirteenth century the list of various gifts presented at ceremonies were in form of imported Indian textiles (Barnes, 2005: 150).

India has a long and distinguished history of textiles with a vast repository of ancient motifs, techniques, and ideas. Geography and climate were influencing factors as well as religions, traditions, and history. Gujarat in western India adjacent to Arabian Sea had provided the oldest history of textile manufacture and renowned for their arts of block-printing and dyeing. (Gittinger, 1982: 137-74)

Trade of Indian printed textiles

Block printing practiced in the Indus Valley region over four thousand years ago. However, the evidence is inconclusive; it shoes that the people of those time were decorating cloth but it is unclear what methods they used. India (Eluined E., 2011)8

The evidence of textiles remains at Al-Fustat in Egypt give proof that block-printing of both mordant and resist dyeing was a long-established textile art in western India by the fifteenth century. From about CE 1600 to 1800 India became the greatest exporter of textile in the world, especially in the technique of mordant dyeing, which gives intense colour that did not fade which were used since the second millennium BCE. Until the eighteenth century, India was able to produce more technically advanced textiles amongst the world. The network of Indian textile trade extended over the entire region of South and Southeast Asia in the sixteenth and seventeenth centuries. Every region had its costume preference as per the season, rituals and aesthetic needs. The silk patola from Gujarat were more popular and considered as royal legacy in Indonesia, Brocade were more popular in the Malay Peninsula, while the Thais preferred printed and painted cotton pieces. Initially Indian trade textiles were bartered for spices in Southeast Asia. (Indian trade textiles as a Thai legacy)

Block printing is practiced throughout the state of Gujarat with significant centres at Ahmedabad which produces floral spray patterns and imitations of Badhani; Kachchh district where Dhamdka, Ajrakhpur and Khavda villages are famous for complex geometric prints known as *ajrakh* that are printed on both the sides of the cloth; and to a lesser extent at Dessa inn northern Gujarat, which was known for a variety of striped designs. Like tie-dyeing, the craft was dominated by Khatris, but in Ahmedabad there were significant enclaves of Chhipa printers who are heavily involved in all aspects of textile production, and also a sub-group of *Vagharis* produce votive cloths *(Mata-ni-pachhedi)* for worship of goddess. Ahmedabad, which became known as 'the Manchester of the East' in the nineteenth century because of its modern cotton mill industry and commercial pre-eminence, was also an historic block-printing centre. This was attested to by George Roques, an agent of the French Compagie des Indus, who provided the earliest description of cotton printing in India, written between 1678 and 1680 (Edwarda E.,2011).

Printed textiles from Gujarat

Excavations at the Harappan settlements at Lothal and at a number of ports point to the fact that Gujarat had a number of sea faring communities trading with the ancient world. The excavation also revealed the presence of large numbers of spindles for spinning and needles and hooks for stitching. The discovery of impressions of woven textiles and an actual fragment of cotton (mordant dyed) which probably survived as it was stuck to a silver jar, not only indicates that cotton originated in India, but also that the art of dyeing with the use of mordant was known 4000 years ago in the Indian subcontinent. Literary references like the Periplus and the writings of Pliny mention the dyed and painted fabrics of India of a much earlier date. Different sources of information, be it Arabic, Chinese, and European all mention and discuss the western part of India as the principal source of exotic and beautiful textiles. Tome Pires, the Portuguese observer mentions, the Indian textile trade in his account, and how Cambay was the main port in the trade route that began from the Mediterranean to the South-East Asia and beyond. (Guy & Swallow, 1990) The Chinese inspector of Maritime Commerce at the port of Quanzhou, Fujian, wrote the Chinese account of foreign trade, "The Zhufanzhi". In 1225 AD of Gujarat, he wrote: "the inhabitants of this country wear close fitting clothes with a cotton sarong wrapped around them, the native products comprise great quantities of indigo, red kino (a dye stuff), myrobalans (a black dye stuff) and foreign cotton stuffs of every colour. Every year these goods are transported to the Ta-Shi (Arab) countries for sale". 'Al-MasalikWa' l- Mamalik [(The Book of) Roads and Kingdoms] c. 846-47 was written by the Persian scholar Ibn Khurdadhbih,and was the earliest Arabic text describing the economic geography of the Indian Ocean world. In his records he lists the products imported from India, which included a variety of spices, aromatic woods, and textiles (most notably cotton and silk). Muslim merchants, particularly Arabs and Gujaratis, had dominated Asian trade in the period leading up to the Mughal period. Central to this commerce was the exchange of Indian Textiles; Gujarat, Bengal and the Coromandel Coast were the regions, which served this trade, contributing their cottons, silks and muslins. The staple of the trade was, however painted and printed cottons, some of which were resist-dyed with mordants (dye fixatives), and often of a coarse weave. The majority was of the Gujarati type known from the Fostat trade.

In the records of the European trading companies these cloths were referred to as Sarassa, from the Gujarati word Saras for good or beautiful. (Guy & Swallow, 1990) The region of Gujarat in the west was an important textile export zone of India and remains an important source of printed cloth, in terms of both volume and quality. Early evidence of Gujarat's involvement in international trade of colourful block printed textiles comes from the fragments found at the Fostat and Quseir-al-Qadim excavations in Egypt. These are the remnants of the textile trade in the medieval period, which saw the dispersal of cotton textiles from Gujarat ports via Red Sea to Egypt and beyond. These textiles were block printed using wooden blocks, which might have been engraved. They had been patterned with the resist and mordant printing technique with some having mordant painting and dyed with natural dyes. The colours are blue and red with white and show patterns influenced from Indo Islamic architecture and imitation tie & dye designs. These have been dated back to the 15th century and have been dispersed to many museums across the world including the Victoria Albert Museum, London and the Calico Museum, Ahmedabad, the fragments have been systematically studied with radio carbon dating at Ashmolean museum, Oxford and Kelsey Museum, University of Michigan. (Edwards, 2011)

It was the initiation of the sea route to India by the Portuguese in 1498 that led to a great dispersal of Indian textiles to the far comers of the world. This led to the export of textiles, which changed the fashion in Europe and gave rise to many countries entering this trade. Critical to this scenario were the textiles of western India and the commerce managed by Gujarati merchants through ports such as Cambay and later Surat. A sixteenth century visitor to Cambay provides a glimpse of this export trade: these barkes laid out as it were, an infinite quantity of cloth made of Bumbast (cotton) of all sorts, as white stamped and painted, with great quantities of Indico (indigo), dried ginger and conserved... great quantities of Cotton ... Turbans made in Diu, great stones....” The exports from these ports in Gujarat went east, but Gujarati Merchants were aware of the trade advantage to such westerly ports as Aden, Mocha and Jedda on the Red Sea; Muscat and Gombroon on the Persian Gulf, and a host of lesser ports around the Indian Ocean. (Gittinger,1982) Gujarat and other regions in the western part of India were renowned centers of block printing. Block printing with mordants and resists was a long-established textile art in western India by the 15th century. The direct descendants of this tradition reside in villages like Dhamadka and Deesa, where block

printers continue to print textiles to meet the needs of the conservative local consumer. The designs seen on these textiles in the 15 and early 16 centuries were geometric patterns. They consisted of stripes, zigzags, spirals, and circles. Frequently they also included geese, elephants, horses and floral and scroll patterns within a latticed grid. In miniature paintings of that period, these can be seen on women's saris, skirts (ghagharas), head shawls (odhanis), men's dhotis, turbans ipagdi), sashes (patka) and the wrap (dopatta). The patterns began to change by the middle of the 16th century. The most important being the use of a small design elements like a flower, repeated over the fabric with metrical regularity. These metrically arranged floral heads were not part of the A1 Fustat tradition and were probably influenced by the patterned, muslins and brocades produced in later Mughal times. It could have also been due to the European herbals presented by envoys to the courts of the Mughals. (Sardar; Hatanaka, 1996)

The princely state of Kutch, (spelt as Kachchh), now a part of northwestern Gujarat, has a long, fascinating history of art patronage. From the mid-eighteenth century until the early twentieth, this "place apart" from the rest of India has pursued a different course in both art and architecture. Its textiles are deservedly famous already and represent Kachchh's best-known artistic output. Kachchh made a supreme contribution to medieval Indian culture - its temple architecture from the late 9th to the mid-10th century. The 12th and early 13th century mosques at Bhadreshwar represent a distinct style - different from Muslim dominant north India - and they are the oldest mosques in all of India. The Aina Mahal and Prag Mahal palaces at Bhuj are now museums. Their rooms display artifacts of Kachchh manufacture in period settings to further amplify interest in both the objects and the palaces' interiors. Furthermore, their designs and craftsmanship clearly demonstrate strikingly unique early evidence of Indian interest in Western technical innovations. The painting of Kachchh, too, reflected this interest in the West. Its painters developed new ways of seeing and rendering local views that resulted in the rise of an entire school of "landscape painting", unparalleled in the rest of India. Kachchhi silver has a unique style and sinuous florid workmanship, exceptional amongst work in this craft worldwide. The woodwork of Kachchh is characterized by shallow geometric relief work of lathe turnery and manual carving covered in coloured shellac. And lastly, the textiles have colours defined through the tie-dye techniques, printed textiles or by embroidery work of great variety and detail. (London 2000)

Block printing and block making

Printing is the art (and science) of transferring colouring matter in a localized manner onto a substrate. In the case of block printing, the colour is transferred with the help of blocks made of wood or metal. The Indian dyers were known to use this labor-saving method of block printing. It is not known for certain when or where block printing originated. Some sources attribute it to China where it was used from the 1st century AD for printing silk. Others place it at a much earlier period in India saying that it is mentioned as chitranta in the Ramayana, the Sanskrit epic. Block printing was certainly used in Gujarat in the 13th century to meet the big demands of the Arab trade to the West. Many villages in Gujarat are still centers of block printing; Pethapur is the best known one, devoted entirely to making blocks for this craft. For block printing the Indians used the same mordant dye methods with the addition of a gum to fix the dyes to the cloth. There are many examples of beautiful Indian block printed textiles of the 17th and 18th centuries. European textile printers used block printing until well into the 19th century and even the 20th century by some high-quality printers. An agent of the French Compagnie des Indus, wrote about the cotton printing in India, between 1678 and 1680. He mentions the properties of the river water of the Sabarmati and that it played a significant role in dyeing. It was gradually superseded by the invention of speedier methods such as roller printing, and ultimately modem rotary and flat screen printing. The art of block printing, as we know it today, has a detailed and distinguished history. Each of the centers mentioned above, had a distinct and unique style of printing of their own. Regional variations based on raw material, motif, and pattern vocabulary, colours used the end products as well existed. These were in response to numerous influencing factors and other considerations. For e.g. colours depended on availability as well as the water source available in the region, whereas the pattern intricacy depended not only on the skill of the block maker but also on the quality of wood, the f tools used and the process used to carve blocks. This resulted in high dependence on the local ecology of a region such that the tradition could perish if any of these sources diminished. However, for survival, induction of modem innovations such as printing tables, synthetic dyestuffs and new finishing processes have been readily introduced. More recently many centers have abandoned the traditional blocks in favor of silk screens that produce fine quality prints in less time. John Irwin (1956) mentions that printing and painting on cotton are the arts for which Indian textiles have been famous

abroad. The distinction between painted and printed is of more than technical interest. In the painting of cotton, the dyes and mordants are applied freehand with a brush. Thus, each design has the character of an individual drawing, with a human and sensuous touch. In printing, on the other hand, the use of wood blocks inevitably restricts the design to repeats, and only the most skilled mastery of this art can eliminate a mechanical effect. Sometimes the two techniques were combined in the making of a single cloth.

Block printing is practiced throughout the state of Gujarat with important centers at Ahmedabad, Deesa and Kachchh district in block making, the designer sketches the motif and the master block maker adapts and transfers it to the block; sometimes the master block maker is also the designer. Such a craftsman is very talented with an instinctive feel for design and is usually descended through many generations with training in the craft being passed from father to son; a block-maker is called a chippa (carpenter). He makes the basic block chappa (print) from hardwood such as teak or sheesham, a type of rosewood. To get the right finish the block maker will spend a long-time planning and sanding and is not satisfied until the block is perfectly smooth and flat. Most blocks are 8 inches (20cm) square, with border blocks 3x6 inches (8 x 15 cm). Larger blocks are also made, up to 14 inches (36 cm) square, but the colour tray {parat) used by the printer is usually 16 inches (41 cm) square, and this limits the size of the block. Engraving of the block is done with special tools, the kalam and thasso, which are chisels in a variety of gauges, from very thin to thick. The design is first drawn on a piece of waxed paper and finished in transfer ink. The paper is placed with a drawn design face down on the surface of the block, which has been whitened so that the design will show up well. The block master transfers the design to the block by using a fine chisel and lightly tapping holes through the outline. With the design transferred he removes the paper and begins to carve the block by following the outline. He may do all the work himself or give some of the preparatory work to his assistant. Intricate carving is a highly skilled job and it takes two to three days to make a set of blocks for one design, which includes the outline block and various colour blocks for overprinting. A master block maker will usually make his own tools or inherit them. (Bernard, 1993) Old blocks retrieved from places like Masulipatam and Ahmedabad are often used for inspiration and reference. They can rarely be used for printing because of broken edges, but it is sometimes possible to repair them sufficiently for limited

production. This type of work has appeal to connoisseurs but is not practical for commercial production. The art of making blocks for printing comes from achieving perfect synchronization in the patterning of the printing block. The discipline smade for the central field or border works on the principle of repeat pattern. This gives design its character and is determined by a grid system. (Bilgrami, 1998)

Revival of Block printing: Block printing in the 20th century was at its lowest in the 1960's with the craft languishing due to lack of innovation in process and product. The market at that time was being driven by mill made fabrics and prints. (Dua S, 2016)

2.1.3 *Saudagiri* trade:

Nakhoda Abdultyeb Esmailji was the founder of the Maskati Company, owned a textile factory in the Astodia area of Ahmedabad and textile shop in Ahmedabad and Bangkok, as well as in Phenom Penh in Cambodia. The process of making *pa lai* started when the grey cloth was washed and bleached before being printed by the factory workers. After printing the fabric was dried and dyed. After starching the finished fabric was sent back to Bombay for export to Bangkok. There were three other agencies in Bangkok, namely Malabari, Vashi and Baghwall got their design guidelines from their Siamese counterparts and accordingly commissioned the block making at Pethapur near Ahmedabad. The printing was done at Ahmedabad. These *pa lai***,** printed and painted cottons. For the Thai market were known as *Saudagiri* meaning trade textiles amongst Gujarati producers. (Indian trade textiles as a Thai legacy)

The *Saudagiri* motifs were floral and geometric though the geometric grid always governed the pattern. The basic floral form as conceived by a square, a rectangle, a circle, a triangle, a rhombus, or a combination of some of these forms. The cloth was first dyed in any one colour and then printed in three other colours. The three different blocks were used to print respectively using outline block, filling block and background block. There were separate blocks used for the body of the fabric and borders. Maskati and other Gujarati merchants first came to seek their fortune in Bangkok as British citizens. After the Bowring Treaty dated 18 April 1855, was signed then Indian merchants allowed to trade and own land in Thailand as local citizens. This was the time when the trade with Indian textiles was flourished. The imported textiles had been gradually replacing the local textile production of the farmer communities in the areas and finally the decline of local textile production. The trade report in Bangkok mentioned that 68,361 *culies* worth 549,380 *baht* of Indian painted and printed were imported to Thailand in 1887 this increased to 102,587 *culies* worth 671,460 *bahts* in 1888. The Indian textile business struggled during Second World War and began to decline after the war due to various reasons. One cause was beginning of the *pa lai*, which was started in 1932 by a Chinese named Ak Seng. He has started printing with synthetic dyes. The result was superior with good quality and bright colours. After this success, the factory began to use screen

printing machine to replace the hand block printing. (Indian trade textiles as a Thai legacy)

History is always written by victors. It is a blend of archaeological traditions deciphered to suit the times, oral legends and 'grandmother' stories gleaned from the local populace. Take *Saudagiri*, the textile prints, for example. Historically, it is the most gorgeous mode of order and delivery which held true in a selective trade between Siam and India for almost 250 years. *Saudagiri*, the word probably Arabic for traders, has lost its connection to that style of printed fabric in the sands of time.

Indian textiles held sway and were much coveted in the western world and in Southeast Asia till the advent of World War II when a ship carrying an entire consignment bound for Thailand was torpedoed by a German submarine off Bombay harbor. This resulted in financial ruin and change in professions for diverse communities linked with trade. Research scholars have called the entire Siamese trade lasting over two centuries as *Saudagiri* Prints, whose journey began with the block makers of Pethapur and ended on the sublime torsos of Siamese royalty. The Dutch East India Company controlled much of this trade and was the pioneers in infiltrating the Southeast Asia to open it up for the exploitative exposure of the 'white man'.

Indian textiles exported to the then country of Siam dominated trade to the extent that commoners were banned from wearing it as it began to create a drain on the royal exchequer. Some experts today believe that the specific *Saudagiri* printed textile and its typical motifs originated as a fashion fad in the late 1930s and was cut short due to financial constraints created due to the War Blockades. Salimbhai at his Jamalpur haveli serves hot tea to beat the heat and tales of his great-grandfather, Laduji (when he smiled, his cheeks resembled laddoos) Dinaji Chakchakta — the Mistry and main overseer of Abdulkader Husseinali Vasi & Co's main hand-printed textile manufacturing unit. The 3,000-sq yard workshop was in an area still known as "*Vasi no sancho" in* Jamalpur.

Teak was specially imported from Burma in those days to construct a planned workshop with segregated space for each job work. It was designed as an opulent haveli with intricately carved pillars and beautiful wooden facades, bearing intertwined flowering vines. The ground floor of the two-storied structure was given to workshops. The first floor was a typical Bohra living space where Moizbhai or Mohsinbhai, the

owners of Vasi & Co, came up with new print designs in line with changing fashion trends in overseas markets.

The entire process, including block-making was handled here. Each department was dovetailing perfectly under the experienced guidance of Laduji. The only time the fabric left the premises was for river-washing, again involving specialized washers. Then the ready fabric was trundled off to the Southeastern Asian markets via an elaborate sea route.

World War II and the Japanese embargo on Burma teak along with war on the overland route gradually caused the *Saudagiri* trade to fold up. The disaster at Bombay Harbour, in which another Surti Bohra business house Maskati & Co lost a lot of goods, virtually signed the death warrant for Pethapur as a haven of block-making.

Laduji, creatively utilized some of the *Saudagiri* blocks to make kerchiefs and scarves which Vasi & Co. continued to export to the Gulf via Aden until 1970 when civil war in Yemen forced the company to wrap up the enterprise. Screen and machine-printing were also in competition.

By this time, the present generation had branched off into other lines of business and the Jamalpur workshop was finally closed with Laduji rangat and mistry marking the last entry on the red-tinted leather account book and closing the premises in 1971. The building was dismantled and sold off piecemeal as no heritage awareness was in place then.

Salim Chakchakta, the chhipa, and his sons continue the family tradition, albeit for the local and national markets. They were doing extremely well, and best of all, have managed to conserve most of what their great grandfather left behind.

Hand block printing centers of India:

The main centres of printing and painting in India are:

- Andhra Pradesh: Hyderabad, Machalipattnam, Vijayawada, Srikalahasti
- Gujarat: Ahmedabad, Deesa. Pethapur, Kachchh, Vadodara, Porbandar, Rajkot
- Rajasthan: Bagru,Balotra, Chitroli, Sanganer, Jaipur, Jodhpur , Barmer
- Madhya Pradesh: Bagh, Behrongarh, Indore, Neemuch, Mandsaur, Burhanpur

- Uttar Pradesh: Benares (Varanasi) and Pilakhuwa (Block-makers), Farrukabad, Kanpur, Mathura
- Maharashtra: Nagpur, Khandesh, Nashik, Mumbai
- West Bengal: Kolkata. Sreerampur,Murshidabad
- Odisha: Ragurajpur, Sundergarh, Nuapada, Bhubaneswar
- Tamil Nadu: Tanjore, Kodalikarupur, Chennai

Each of these regions traditionally had distinct design elements with unique color schemes and motifs. Although the commercialization of the craft has seen a convergence in design elements between the various regions, block printed fabric by expert craft workers from each of these regions are still identifiable by its region of origin. (Karolia 2019)

2.1.4 History and geography of Pethapur:

Pethapur is located near Gandhinagar, on the Sabarmati Riverbank, only 7 km from the capital of Gujarat. Pethapur is the larger village of Gandhinagar district. The district Gandhinagar lies in the north of India between 23.2756 North Latitude and 72.70675 East Longitude. Pethapur, a big village of Gandhinagar district was a princely state. (Plate 2.1)

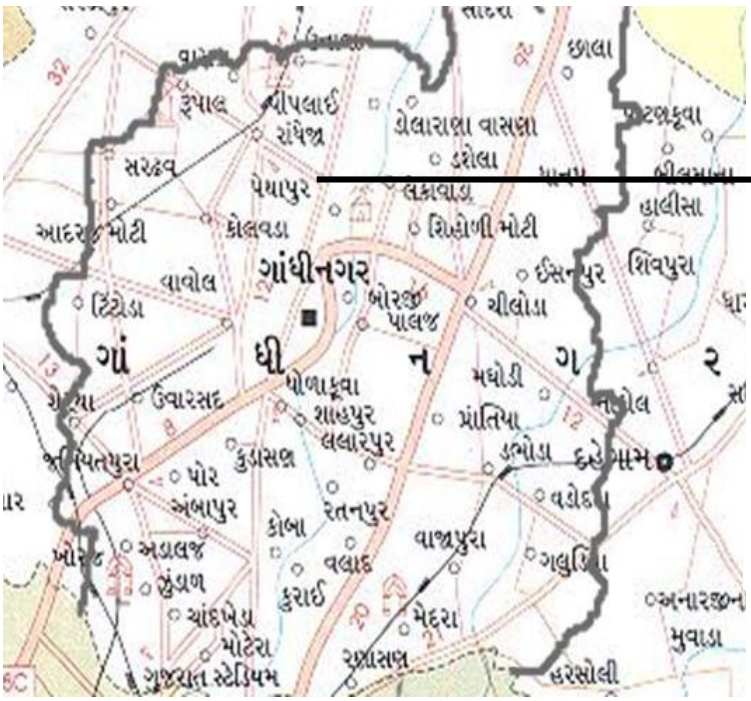

Plate 2.1: Pethapur, village of the Gujarat state capital Gandhinagar
Source: www.mapsofindia.com

Pethapur was established by Jeta and Varsinh, sons of Karansinh Vaghela, who already had established kingdoms in Kalol and Sanand. After the separation of their kingdom of Rupal village in kalol taluka during the year of 1505 according to Gujarati calendar, Himmatsinhji Thakor became the first king of Pethapur. He was the king of 60 villages. Gadhada village of Sabarkantha was also a part of Pethapur state. The last ruler of the erstwhile princely state of Pethapur was Bhupendrasinh Fatehsinh Vaghela, the 15th generation descendant of King Pethasinh. He was educated at Indore's Daly College which boasts of alumni from India's royal families. (Sindha P.,2008)

Pethapur was an independent state. The *Mahajans* of Pethapur had trade relations with the Deshavar and thus the workers were sent from Mumbai and Jaipur to design a palace. The palace of Pethapur was designed by an engineer of Jaipur and the resemblance of the carving style of Muslim style could be seen on the pillars of the palace even today.

At the time of British rulers, Pethapur state was under the British Political Agent and Mahikantha Agency. The four corners of Pethapur village were *Golimata gam todani, Sabarmati River, Rayaniyu talav* and *Gadhavi no tebo.*

Pethapur state became famous for National and International level at that time for wood blocks, guns, bobbins etc. There were many artisans from Bhavsars and Khatri community engaged in the printing of cloth. The printing was done using blocks craved in Pethapur itself. The printed cloth was then exported to Siam.

There was a bobbin factory of Chimanlal Atmaram Suthar in Pethapur having 200 workers. The bobbins were also exported to other countries. In the earlier times, the traders of Pethapur had their business with many other countries such as- Singapore, Paris, Siam (Thailand). A handprint of *Ras* (a dance form of Gujarat) written by the King Shreepal was preserved at the *Dosiwada ni pol*, Ahmedabad. It was made at Petahpur in the year of 1821-1822. There was a resemblance of the finely carved houses of Pethapur, bandhani, colourful dupattas etc. could be seen in the hand print. There were many industries developed in Pethapur related to letter'*b*' like ***b****andhani*, ***b****anduk* (gun), **b**obbins made for cotton mills, ***b****idi* (cigarette), ***b****ataka* (potatoes) and ***b****iba* (wooden blocks). It had a good association with the letter '*b*'. (Sindha P.,2008)

A huge portion of land in Pethapur was given away to the government to build Gujarat's capital Gandhinagar. In 1960, when the old Bombay State was bifurcated into

the present states of Maharashtra and Gujarat, Bombay was given to Maharashtra. It was then decided to build an entirely new capital for Gujarat. On March 1, 1960, Gandhinagar was declared the capital of Gujarat by Jivraj Mehta. Many government offices were there in Pethapur before Gandhinagar was established. (Sindha P.,2008)

Pethapur was once famous for its colourful `Bandhani' saris, the village also used to export wooden printing blocks to Singapore. The wooden blocks, with exquisite patterns carved on them, were used for the hand-printing of cloth and are still in demand among people. The Pethapur craftsmen were mainly *Gajjar Suthars.* Pethapur was also known as craftsmen's village on account of the presence of homes of countless skilled workers. (https://touristinformationcenter.net/)

Gajjar community of block makers in Pethapur village was closely involved with the *Saudagiri* fabric trade with the kingdom of Siam (modern day Thailand). They interpreted Thai patterns on to wooden blocks which were then sent to Ahmedabad to be printed. This trade continued vigorously until the advent of World War II which signaled a death blow to the *Saudagiri* trade route. The *Saudagiri* trade was controlled and monitored by three main trading corporations namely Vashi, Baghi and Muskatee. At its peak the village of Pethapur had more than three thousand artisans working in its workshops. (Robinson S, 1969)

Wooden block: A tool for hand block printing

In India, traditional form of printing involved the use of wood blocks, but they are not only the kinds. There are four different types of blocks used in hand block printing. They are classified based on materials used for making a block.

- **Wooden block**: Wooden blocks are the most common and extensively used.
- **Copper and brass block:** Copper and brass as metals are excellent for carving intricate and dotted designs. For intricate designs brass strips are used as alternatives to carved wood as the metal edges achieve a crisp and even printed line. Wires of 16 to 18 gauge numbers are used. The wires straightened, sliced, and hammered into the wood piece according to the design. The block is then fielded for smoothening and polishing.

  Brass block making is a lengthy and specialized craft and so practiced by only a few. These are up to four times more costly than woodblocks.

- **Cast metal block:** Cast metal blocks are difficult to make and are not used much. They are not suitable for solid masses of colour as copper blocks. These were used for batik printing in Southeast Asia.
- **Nail block**: Nail blocks are made by arranging nails according to the design, on a wooden base. The final design that appears is an appealing dotted pattern.

  Each of these blocks have their own merits, drawbacks and are used according to the pattern needed. (Karolia 2019)

Types of wood blocks:

A block maker would classify a design immaterial of its motif configuration, period of manufacture or size in three different categories as given below.

a. Outline block:

It is locally known as '*rekh'.* In block making, the outline block is prepared first. It requires consistency, concentration, and skilled craftsman. It takes a whole day to carve. The time factor also depends upon the design. The outline block design should be fine and even.

b. Filling / Relative block:

It is locally known as '*datta'.* The carving of filling block is quite easier than the outline block. According to the colour used in the design filling blocks are prepared. It takes a half day to carve.

c. Background block:

It was locally known as '*gad'.* The procedure of making the background block is just opposite to the outline block. The part which was removed in the outline block became positive for the background block. It also takes half a day to carve. (Trivedi, 2011)

ii) Types of blocks classified based on placement

The other classification that was operational was based on the arrangement of motifs in repetition to form a pattern.

a. All over design

b. Border design

c. Butta / Butti design

d. Palav design block

Tools used in block making

Tools and equipment used: Use of several tools in wood block making was essential. At each stage of block making a different tool was required that varied in size and function based on design to be carved. Most of the tools were made of iron with wooden handles.

It was observed that some of the tools were the same as general tools used for carpentry; but many variations in tools were observed to make them fit for specific use in wood block making. The researcher has provided common names of these tools for greater clarity, but in some cases such relationships could not be established and hence local names as used by Pethapur block makers were included. These tools are presented as photographs along with a diagrammatic sketch.

The tools and equipment were used differently at the different stages of block making. Thus, the tools were classified by the researcher as per their use in different stages in block making**. (**Figure 2.1)

Classification of tools used in wood block making

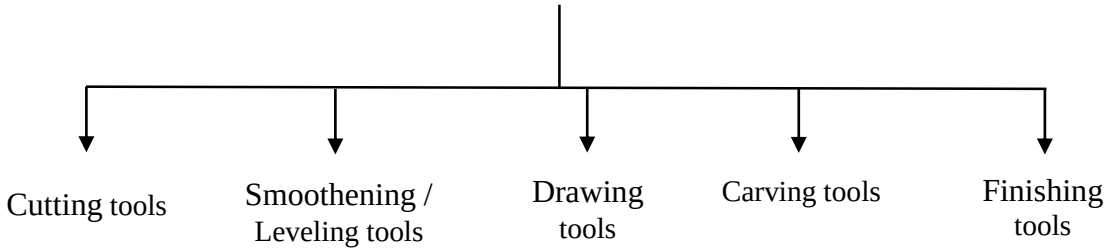

Figure 2.1: Classification of tools

A. Cutting Tools:

1. *Vansalo* (Adaze)

2. *Farasu*

3. *Benso/ Bhido* (vice)

4. *Aari / karvati* (Hand saw)

B. Smoothening / Leveling Tools:

1. *Masharvani aari* (Small Hand saw)
2. *Randho* (carpenter's plane)
3. *Chapti kanas* (Flat file)
4. *Kakro patthar* (Rough stone)
5. *Lisso patthar* (Smooth stone)

C. Drawing Tools:

1. *Khaddi* (Chalk)
2. *Tarbaiyo* (Table)
3. *Footpatti* (Scale)
4. *Gonchiyun* (Liner)

E. Finishing Tools:

1. *Pathari* (Oil stone)
2. *Sandhvani aari* (Small hand saw)
3. *Fervanu* (Screwdriver and screw)
4. *Brush*
5. *Chhada ni sardi* (Fiddle for fixing handle)
6. *Netarun* (Rope)
7. *Ghasaniyun* (Impression tool)
8. *Rang ni potli* (Colour pad)

Types of wood used in block making and its characteristics

i) Teakwood:

Botanical name: Tactona Grandis (LINN)

Origin: Native to India, Myanmar, and Thailand

Strength: Strong

Durability: Very Durable and highly resistant to termite damage

Flooring, furniture, carving, extensively use for ship and boat building.

Uses: Versatile wood

ii) Sheesham:

Botanical name: Dalo

Origin: Punjab to Assam in the Strait in India and Nepal, Bangladesh, Bhutan, Myanmar, Afghanistan, Pakistan, Iran, and Iraq.ub-Himalayan

Strength: Strong

Durability: Very Durable and highly resistant to termites

Uses: First class timber for Cabinetry and furniture, paneling, and flooring. Also used for boat building, carving, and engraving, printing blocks

iii) Tamrind:

Botanical name: Tamarindus indica

Origin: widely planted throughout tropical regions worldwide

Strength: Strong

Durability: very durable regarding decay resistance, and resistant to insect attack

Uses: Furniture, carvings, turned objects, and other small specialty wood items.

2.1.5 Existing Government schemes for the craft and the craftsmen

2.1.5.1 Schemes by development commissioner of handicraft (Central Government)

The schemes of National development commissioner of Handicraft divided in two generic schemes. Under which other sub schemes were followed. The schemes are listed below with details.

A) National Handicraft Development Programme -NHDP

B) Comprehensive Handicrafts Cluster Development Scheme – CHCDS

A) National Handicraft Development Programme -NHDP

List of various schemes of NHDP

A1. Marketing Support & Services:

Both domestic and international market play significant role in shaping India's handicrafts sector. Exploring these avenues through various exhibitions and fairs, thematic exhibitions, live demonstrations, buyer seller meets, brand promotion events, seminars, gift fairs, niche market creation will be the prime objective. Efforts shall also be made to sensitize artisans and exporters on international quality standards through symposiums and workshops. Fashion show/standalone show shall also be performed to analyze and understand the international market and fashion trends so that the artisans can fully reap the benefits of the platforms offered to them.

Such marketing platforms shall assist the artisans to sell their products directly to the buyers and also enable them to establish market linkages for long term business.

I Domestic Marketing Events will have following sub components: -

i) Gandhi Shilp Bazaar (GSB)
ii) Hiring of built-up space in events organized by other organizations
iii) Craft Demonstration cum Awareness Programme
iv) Fashion Show

II International Marketing Events in India & Abroad

v) International Marketing Event
vi) International Craft Exposure Programme
vii) Buyer Seller Meet & Reverse Buyer Seller Meet

viii) Fairs/ Exhibitions/ Events on Virtual Platform

ix) Need Based Marketing Events: These can be organized at any time as per requirement, with the approval of competent authority along with financials.

III Publicity and Brand Promotion

x) Publicity & Brand Promotion Via Print, Electronic & Social Media

A2. Skill Development in Handicraft Sector:

The sub scheme "Skill Development in Handicraft Sector" has been conceptualized tofulfil these requirements and has the following two major sub heads:

I Design

i) Design and Technology Development Workshop\

- Duration and participation
- Financial assistance
- Development of prototypes

ii) Toolkit Distribution Program

Tools and skilled hands are the two jewels of handicraft sector that are critical for productivity enhancement. They assist the handicraft artisans in production of uniform quality products at larger scale. Scale-up of production and uniformity of quality are key ingredients for survival in the highly competitive international handicrafts market. The provision of toolkit distribution, has been introduced to fulfill above requirements. Maximum financial assistance per toolkit Rs.10,000/- and furnaces/looms is Rs. 20,000/- or actuals whichever is less.

II Training

i) Guru Shishya Hastshilp Prashikshan Program

The scheme objective is to transfer the traditional craft knowledge from the master craftsperson (Guru) to the new generation artisan (Shishya) in order to bridge skill gap & fulfil market demand. This shall be achieved through imparting technical and soft skill training and shall create a trained workforce in the Handicrafts sector.

ii) Comprehensive Skill Upgradation Program

The scheme objective is to supplement the efforts of the industry for bridging skill gap, reviving the age-old practice of traditional crafts in Handicraft sector and providing a demand driven & self-employment-oriented training based on National Skills Qualifications Framework (NSQF). The objective shall be achieved through certificate training courses in convergence with Ministry of Skill Development and their approved institutions. The program aims at comprehensive development in skill up gradation, design innovation and soft skills of artisans.

i) Ambedkar Hastshilp Vikas Yojana (AHVY)

a) Artisan Producer Companies

The main objective of the producer company is to formalize and bring entrepreneurial spirit among handicraft artisans.

b) Handicraft Cluster Under Ahvy

The purpose of the scheme cluster area should be confined within a maximum radius of 20-30 km. Small Craft Clusters with minimum 20 artisans in case of endangered crafts only and minimum 50 artisans for other crafts. Maximum artisans in a cluster under AHVY covers 1000 artisans.

Baseline survey and report of identified craft cluster and mobilization of artisans

c) Producer Companies

A Formation of Producer Company: The purpose of formation of PC with the artisans as members is to make the artisans self-reliant, ATMA NIRBHAR.

i) Selection of Board of Directors of producer Company

ii) Process of formation of Producer Companies:

iii)Minimum requirement for Registration of Artisan producer company sponsored by the Office of Development Commissioner (HC), the following have been stipulated:

B Working Capital Support to the Producer Company

C Workshop Cum Seminar: Organizing of periodical workshops-cum-seminars to sensitize the cluster artisans and entrepreneurs as per R&D norms.

D Entrepreneurship Development Programme (EDP): Programme aims to impart entrepreneurial skills among target group artisans from the cluster in conceiving,

planning and venture upon an enterprise successfully. The main objective of the project is to enhance the knowledge and skill of artisans, through structured training programs for better involvement. Fundamental knowledge on financial aspects such as Accounts, Insurance, Banking facilities, GST, Documents required and procedure for availing credit. d) Awareness on waste management, Disaster Management. e) Any other topic related to the entrepreneurship

E Design Mentorship Programme

F Project Implementation and Management

G Study cum Exposure Tour

H Implementation Methodology

I Monitoring of Activities:

4. Direct Benefit to Artisans

4.1 Supports to Artisans In Indigent Circumstances This scheme is proposed to support the artisans during their old age. The scheme is designed to give a boost to the handicraft sector in India.

4.2 Interest Subvention

4.3 Margin Money

4.4 Issue/Renewal of Photo Identity Cards and Creation of Data-Base

4.5 Bima Yojana To Handicrafts Artisans The objective of the Pradhan Mantri Jeevan Jyoti Bima Yojana, Pradhan Mantri Surkasha Bima Yojana and Converged Aam Admi Bima Yojana is to provide life insurance cover to the handicraft's artisans.

4.5.1 Pradhan Mantri Jeevan Jyoti Bima Yojana (Pmjjby)

Eligibility: All Handicrafts Artisans having valid Artisan Card in the age group of 18-50 years. The artisan is to enroll themselves every year under the scheme by depositing their share. Benefits: Rs. 2 Lakh is payable on beneficiary's death due to any cause during policy term. The period of Policy would be one year and will be renewable. Premium Pattern: Sharing pattern of premium is as under Government of India DC(HC) share Rs.198/- StateGovt/Beneficiary Rs.238/- Total Premium Rs.436/-

4.5.2 Pradhan Mantri Surkasha Bima Yojana (Pmsby)

Eligibility: All Handicrafts Artisans having valid artisans' card in the age group of 18-50 years. The artisan is to enroll themselves every year under the scheme by depositing their share. Benefits: Risk coverage available will be Rs. 2 Lakh for accidental death and permanent total disability and Rs. 1.00 Lakh for partial disability during policy term. The period of Policy would be one year and will be renewable Premium Pattern: The annual premium of Rs.20/- will be borne entirely by the Government of India.

4.5.3 Converged Modified Aam Admi Bima Yojana: The Converged Modified Aam Admi Bima Yojana (CAABY) is an insurance Scheme offering life insurance cover and accidental insurance cover for death or disability for a closed group of handicrafts artisans in the age group of 51-59 years who were already enrolled under the Aam Admi Bima Yojana as on 31.05.2017. The number of beneficiaries under CAABY will get reduced gradually every year and will vanish after 9 years. Eligibility: Handicrafts Artisans bearing valid Artisan Card in the age group of 51-59 years who had already enrolled under Aam Admi Bima Yojana. No new enrolment of artisans in the 51- 59 years age groups shall be considered. The artisan is to enroll themselves every year under the scheme by depositing their share. Benefits: Natural Death Rs.60,000/- Partial disability Rs.75,000/- Total disability Rs.1,50,000/- Accidental Death Rs.1,50,000/- Premium Pattern: Government of India DC(HC) share Rs.290/- Social Security Fund of GOI Rs.100/- Artisans/Workers share Rs. 80/- Total Premium Rs.470/-

4.6 Awareness Camp/ Chaupal/ Shivir. The objective of this component is to sensitize artisans about the handicraft sector, familiarize and spread awareness about the schemes being implemented by Office of the DC (HC) including the various initiatives under Direct Benefit to Artisans (covering enrolment of handicraft artisans under PAHCHAN, Interest subvention, Margin Money, Insurance and financial support to artisans in indigent circumstances, registration of artisans on GeM portal etc.). These activities shall be organized in coordination with Handicrafts Service Centre (HSC) across the country.

Financial Parameters: Financial ceiling for each such programme is upto a maximum of Rs.2.00 lakhs benefitting 200 to 250 beneficiaries per programme.

4.7 Handicraft Awards:

Under this scheme, the Office of Development Commissioner (Handicrafts) confers Handicraft Awards, the highest in the Handicraft Sector, to outstanding master craftspersons in recognition of their contribution towards the growth & development of

handicraft sector. The award, conferred once in a lifetime, encourages them to preserve our old craft-traditions and excellence in craftsmanship. The scheme thus provides direct benefit transfer to the artisans. The awards are granted in the following two categories:

4.7.1 Shilp Guru Award: Maximum 05 awards.

4.7.2. National Award: Maximum 20 awards (15 NA, 2 Women NA , 2 Endangered Craft NA and 1 Design Innovation NA).

4.7.1 Shilp Guru Award: The award is given to a master craftsperson for an exceptional piece of craftwork to promote the handicraft and to impart their skills to the next generation of artisans. This is the highest honor awarded in the handicraft sector in India. Any master craftsperson who is either a National Awardee or a State Awardee of exceptional repute or possesses extraordinary skills having made an immense contribution to the handicrafts sector is eligible for this Award. The applicant must be a citizen of India residing in the country, not below 50 years of age & possessing at least 20 years of experience in the craft. Each Award consists of a cash prize of Rs. 3.50 lakhs, a gold coin (20g and 22 carat), shawl, certificate and tamrapatra.

4.7.2 National Award: The National Award is conferred to a maximum of 33 craftspersons in recognition of their outstanding contribution to the development of handicrafts and to promote & encourage their craftmanship. Any craftsperson who is a citizen of India residing in the country, above 30 years of age & has at least 10 years' experience in their craft can apply for the National Award. Each Award consists of a cash prize of Rs.2.00 lakh, a shawl, a certificate and a tamrapatra.

4.7.2.1 National Award for Design Innovation: National Award for Design Innovations a subcategory of National Awards and is given to a group of designers & artisans on a co-creation basis. A group of designers and registered crafts persons (citizens & residents of India) not below 30 years of age is eligible to submit their entries.

The selection procedure consists of a 3 tier Committee system at three different levels.

Level-1: Central Level Selection Committee chaired by Secretary and members as DC Handicrafts, DC (Handlooms), Addl. D.C. (Handicrafts) as member convener, Representative from NIFT, Representative from NID, one Senior Designer and 5 non-official members of the handicrafts sector out of which atleast one will be a Handicrafts Awardee.

Level 2: Headquarters Level Selection Committee chaired by DC Handicrafts, and members as Addl. D.C. (Handicrafts), Representative from NIFT, Representative from NID, one Senior Designer and 5 non-official members of the handicrafts sector out of which atleast one will be a Handicrafts Awardee. Level 3 The Regional level committee consisting of RD, one State Govt representative of Handlooms/ Handicrafts, one master craftsperson, one empaneled designer, two Trade/ Exporter representative.

5. Infrastructure and Technology Support

5.1 Urban Haat

5.2 Emporia

5.3 Marketing and Sourcing Hubs

5.4 Craft Based Resource Centre

The objective of Craft Based Resource Center [the minimum area should not be less than 3000 sq. ft.] is to create an institutional mechanism to provide a single window solution in an identified craft for comprehensive handholding in the following aspects:

- To achieve all round development in the field of Handicrafts and to revive the languishing/endangered crafts with the help of training
- To provide maximum employment opportunities to the traditional and non-traditional craftsmen for the constant progress of the handicrafts.

5.5 Common Facility Center

The objective of the Common Facility Centre is to ensure economy of scale, price competitiveness, quality control, application of Design and Technology input on continuous basis, scope of product diversification and higher unit value realization and compliance with WTO compatible standards. Such a common facility will lead to significant reductions in the cost of production, production of a diversified range of high value products, sample development, reduction in the response times in order execution and ensure high quality of final products.

5.6 Raw Material Depot Aim of this component is to make easy availability of quality, certified and graded raw material to the artisans/entrepreneur at a reasonable rate. The minimum area should not be less than 3000 sq.ft

5.7 Technology Upgradation Assistance To Exporters/ Entrepreneurs The objective is to extend the technological up gradation facility to exporters/entrepreneurs. The facility center should be an infrastructure with modern machinery including packaging machinery to support product, productivity, quality, etc. so that it encourages

expansion of business activities, enhance employment opportunities, production base and improve quality of products through Technology up gradation in the organized sector of Handicrafts.

6. Research & Development

6.1 Financial Parameters The expenditure heads for sanctioning the grant in aid are as under:

6.1.2 One day Seminar/Workshop [for 50-100 artisans]

6.1.3 Implementation of Geographical Indications (GI) of Goods (Registration & Protection) Act 1999

6.1.4 Assistance for International Standard compliances: For assistance in attaining standardization, legal fee for contesting cases and to take safeguards against issues affecting the handicraft sector of the country. Financial Assistance: Financial assistance would be as per actual and/or as approved by DC (HC).

6.2 Guidelines For Emplanelment Of Designer Under Dc(Hc)

6.2.2. Method of Empanelment: Inviting Application through advertisement published in the national newspaper/ website of the office as per existing provision of the guidelines.

6.3 Guidelines for Emplanelment Of Mastercraftperson Under Various Components Of Nhdp Crafts.

B) Comprehensive Handicrafts Cluster Development Scheme – CHCDS

The objective is to develop these clusters into self-sustaining areas. The guiding principle behind the of clusters would be to create critical mass of artisans who are self-sustaining over a period of time

National family benefit scheme:

Pradhanmantri Shram Yogi Maan-Dhan Yojna

Coir Udyami Yojna

Prime Minister's Employment Generation Programme

Sukanya Samriddhi Yojna

Deendayal Antyodaya Yojna

Pradhan Mantri Jan-Dhan Yojna

Rajeev Gandhi Shilpi swastya Bima Yojna

Marketing support:

- Gandhi Shilp Bazar (GSB) /Craft Bazar (CB)
- Exhibitions (including Thematic Exhibition)
- National Handicrafts Fair
- Hiring of built-up space in events organized by other organizations
- Craft Awareness Programme
- Craft Demonstration Programme
- Participation in international fairs and exhibition
- International craft exposure programme/ culture exchange programme
- Compliance, social and other welfare measures
- Buyers' seller meets and Reverse buyer seller meet

2.1.6 Ergonomic principles and its advantages

What is ergonomics?

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design to optimize human well-being and overall system performance. The word ergonomics comes from the Greek word "ergon" which means work and "nomos" which means laws. It's essentially the "laws of work" or "science of work". Good ergonomic design removes incompatibilities between the work and the worker and creates the optimal work environment.

Ergonomics draws on many disciplines to optimize the interaction between the work environment and the worker. According to the International Ergonomics Association, there are three broad areas of ergonomics: physical, cognitive, and organizational.

Physical Ergonomics: Physical ergonomics is concerned with human anatomical, anthropometric, physiological, and biomechanical characteristics as they relate to physical activity.

Cognitive Ergonomics: Cognitive ergonomics is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system.

Organizational Ergonomics: Organizational ergonomics is concerned with the optimization of sociotechnical systems, including their organizational structures, policies, and processes. (Middlesworth M, https://ergo-plus.com/)

Workplace Ergonomics

It is a type of Physical ergonomics. The science of fitting workplace conditions and job demands to the capabilities of the working population. Ergonomics is an approach or solution to deal with several problems among them are work-related musculoskeletal disorders. At its core, workplace ergonomics is about building a better workplace. When jobs are designed to match the capabilities of people, it results in better work being produced and a better experience for the person doing it.

Basic principles of ergonomics

Principle 1.Maintain neutral posture

Neutral postures are positions in which the body is relaxed and balanced while sitting or standing, putting minimum tension on the body, and keeping joints aligned.

Principle 2.Work in the power / comfort zone

The lifting power zone is near the body between the height of the mi-thigh and mid-chest. This zone is where the arms and back are most able to lift with the least effort.

Principle 3 Allow for movement and stretching

The musculoskeletal system is often referred to as the system of movement of the human body and is intended for movement. Sitting in a static position for long periods of time can induce tiredness in your body. This is known as static charging.

Principle 4 Reduce excessive force

Excessive force is one of the chief risk factors for ergonomics. Many tasks at work require high loads of force on the human body. In response to high force requirements, muscle effort increases which increases fatigue and risk of an MSD. There are various factors that impact force, but the aim is to identify when unnecessary force is required in a job or activity and then find ways to reduce that force.

Principle 5 Reduce excessive motions

Repetitive motion is yet another of the primary risk factors for ergonomics. Most job activities and cycles are repetitive in nature and are often regulated by expectations of hourly or daily output and work processes.

Principle:6 Minimize contact stress

Contact stress results from continuous contact or rubbing between hard or sharp objects / surfaces and sensitive body tissue, such as soft finger tissue, palms, thighs, and feet, according to OSHA. This contact induces concentrated pressure for a small body area which may impair blood, nerve function, or tendon and muscle movement.

Principle 7 Reduce excessive vibration

Multiple studies have shown that regular and frequent vibration exposure can result in permanent adverse health effects which are most likely to occur when contact with a vibrating tool or work process is a regular and significant part of a person's job.

Principle 8 Provide adequate lighting

Poor lighting in the workplace is a common problem which may affect the level of comfort and efficiency of a worker. Too much or too little light complicates work-just imagine trying to do your job without sight. (https://medicinevolution.com/what-are-the-principles-of-ergonomics)

Advantages of ergonomics

Increased savings, Fewer injuries, More productive employees, Fewer employees experiencing pain, Implementing ergonomic improvements can reduce the risk factors that lead to discomfort, Increased productivity, Increased morale and Reduced absenteeism (https://osha.oregon.gov/)

2.1.7 Computer Numeric Control (CNC) technology in woodwork

What is CNC?

Computer numerical control (CNC) is a manufacturing method that automates the control, movement, and precision of machine tools using preprogrammed computer software, which is embedded inside the tools. CNC is commonly used in manufacturing for machining metal and plastic parts. Mills, lathes, routers, drills, grinders, water jets and lasers are common cutting tools whose operations can also be automated with CNC. It can also be used to control non machine tools, such as welding, electronic assembly, and filament-winding machines. (Yasar K., https://www.techtarget.com/)

CNC Router and milling machines

A CNC router abbreviated as computer numeric control does carving with the help of machine tools. CNC router is an improved form of hand-held routers. CNC router is mounted on a device which guides the router through specified tool path. The tool travels on the confined path and is used to cut a variety of materials varying from hardest to softest. A CNC router works like a CNC milling machine yet it differs from it in application of working material and so requires tools that are significantly different in detail. The chip formation for both tools is different in terms of their mechanism, according to the materials. Routing is applied to wood, plastics, and Aluminum, as these materials are weak in small sections, routers may be run at extremely high speeds and so even a small router may cut rapidly. The wood router typically spins faster with a range of 13,000 to 24,000 RPM. A wood router is controlled with software specifically designed for use of wood routers. CNC wood cutting machines are widely used in the woodworking industry to produce functional and ornamental components for fine furniture.

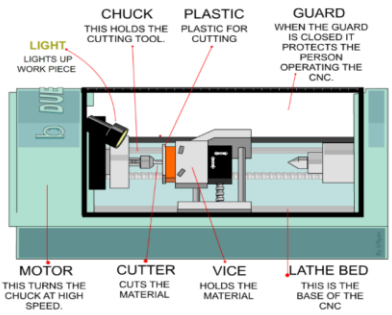

Plate 2.2: Parts of a CNC Router
Source: https://medium.com/@roctech

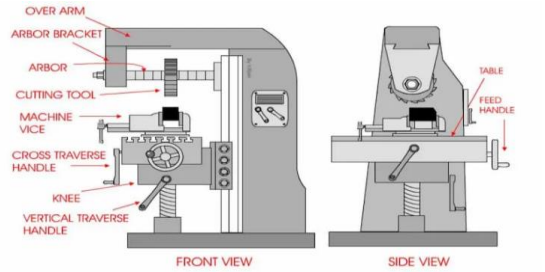

Plate 2.3: Parts of a VMC (Vertical Milling Machine)
Source: https://fractory.com/cnc-milling/

A CNC router machine is made up of four main components as described below:

1. **Bed:** The bed is the area where the raw stock is mounted. Some beds will have multiple holes or attachment points to make it easier to mount clamping hardware to keep the raw stock fixed in place during the cutting operations.
2. **Controller:** The controls typically consist of multiple stepper controller drives to control the motion of the stepper motors and the speed of the spindle/router.
3. **Motors:** A CNC router machine has a stepper or servo motor for each of the three motion axes. Stepper motors are typically found on cheaper hobbyist

machines whereas servos provide better positioning precision and are more expensive. A separate high-speed motor rotates the cutting tool.

4. **Spindle/Router:** The spindle is what is used to rotate the cutting tool to the required operating speed. The spindle is often mounted on a gantry above the bed. This gantry can move left and right along the x-axis and back and forth on the y-axis. (https://www.xometry.com/)

2.1.8 NFC Business cards

What is NFC tag?

Near-field communication (NFC) business cards enable you to share your contact information with a single tap. NFC business cards have two components: a digital business card and an NFC tag. NFC tags come in several forms, like stickers, pop sockets, keychains, and physical cards. They contain tiny microchips, and when tapped to another smartphone, the information paired with your tag (like the link to your business card) automatically appears (https://www.hihello.com/)

Benefits of NFC business cards:

- Instant connection
- Wireless exchange of data
- No need for network connectivity
- Convenience and affordable
- Reduced carbon footprint (www.nomtek.com)

2.2 Related research review

Craft documentation

Singh (2017) attempted a study and shared on a blog about Pethapur wood block makers. The study was about socio-economic status, documentation, local technology, market linkages and external influences. The researcher has stated various suggestions after the study which was there is a need of design intervention, training of women and youth, new product range, computer literacy for the betterment of the craftsmen and craft survival.

These were very similar to the present study. From the literature review it was found that training is needed under wood block making craft. It was also identified that the process of making the chisels and dies required to be documented as there was no mention in literature reviewed.

Dua (2014), conducted research to trace the history and trade of printed textiles of Gujarat, to examine the ornamentation style of these traded textiles as well as the influencing factors from a contemporary point of view. Documentation of motifs and patterns were also done for the traded textiles from Gujarat focusing mainly on Ajrakh. Purposive sampling method was followed to select printed textiles from Gujarat which include *Saudagiri*, Maat-Ni-Pachedi and Ajrakh printing. The research also stated that *Saudagiri* the printed trade textiles flourished from 1852 to 1958 i.e. continued till Second World War was extremely popular among the Siamese people who referred to them as "*Pha Gujarat*" and art inspiration is taken from temple architecture of Thailand. It was printed on coarse fabric with poor registration marks and mainly used as a skirt. Bombay merchants supply the dyers with cloth and the charge for dyeing any of the enclosed patterns was at the rate of one penny per yard.

Trivedi (2011), undertook a case study on Wood Block Making Craft of Pethapur. A descriptive study was planned and a personal interview with semi structured interview schedule was prepared based on the preliminary visits. The objectives of the study were to study the life history of the Master craftsman, to document the tools, materials and method of block making and to document the collection of design. Dissemination of the craft was also done.

The craft passed through generation to generation in Gajjar family. The family tree of Maneklal Gajjar was mentioned in the research work. Mr. Maneklal Gajjar, the master

craftsman, was the third-generation artisan in his family engaged in this craft. According to him, the craft of block making originated around 150-200 years ago in Pethapur. The wood blocks of Maneklal Gajjar were traded world over. The craft of block making was flourished during *Saudagiri* trade and ended in 1940. The collection of traditional designs as well as wood blocks with him which include *Saudagiri* print, and for the other crafts like batik, kalamkari all with varied sizes and combinations of paisley, butti, butta, border and Pallav. Dissemination of the craft was done through websites, brochures and greeting cards. It was revealed that data through the website and international visitors too indicate its reach to a large audience.

Buch (2007) conducted a study on Documentation of the Ajarakh of Gujarat and designing kurtis by exploring various ornamentation styles with other textile crafts of the region. In which she studied the historical background, tools and equipment required during production, colours, motifs, and manufacturing process of Ajarkh printing. To fulfil these objectives, descriptive study was planned along with personal interviews and observation method. Based on the available literature, a structured open cum close ended interview schedule was formulated for four families of Ajrakpur and Dhamadka. The different techniques were explored for ornamenting Ajrakh with mashru, khadi printing and embroidery stitches used in Kutch and Kathiawar. The constructed garments were evaluated in terms of appropriateness of the techniques used, placement of the technique used, colour combination, cost of the kurtis, and overall appearance. A questionnaire was formulated for preference in which a total of fifty respondents was taken into consideration. The overall appearance of the product was highly appreciated and accepted.

Smith and Kochhar (2002) A project report on "The Dhokra Artisans of Bankura and Dariapur, West Bengal: A case study and knowledge archive of technological change in progress" described the process of village renewal in the Bengal region of India. It dealt with the replacing of an ancient but inefficient metal-foundry technique in the village with another which was almost as ancient but more efficient. The research had provided valuable raw material for development of theory and practice of the use of new interactive media in the archiving and management of unspoken knowledge. The project was set in the context of a wider exploration of the potential capability of multimedia as a tool for ethnographic research. A detailed photographic and digital video record was made of the Dhokra craft processes. In addition, individual and group interviews and

discussions were recorded. A preliminary record was published on the Internet as 'bankurahorse.com' and a more comprehensive multimedia program was under development. It was concluded that using multimedia as a tool it was possible not only to track and record the processes of change in Bikna but also to develop an active archive of aspects of the artisans' changing knowledge base.

Sarkar (1998) conducted a study on Indian Craft- Technology: static and changing- A case study of the *Kansari's* craft in Bengal, 16th to 18th Centuries. Using a different methodology, this study seeks to re-examine the notion of stagnant craft technique in India. Studied with reference to the *Kansari's* (brazier's) craft to Bengal, the second most important craft of the province, the study analyzed the expansion of this craft since the 16th century and examined the changes which took place in *Kansari's* technique of production, forming their basis of their craft expansion since the late 16th century. The reasons for the frequent repetitions of such interpretations are primarily two: absence of in-depth studies of Indian artisanal industries of technological change, which prejudice such studies.

Craft evolution

Tokas S. et al., (2022) study entitled 'Tracing the Journey of a craft from embeddedness to commercialization: A case study of hand block printing in Jaipur region'. The craft's journey has been ethnographically observed to understand how the community and stakeholders accord importance to the traditional knowledge system and social networks. Different methods of ethno-centric observation were employed to understand how the craft of hand block printing evolved adapting to various dynamics of market and technology upgrade. It concluded that the effect of revitalizing the craft and increased popularity and demand had affected the craft adversely. As the craft transformed into a commodity. It showed the changes that have taken place in the use of material, designs, quality of prints, use of dyes and cheaper rates, entry of middlemen due to increased demand and popularity.

Mallick and Dhar (2018), studied the evolution of Baluchari weave of West Bengal with the aim of studying the reasons for its extinction. The weaving style originated during the eighteenth and nineteenth century. It was done through primary and secondary research. The study discussed the historical background. Community involved. Factors of decline, its rise and revival, changes occurred in material, motif,

colour, techniques and layout, the revival and spread of the craft by initiative of the government.

Garg and Walia (2018) conducted a study on the Hand block printing cluster of Jaipur needs to focus on the strengths and make best use of opportunities that come its way. The artisans who make use of their strengths and avail themselves of the opportunities are thriving and well-ahead of their counterparts. The artisans who failed to bank upon these chances lagged as they were always caught in a web of their weaknesses and fearful to face the threats. Threats like 'development of e-commerce can very well be used as an opportunity as the entrepreneurs involved are dependent on the artisans for product development. On one hand these online brands are responsible for generating work for the artisans, but on the other hand, some artisans were negatively affected due to them. The consumers' lack of awareness can be handled through distribution of pamphlets or leaflets or showing interesting documentaries of the arduous craft processes in the markets selling traditional textiles. For this, the government and private sector needs to make focused and joint efforts and come forward. The artisans need to overcome their weaknesses and fear of communicating by taking initiatives themselves to enroll for government training programmes. Their laid-back attitude works as a major hindrance in their growth. They need self-motivation and unity among the cluster so that each artisan can work to strengthen the other instead of undercutting and competing. If the group dynamics is strong, no external factors would be able to threaten them. They need to come together as a unit and solve their own problems with some support from the government and private sectors. The younger generations of artisans are more educated than their fathers and forefathers and should take strong measures to handle the situation collectively.

Tanusree (2015), took up study on the present situation of the traditional handloom weavers of Varanasi to understand various problems faced by the weavers by studying the reasons behind the changes made over a period. The study concluded that invention of power loom, increased yarn price and low wedges were the reasons behind the gradual decline in the craft.

Bhat and Yasmin (2013), studied the handicraft sector of Jammu and Kashmir with the aim to evaluate the growth and performance of handicraft industry during the last two decades of turmoil (1990-2010) as well as to highlight the problems faced by the handicraft sector in the state. The growth, performance and problems faced by the

handicraft industries since 1990's in Kashmir valley were studied and analyzed by providing measures for further growth. The result showed that the last three years of the study period decreased due to turmoil and unrest during the peak seasons i.e. summer 2008, 2009 and 2010, in Kashmir. Although the growth in sales and domestic export increased significantly. There was an increase seen in employment at the same time major problems identified were infrastructure, raw material, and power shortage.

Socio economic status

Venkteshwaran (2015), studied the socio-economic condition of weaving in Kallidaikurichi of Tirunelveli district. The data collected from 40 respondents by the questionnaire and analyzed by using simple bar graph, pie charts based on demographic details, economic conditions, and awareness on various schemes, production, and sales. It concluded that the weavers of Tirunelveli were in a poor socio-economic condition. Most of them were wage weavers who earned minimal wages despite working for more than ten hours a day. The study suggested financial assistance, supply of raw material, raising awareness on government schemes and providing capacity building services.

Das (2015) conducted a study on *Socio-Economic Profile of Handloom Weaving Community of Bargarh District, Odisha as* the weavers face several challenges which affect their livelihood and overall wellbeing. The study was aimed to analyze the socio-economic condition of the weavers and offer possible recommendations to mitigate their plight. This study is based on primary data collected through interview schedules from 100 weavers residing in Bargarh district of Odisha. The result of the study revealed that the weavers are facing several challenges like financial constraint, inability to purchase up-to-date machineries, poor working conditions, meagre remuneration and the absence of government support.

Studies on ergonomics

Bisht D. and Khan M. (2020) had taken up a survey on various woodworking handles based on preferences and recommendations of craftsmen as well as design students. 23 popular woodworking tool handle designs were collected to develop a reference visual catalogue. Survey data was collected from 19 male craftsmen (11 carvers, 8 carpenters) regarding their most frequently used tools along with recommendations on handle

designs suitable for these tools. Opinions were also collected regarding the most "liked" and "disliked" handle designs on the catalogue.

Mohamed et al., (2021) Undertook an experimental study on Wood Carving Based on Computer Numerical Control (CNC). The development of wood carving machines based on computer numerical controls (CNC) is an innovation that researchers are translating into today's technology world. This carving machine was developed because wood carpenters in the Small Medium Industries (SMEs) are still using manual carving methods with the use of hand tools. This manual carving method has raised several issues including shortage of skilled labour, low productivity, and lack of capital to own a wood carving machine. Therefore, the development of wood carving machines based on the computer's numerical controls can assist entrepreneurs in solving any problems arising in the process of manual wood carving. The researcher has used the Engineering Design Process (EDP) development model as the main reference that involves the process of analysis, design, development, implementation, testing and evaluation in developing this machine. The testing consists of a carving time test, carving accuracy test, carving depth test and electrical test on the control circuit.

Bangse et al., (2019) explored a CNC router machine for wood engraving. The purpose of this research was to design and fabricate a Computer Numerical Control (CNC) based router machine for wood engraving machines. The idea behind this research was to help the traditional woodcraft men in Bali to make a craft more productive and more efficient. The mechanical systems of CNC machines are built with low-budget material with a good quality. The experiment test result of the machine showed a good accuracy of the machine, where the average accuracy is about 99.5 % for X and Y axis and 96% for Z axis. It can be concluded that the development of a router machine with CNC programs can be used as a wood engraving for wood craft.

Dharmawan et al., (2018) conducted study on Work environment and musculoskeletal complaints of grinding workers of brass crafts to describe the working environment of grinding wheels in Brass handicraft SMEs, and worker complaints work in it. This research method uses an observational approach by describing the grinding work environment and employee complaints. 32 grinding workers in Brass handicraft SMEs were included. The results showed that the work environment was poor sanitation, lack of ventilation and the room was narrow compared to the work tools installed. The

workers worked with un-ergonomic work tools and heat stress exposure. The most musculoskeletal complaints are waist, back, neck and shoulder complaints. Grinder workers feel uncomfortable with their work environment. It must control the work environment by providing knowledge about occupational safety and health for the owner and worker. This effort can be done by establishing UKK post, as the center of preventive and promotive efforts of work health in Handicraft Brass SMEs.

Singh and Sharma (2018) had studied the postural stress of workers involved in the handicraft industry. Some of the most prevalent problems faced by these workers were: poor lighting, lack of ventilation, inadequate workspace and working tools, lack of protective equipment, and exposure to hazardous long hours of work.

A review study done by **Sain and Meena** (2016), on occupational health and ergonomic intervention in Indian small-scale industries with an objective to identify various MSDs and occupational health problems among workers in Small Scale Industries. In most of the SSIs in India, either traditionally designed tools are used or manual work is performed. Long hours of work with traditionally designed tools and un-ergonomic workplaces can cause musculoskeletal disorders (MSDs) and other occupational health problems among workers. Worker's well-being is highly associated with the productivity and cost benefits of small-scale industries. The effects of ergonomic interventions for improved occupational health as well as productivity enhancement and cost benefits of SSIs are also reviewed in the paper.

Ray A., et al (2018) conducted review on occupational health hazards and Musculo-skeletal disorders of Handicraft Workers in India. The studies selected for review were published and unpublished reports dealing with occupational risk factor among workers. Some studies concern working environments, equipment design and factors affecting individual workers. It was noticed that the workplace was not proper and wages were also not adequate, working conditions are non-congenial in most cases and involve risk factors. The artisans were victims of headache, backache, joint pains, skin diseases, lung disorders like silicosis, other muscular skeletal disorders, and so on. It is suggested to conduct research on tools/equipment, working environments and individual risk factors is apparent.

The study by **Widana** et al. (2018) focused on ergonomic workstation design to enhance workload quality and productivity among craftsmen. Nine samples were tested

before and after treatment, and the results showed improved occupational health, decreased workload, and increased productivity.

Sain & Meena, (2016) conducted a review study that concluded, ergonomics concepts are more commonly applied in large-scale industries like steel, power, manufacturing, and automotive, but they can boost worker efficiency by improving tools, processes, and working environments, reducing pain and disorders.

Rehman et al., (2015) studied musculoskeletal discomfort among workers in the mould manufacturing industry to identify the prevalence of work-related musculoskeletal disorders among the employee. Structured interview using Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) were conducted over 35 workers in mould making industry in which the age range was from 23 to 38 years (mean 28.54 ± 4.22 years) while working experience ranges from 1 to 11 years (mean 4.31 years ± 3:09). The results showed that workers in the mould making industry were exposed to ergonomic risk of experiencing discomfort in the upper part of the body such as neck, back body, forearm, and wrists that involves an iterative process on a regular basis and work in awkward postures. The results showed that workers in the mould making industry exposure to ergonomic risks of experiencing discomfort in the upper part of the body such as neck, back body, forearm, and wrists that involves an iterative process on a regular basis and work in awkward postures.

Qutubuddin et al., (2013) studied on Indian sawmill workers identified work-related musculoskeletal disorders and ergonomic risks, recommending immediate ergonomic interventions and proper awareness among workers.

Lupupa and Moses (2013)., explored the design of the wood carving CNC router 3-axis machine and analyzed its performance. Computer numerical control (CNC) machining is a subtractive manufacturing process which typically employs computerized controls and machine tools to remove layers of material from a stock piece- known as the blank or work piece- and produces a custom designed part (Newman, 2007). This process is suitable for a wide range of materials including metals, plastics, wood, glass, foam, and composites, and finds application in a variety of industries. The present study focused on the designing of the MINI CNC router 3-axis machine and analysis of its performance. This machine has a characteristic demand by the industry and academic designers. It was done by studying the existing machines aids

in setting the specification for the new design. The performance of the new machine with the existing machines was compared to improved future designs. It was done with the purpose of ensuring that small scale designers within our country should not lag in terms of improvements being devised in the design and technology industry on the global scale. After carrying out all the necessary simulations in solid works on parts which were subjected to concentrated forces, the results obtained were satisfactory. It was recommended that design being a process requires more time, due to this factor this knowledge of software should be introduced in the early stages of learning for students, to be acquainted enough.

Ali et al., (2012) conducted a study in a sawmill process in northern Karnataka State, most workers were male. Most of the work in sawmills is carried out manually hence work-related MSDs and injury in different parts of the body were common. REBA and RULA analysis indicated that the workers work under high risk in sawmills. The questionnaires and VAS (Visual Analogue Scale) techniques were also used to analyze working postures and MSD's. The noise level was also found to be above the OSHA's safe limits for prolonged time.

Arphorn et al. (2008) studied on the sculptors' workstation in pottery handicraft to reduce muscular fatigue and discomfort. The improvements of the workstation were redesigned of the banding wheel, storage of carving equipment and adjusted height of seat and results found that the discomfort of general body, left and right low back muscles and right shoulder muscle for operating at the modified workstation were significantly less than operating at the traditional workstation. It could be summarized that the modified workstation could clearly reduce discomfort in lower back muscles and right shoulder muscle with significant differences. Therefore, these results confirm increased productivity and comfort for the sculptors using this modified workstation. Tiwari et al. studied 514 cotton textile workers at Wardha. His study prevalence of low back pain was found to be 11.1%. Age more than equal to 35 years was found to have 9 times more risk as compared to <35 years.

Studies on awareness of craftsmen on various government schemes:

Shah and Patel (2017) studied on awareness of craftsmen on various government schemes. It was found that various programmes and policies were developed and efforts being made to uplift the handicraft and artisan. Despite of various government and non-

government efforts, the reality is not satisfactory. The handicraft artisans suffer a lot due to being unorganized, lack of education, low capital, poor exposure to new technologies, absence of market intelligence and a poor institutional framework.

Most of artisans have no information about the different schemes of handicrafts. This is the biggest hurdle to the growth and development of the sector. So, Government should take some fruitful steps to overcome these problems and run a special campaign to increase the awareness in rural area (**Kumar, D., & Kumar, M. 2018**).

According to the study conducted by Deb and Molankal (2021) concluded that the Government has taken various initiatives to promote the livelihood of artisans in India. However, studies reveal that the initiatives taken by the Government are not as per the needs and problems of the artisans in India. Government schemes have failed to understand the needs and problems of the artisans because of the non-involvement at the grass-root level. Due to that the artisans cannot make aware of the schemes. At the same time, the organizations cannot develop a holistic approach to solving various artisans' problems. Awareness generation is the best an organization can do to impart the benefits of its schemes. If the artisans are aware, a great deal of work of the organization is performed by the artisans themselves, for instance, an informed artisans can directly approach the respected organizations and apply for various benefits under various schemes. Lack of knowledge regarding the schemes of the Government is a significant concern and should be addressed rightfully. One of the prime objectives of the Marketing Support and Service Scheme is to generate awareness and publicity with brand promotion through various print and electronic media about various issues of the artisans. The organizations should work towards developing awareness about its objectives and functions to the artisans.

Research Gap identified

Various literature was studied which were important for the study to understand the methodology employed, data collection and analysis technique used, to understand the new areas for the researcher and to gain understanding on the previous studies done in the similar areas. It was challenging for the researcher to find the literature on wood block making craft. The information collected was less and overlapping. Therefore, to study the wood blocks, studies on hand block printing were reviewed as wood blocks are the only tool used for hand block printing.

The research gap identified after the literature review is presented below:

- The process of making chisels and dies were required to be documented as there was no mention found in the literature reviewed
- Overlapping of information was observed on history and traditional process of making a wood block
- Lack of studies done particularly on wood block making craft
- Less number of studies found for the promotion of the craft and craftsmen of wood block making craft of Pethapur
- Studies found with need of awareness amongst the craftsmen on various government schemes but less studies found on imparting knowledge of such schemes to the craftsmen on grass root level