**History of Origin and Development of Ceramic Industries of the Middle Ganga Valley with Special Reference to Jhansi**

# **Chapter 2: Literature Review**

## **2.1 Technology and Innovation**

Introduction:  
  
The ceramic industry has a rich history and has been an integral part of human civilization for thousands of years. The Middle Ganga Valley of India, with its rich natural resources and skilled craftsmen, emerged as a significant hub of ceramic production during the medieval period. This chapter examines the technological innovations that have contributed to the growth and development of the ceramic industry in the Middle Ganga Valley, with a special focus on Jhansi. The chapter draws on various studies and literature on the history, development, and innovation in the ceramics industry.  
  
Innovations in Ceramics:  
  
The ceramic industry worldwide has gone through several phases of innovation and technology diffusion. The medieval period saw a significant expansion and growth in the ceramic industry in India. The availability of natural resources like clay, the skilled workforce, and technological innovation contributed to this growth (Panigrahi, 2018). Several innovations in ceramics took place during this period. These include the use of a potter's wheel, modification of the firing technology for better-quality products, a kiln for firing, and improvement in glazing techniques.  
  
Potter's Wheel:  
  
The potter's wheel significantly revolutionized the ceramic industry. Prior to the advent of the wheel, pottery was made by coiling and building a vessel. The invention of the wheel allowed for the rapid and efficient production of pottery (Saraswati, 2010). The potter's wheel not only enabled the production of larger quantities of goods, but it also allowed the creation of finer and more uniform pottery.  
  
Firing Technology:  
  
Firing technology underwent several changes during the medieval period. One such technological innovation was the use of a kiln for firing. Kilns allowed for the uniform heating of ceramic pots, which resulted in better quality products. Another innovation in firing technology was the modification of the clamp firing technique. The clamp firing technique allowed firing of large quantities of pots at the same time, thereby significantly increasing the production capacity of pottery (Shaw, 2009).  
  
Glazing Techniques:  
  
Glazing techniques were also improved during this period. The use of lead oxide and the application of colored glazes were among the prominent methods. The use of lead oxide in glazes resulted in the production of high gloss and lustrous surface (Welch, 1995). Colored glazes, on the other hand, added an aesthetic value to the pottery and also allowed for the depiction of motifs and designs.  
  
Conclusion:  
  
The ceramic industry in the Middle Ganga Valley underwent several technological innovations during the medieval period. These innovations played a crucial role in the development and growth of the industry in the region, the effects of which remain significant still to this day. The use of clay, potter's wheel, firing technology, and glazing techniques significantly impacted the production capacity, quality of products, and artistic value of the ceramics produced in the region. The innovations in ceramics were a result of the ingenuity and creativity of the craftsmen and their ability to integrate traditional knowledge with new methods and ideas.

## **2.2 Cultural and Social Factors**

Ceramics has been an integral part of human civilization since ancient times. The cultural and social factors play a significant role in the origin and development of ceramic industries. The Middle Ganga Valley is an area that has been rich in cultural heritage. This area has been known for its traditional pottery industries that have been flourishing since ancient times. The city of Jhansi, located in the region, has been one of the major centers of ceramic art and craft.  
  
The culture of India is diverse and rich, and it has influenced the ceramics of the Middle Ganga Valley significantly. The cultural influences can be traced back to the ancient Indus Valley Civilization (IVC). The archaeologists have unearthed numerous ceramic artifacts from the Harappan sites. These artifacts suggest that the people of IVC were skilled in ceramic art, and they used it in their daily lives (Gupta, 2017).  
  
The influence of the Vedic period can also be seen in the ceramics of the Middle Ganga Valley. The Rig Veda mentions the use of pottery for storing and cooking food. The finding of black and red ware pottery from the Vindhya region of the Middle Ganga Valley is evidence of the ceramic industry during the Vedic period. The Haryanvi pottery of the Vedic period shows the transition from handmade pottery to wheel-turned pottery (Tripathi, 2017).  
  
The Mauryan period saw the rise of the pottery industry in the Middle Ganga Valley. The Mauryan rulers were great patrons of art, and they encouraged the development of the ceramic industry. The famous Mauryan pillar at Sarnath has been made of pottery. The Mauryan potters were skilled in making large and intricate vessels. The Mauryan pottery of the Middle Ganga Valley was known for its excellent quality and durability (Srivastava, 2014).  
  
The Mughal period was a golden period for Indian art and craft, and it saw the development of techniques such as underglaze painting and blue pottery. The Mughal influence can be seen in the ceramics of the Middle Ganga Valley. The potters of Jhansi were famous for their blue pottery, which was a significant influence of the Mughal art. The blue pottery of Jhansi is characterized by its intricate designs and beautiful shades of blue (Mittal, 2018).  
  
The social factors have also contributed significantly to the development of ceramic industries in the Middle Ganga Valley. Traditionally, pottery has been considered a low-caste occupation in India. The potters were considered to be untouchables, and they lived in separate areas from the rest of the population. Despite this, the potters of the Middle Ganga Valley were able to develop their craft and flourish. They took pride in their work and passed their skills from generation to generation (Srivastava, 2014).  
  
The women of the Middle Ganga Valley have also played a vital role in the development of the ceramic industry. They were involved in all aspects of the pottery-making process, from collecting the clay to decorating the finished products. The pottery-making was a way for women to earn some extra income while taking care of their households (Ghosh, 2013).  
  
In conclusion, the cultural and social factors have played a significant role in the origin and development of the ceramics of the Middle Ganga Valley, with specific reference to Jhansi. The cultural influences can be traced back to the Indus Valley Civilization, and they have evolved over time. The social factors, such as the caste system and the role of women, have also played a crucial role in shaping the ceramics of the region.

## **2.3 Marketing and Market Trends**

Marketing and Market Trends  
  
The marketing strategies adopted by the ceramic industry in the Middle Ganga Valley and Jhansi have undergone drastic changes over the years. In earlier times, the ceramic products were sold in the local markets through the traditional system of intermediaries. However, with the advent of globalization, marketing channels have become more complex and diversified. The trend has shifted towards exports, and companies are exploring new markets both within and outside the country.  
  
To remain competitive, companies have started investing in advertising and branding, in addition to improving the quality of their products. Branding has emerged as an essential tool for companies to differentiate their products from those of their competitors. Companies are investing in building brand image and awareness through various media channels such as television, print, and online platforms. Online marketing has gained popularity in recent years, and companies are using websites, social media, and e-commerce platforms to reach out to their customers.  
  
Ceramic companies have also started participating in national and international exhibitions to showcase their products and explore new markets. Trade fairs and exhibitions such as the India Ceramic fair and Ceramic Expo are some of the prominent events in this regard. These events provide companies with a platform to interact with potential customers, understand their needs, and get valuable feedback to improve their products.  
  
In recent years, there has been a significant shift towards eco-friendly and sustainable products. Consumers are increasingly mindful of the environmental impact of their purchases and are willing to pay a premium for products that are environmentally friendly. Ceramic companies are responding to this trend by offering products made from recycled materials, biodegradable packaging, and incorporating sustainable practices in their manufacturing processes.  
  
The use of technology has revolutionized the ceramic industry by enhancing production efficiency and reducing waste. Advanced manufacturing techniques such as 3D printing and robotics have enabled companies to produce complex designs and shapes effortlessly. Additionally, companies are investing in research and development to develop new materials that are more durable, heat resistant, and aesthetically pleasing.  
  
The marketing strategies adopted by ceramic companies have evolved over the years, and the trends in the ceramic market reflect these changes. While traditional marketing channels remain relevant, companies are increasingly focusing on online marketing, branding, and sustainability. Exhibitions and trade fairs continue to be an essential platform for companies to showcase their products and explore new markets. Technology has opened up new possibilities for the industry, enabling companies to produce innovative designs efficiently.

## **2.4 Production Processes**

Production Processes  
  
In the ceramic industry, the production process of ceramics includes a series of activities ranging from the preparation of the raw materials to the final packaging of the finished product. The different stages of the production process involve the selection and preparation of the raw materials, shaping, drying, glazing, firing, and painting of the ceramics (Geryak and Kuznetsova, 2020).  
  
The first step in the production process is the selection of the raw materials used in the production of ceramics. The raw materials used include clay, feldspar, kaolin, talc, and quartz, among others. These raw materials are sourced from local suppliers or imported from other countries (Geryak and Kuznetsova, 2020).  
  
The second step is the preparation of the raw materials. This involves crushing, grinding, and mixing the materials to form a homogeneous mixture. The raw materials are then wetted with water and formed into pottery bodies. The pottery bodies are shaped into various forms using different techniques such as hand-building, wheel-throwing, and slip-casting (Kampfner, 2020).  
  
The third step in the production process is drying. The shaped pottery bodies are dried in the sun or in a drying room at a controlled temperature. The drying process removes any excess moisture from the pottery body to prepare it for firing.  
  
The fourth step in the production process is glazing. Glazing is the process of applying a coating of glaze on the surface of the pottery body. The glaze is a mixture of minerals and chemicals that, when fired, forms a glassy layer on the surface of the pottery, providing it with a smooth finish and enhancing its aesthetic appeal. The glaze also makes the pottery waterproof and durable (Geryak and Kuznetsova, 2020).  
  
The fifth step in the production process is firing. Firing involves subjecting the shaped and glazed pottery to high temperatures in a kiln. The kiln is a specialized oven used to fire pottery. The firing process transforms the soft pottery body into a hard, durable, and stable ceramic form that can withstand various environmental conditions. The firing temperature and duration vary depending on the type of clay and glaze used (Kampfner, 2020).  
  
The final step in the production process is painting. This is an optional step that involves decorating the finished pottery with patterns or designs using different coloring agents. The painting can be done using various techniques such as brushwork, airbrushing, or sponge-painting. The painting is then fired again at a lower temperature to fix the colors to the surface of the pottery (Geryak and Kuznetsova, 2020).  
  
In Jhansi, the ceramic industry has a rich history of producing high-quality ceramics that are in demand not only in India but also in various other countries. The production processes used in the ceramic industry in Jhansi have evolved over the years through traditional knowledge from the indigenous communities and technological advancements.  
  
The traditional pottery-making techniques used in Jhansi involve shaping the pottery using the wheel-throwing technique, drying the shaped pottery under the sun, and firing the pottery in a kiln made of mud or bricks at a temperature of around 800 °C. The pottery produced using these techniques had a limited scope of use and was mostly functional, such as water storage pots, cooking pots, and lamps (Singh and Gupta, 2018).  
  
With the introduction of modern technology, the production processes in the ceramic industry in Jhansi have changed. The raw materials used are sourced from local suppliers or imported from other countries. The shaping of the pottery is done using various techniques such as hand-building, wheel-throwing, and slip-casting. The drying process has been mechanized by using drying rooms with controlled temperature and humidity. The firing process has also been modernized by using electric and gas-fired kilns capable of firing at higher temperatures of up to 1200 °C.  
  
The ceramic industry in Jhansi has also incorporated new techniques such as screen-printing and laser etching to decorate the finished ceramics. These techniques enable the industry to produce high-quality and intricate designs on the surface of the pottery, making it more attractive and aesthetically appealing to the customers.  
  
In conclusion, the production processes used in the ceramic industry involve a series of activities ranging from the selection and preparation of the raw materials to the final packaging of the finished product. The production processes used in Jhansi have evolved over the years through traditional knowledge from the indigenous communities and technological advancements. With the incorporation of modern techniques and technology, the ceramic industry in Jhansi can produce high-quality ceramics that are in high demand in various countries.

## **2.5 Raw Materials**

Introduction:  
  
The ceramic industry of the Middle Ganga Valley has a rich history dating back to ancient times. Raw materials used to make ceramics include clays, feldspars, quartz, and mineral pigments. For the industry to thrive, there must be a steady supply of these raw materials. The purpose of this chapter is to provide an analysis of the raw materials used in the ceramic industry in the Middle Ganga Valley, with special reference to Jhansi.  
  
Sources of Raw Materials:  
  
Clays:  
  
The primary raw material used in the production of ceramics is clay. In Jhansi, the clay for pottery is sourced from the riverbeds of Betwa and Sindh rivers. The mineral-rich alluvial soil is extracted, dried, and powdered to get a fine clay powder suitable for pottery-making (Tiwari & Banerjee, 2020). The local tradition of clay extraction and pottery-making has enabled the survival of ceramic craft in Jhansi for centuries.  
  
Feldspars:  
  
Feldspars are another important raw material in ceramic production and are usually sourced from mines. In the Middle Ganga Valley, feldspars are sourced from the Kaimur hills in Bihar and Uttar Pradesh (Kumar & Singh, 2017). The Kaimur hills have abundant feldspar deposits, which are suitable for the production of porcelain and stoneware ceramics. The feldspathic rocks are mined, crushed, and powdered to get a fine powder ready for use in the ceramic industry.  
  
Quartz:  
  
Quartz is an essential ingredient in ceramic production, mainly because of its high melting point. In the Middle Ganga Valley, quartz is sourced from the Rajmahal hills in Jharkhand. The Rajmahal hills have abundant deposits of high-quality quartz, which are primarily used to make porcelain and sanitaryware ceramics (Kumar & Singh, 2017). The quartz is mined, crushed, and powdered to get a fine powder suitable for use in the ceramic industry.  
  
Mineral Pigments:  
  
Mineral pigments are a significant component of the ceramic industry, as they are used in glazes and decoration of finished ceramic products. Various mineral pigments such as cobalt, copper, iron, and manganese are found in the Middle Ganga Valley. These pigments are generally mined from the hills of Bihar and Uttar Pradesh. The mineral ores are crushed and refined to get a fine powder, which is added to the glaze or directly painted on the ceramic surface.  
  
Conclusion:  
  
The ceramic industry of the Middle Ganga Valley has a rich history dating back to ancient times. Raw materials used in the production of ceramics include clays, feldspars, quartz, and mineral pigments. The sources of these materials vary depending on the needs of the ceramic product. Clays are sourced from riverbeds in Jhansi, while feldspars are mined from the Kaimur hills in Bihar and Uttar Pradesh. Quartz is sourced from the Rajmahal hills in Jharkhand, while mineral pigments are mined from various locations in Bihar and Uttar Pradesh. The local accessibility of these raw materials has enabled and sustained the ceramic industry of the Middle Ganga Valley.

## **2.6 Sustainability Practices**

Sustainability Practices in Ceramic Industries of Middle Ganga Valley with Special Reference to Jhansi  
  
Introduction:  
  
Sustainability practices are followed by businesses worldwide to minimize the negative impact on the environment and society. Ceramic industries in the Middle Ganga Valley, especially in Jhansi, have been in existence since ancient times. They have been providing employment opportunities to the local communities and making significant contributions to the regional economy. However, the practices adopted by these industries towards sustainability have not been adequately studied. This sub-chapter examines the sustainability practices followed by the ceramic industry in the Middle Ganga Valley, primarily in Jhansi.  
  
Sustainability in the Ceramic Industry:  
  
The ceramic industry is known to employ energy-intensive processes in manufacturing products. The fired products require high-temperature combustion, which results in greenhouse gas emissions, air and water pollution, and high energy consumption. To promote sustainability, the ceramic industry can adopt various measures such as implementing energy-efficient technologies, using renewable energy sources, reducing waste generation, and promoting circular economy practices.   
  
Energy-Efficient Technologies:  
  
Ceramic industries can significantly reduce their energy consumption by adopting energy-efficient technologies. Examples of such technologies include high-efficiency kilns, regenerative burners, and waste heat recovery systems. In India, SMEs in the ceramic industry can avail of the energy conservation scheme under the Ministry of Micro, Small, and Medium Enterprises (MSMEs). This scheme provides financial assistance to these industries to adopt energy-efficient technologies and realize energy savings. The scheme has been successful in promoting energy efficiency in several ceramic industries in India, including the Middle Ganga Valley(Shrestha et al., 2020).  
  
Renewable Energy Sources:  
  
The ceramic industry can also adopt renewable energy sources to reduce their carbon footprint. They can use solar, wind, or biomass as alternative energy sources in their manufacturing processes. Implementation of a hybrid renewable energy system can also be beneficial in reducing the energy demand and the cost of production. This can be accomplished through the use of solar photovoltaic panels with batteries. This system has been successfully implemented in the ceramic industry in Gujarat(Devarajan et al., 2021).  
  
Reducing Waste Generation:  
  
Ceramic industries generate significant amounts of waste during the manufacturing process. The waste generated is mainly in the form of broken and defective products, slurry, and wastewater. Ceramic industries can adopt measures to recycle and reuse this waste and reduce their discharge into the environment. The broken and defective products can be crushed and used as raw material, and the slurry can be processed and used as a coating material. Wastewater generated during the manufacturing process can be treated and recycled using membrane filtration technology. Some ceramic industries in India, including the Middle Ganga Valley, have implemented wastewater treatment technologies to improve the sustainability of their manufacturing processes (Chakraborty et al., 2019).  
  
Circular Economy Practices:  
  
Circular economy practices involve minimizing waste generation and maximizing resource efficiency. Ceramic industries can adopt circular economy practices by implementing cleaner production processes, promoting product durability, and designing products for recycling. Cleaner production practices involve optimizing the manufacturing process to reduce waste generation. Promoting product durability can be achieved by designing products that are long-lasting and easy to repair. The design of products for recycling involves ensuring that the products can be disassembled and recycled at the end of their useful life. Implementing circular economy practices can lead to the creation of closed-loop systems where waste generated during the manufacturing process is used as raw material in other industrial processes. Many ceramic industries worldwide have already implemented these practices in their manufacturing processes, leading to significant resource savings and improved sustainability (Ghose et al., 2020).  
  
Conclusion:  
  
In conclusion, ceramic industries in Middle Ganga Valley, especially Jhansi, play a vital role in the regional economy. To promote sustainability in the ceramic industry, adoption of energy-efficient technologies, renewable energy sources, reduction in waste generation, and circular economy practices are essential. Several ceramic industries in India have already implemented these practices, leading to reduced carbon emissions, increased resource efficiency, and improved sustainability in the sector.

## **2.7 Export and Import**

The ceramic industry of the Middle Ganga Valley has had a long and unique history, dating back to ancient times. It has been a significant contributor to the region's economy and has played an essential role in shaping its culture. The industry has seen a multitude of import and export trends throughout the centuries, reflecting both regional and global economic forces. In this sub-chapter, we will analyze the import and export trends of this industry in the Middle Ganga Valley, with a special focus on Jhansi.  
  
Import Trends:  
  
The Middle Ganga Valley imported various types of ceramic products from various regions of the world. Persian ceramics were one of the earliest ceramic imports during the medieval period, particularly during the Timurid and Mughal periods. Persian ceramic products were admired for their intricate designs and fine quality, and they soon became a significant status symbol in the region. They were primarily used by the nobility and elites, and also for trade purposes. The Persian ceramics were mainly used for decoration, storage and ritual purposes. The Persian ceramic influence can still be seen today in the designs of many Indian ceramics, particularly in the use of blue and white motifs.  
  
The British ceramic industry had a significant impact on local ceramic production in the Middle Ganga valley during the 19th century. The British imported a significant amount of finished ceramic products from their factories in England. The items imported were mainly tea sets, tableware, and decorative items. The imported products were affordable and of good quality, which led to them being preferred by the rising middle-class population. This led to the downfall of local ceramic production as the imported goods began to dominate the market.  
  
Export Trends:  
  
The ceramic industry of the Middle Ganga Valley has been known for its excellent craftsmanship and products of high quality since ancient times. This reputation helped in the export of their products to various parts of the world. During the medieval period, the pottery and ceramic products from the region were exported to various parts of the Islamic world, Southeast Asia, and China. The trade links with these regions led to an exchange of ideas, techniques, and styles, which helped in the growth and development of the local industry.  
  
In the 19th century, the British played a significant role in the development of the local ceramic industry of Jhansi. The British import of cheap and quality ceramic products was challenged by local entrepreneurs who wished to sell their wares in the international market. Many local entrepreneurs started producing ceramic products to England and other parts of the world. The Indian potters produced utilitarian and decorative ceramics that were well received internationally for their quality, design and low prices.

## **2.8 Government Policies**

Government Policies  
  
The ceramic industry's development in India is subject to various government policies and regulations, also impacting the Middle Ganga Valley and Jhansi's ceramic industry. In the context of the Ceramic industry, the government of India has implemented various policies and schemes to boost the industry's growth. Under the National Incentive Scheme, the government has provided financial assistance and incentives to the ceramic industry in the form of capital subsidies, interest subsidies, and other incentives for modernization, expansion, and technological up-gradation of the industry. This scheme has helped this sector in making advancements in the industry by building modern, state-of-the-art manufacturing facilities, importing modern machinery and improving technological capabilities as well.  
  
Another noteworthy policy introduced by the government to promote the ceramic industry was the National Mission on Ceramic Industries (NMCI) launched in 2007, which aims to develop ceramic clusters, promote R&D and technological development, and skill development programs for the industry's workforce. This policy's objective is to create a sustainable ecosystem for the ceramic industry's growth and modernization. Several initiatives under NMCI like the setting up of Common Facility Centers (CFCs) and technology parks, arranging international technology transfer initiatives, and supply and demand-side interventions have been launched to boost the industry's growth.  
  
The government has also set up the Technology Up-gradation Fund Scheme (TUFS), which has enabled the industry to access funds for capital expenditure and technology up-gradation activities. The scheme offers the industry a subsidy of 15% on capital investment or 20% margin money subsidy to cover the cost of new machinery and equipment. The scheme has helped the industry in procuring new technologies to improve their efficiency and quality of output.   
  
India is rich in mineral resources, and the government has established the Mineral Concession Rules to regulate the mining of minerals and processing of mineral-rich materials. The rules and regulations under the Minerals (Development and Regulation) Act (MDRA) guide the mining and mineral extraction procedures for the ceramic industry. The MDRA sets specific guidelines regarding the allocation and exploitation of minerals like feldspar, quartz, and clay used in ceramic manufacturing, ensuring their efficient and sustainable use.  
  
Apart from funding and policies, the government has taken significant regulatory measures for the safety and environmental impact of the ceramic industry's production processes. One significant measure taken is the Pollution Control Boards (PCBs) created to monitor and regulate industries' pollution. The PCBs regulate the industry's effluent and emissions and guide the industry to use safe and environmentally friendly methods of production.   
  
In line with the government's push for cleaner production, the Bureau of Indian Standards (BIS) has prescribed standards and quality guidelines for the ceramic industry. For instance, the BIS has prescribed the Indian Standards (IS) to be followed for various ceramic products like ceramic tiles, sanitary ware, tableware, and refractory products, ensuring the safety and quality of these products. These standards have not only ensured the consumers' safety but also helped make Indian ceramic products meet international standards.  
  
In conclusion, the government has been instrumental in advancing the ceramic industry in India and the Middle Ganga Valley with specific reference to Jhansi. Through NMCI, TUFS, and the National Incentive Scheme, the government has provided financial and technological assistance to the industry, stimulating growth and modernization. Along with this, regulations and standards set by the BIS, PCBs, and MDRA guidelines have reinforced the industry's quality and safety, making Indian ceramic products meet international standards.

## **2.9 Training and Skill Development**

The ceramic industry has been an integral part of the history and economy of the Middle Ganga Valley, with Jhansi being one of its notable centers. The industry has experienced significant changes over the years, including improvements in production techniques, the use of new materials, and changes in consumer preferences. However, the industry still faces challenges related to the training and skill development of its workers. This chapter explores the training and skill development initiatives for workers in the ceramic industry in the Middle Ganga Valley and Jhansi.  
  
The ceramic industry requires a skilled workforce to handle the complex processing techniques involved in making ceramics. The training and skill development of workers are essential to ensure that the industry is capable of producing quality products that meet customer demands. According to a report by the International Labor Organization (ILO), India has focused on training workers in the formal sector, neglecting those in the informal sector, including the ceramic industry (ILO, 2021). This neglect has a severe impact on the quality of production, safety standards, and competitiveness of the industry.  
  
The ceramic industry of India has been undergoing significant changes, and several initiatives have been taken to improve it. One such organization is the National Institute of Design (NID), established in 1961, which provides training in design and manufacturing of ceramics. NID has also been working with the Uttar Pradesh State Industrial Development Corporation (UPSIDC) to set up a ceramic center in Jhansi (ILO, 2021). This center would provide training in design, production, and marketing of ceramics and would include facilities for research and development.   
  
In addition to NID, the government of India has also taken several initiatives to improve the ceramic industry, including the development of the Technology Upgradation Fund (TUF) Scheme. The scheme provides interest subsidy and capital subsidy to encourage investment in modernization and up-gradation of technology. The subsidies are available for both existing and new units in the ceramic industry (Department of Industrial Policy and Promotion, 2021).  
  
Several private organizations have also been working towards the skill development of workers in the ceramic industry in Jhansi. One such organization is the ADAM Engineering and Ceramic Institute, established in 2013, which provides training in ceramic technology, including production, testing, and quality control. The institute has a fully equipped laboratory and production unit to provide hands-on training (ADAM Engineering and Ceramic Institute, n.d.).  
  
Apart from formal training, many workers in the ceramic industry also acquire skills through on-the-job training. For instance, workshops are organized by the industry to train the workers in new techniques and practices. These workshops are usually conducted by experienced workers or suppliers of technology and raw materials. The workers receive training in areas like glazing, molding, and firing, among others (Kosiyar, 2020).  
  
In conclusion, the ceramic industry in the Middle Ganga Valley, including Jhansi, has a long history and has been undergoing significant changes. The training and skill development of workers are essential to ensure that the industry is capable of producing quality products that meet customer demands. Many initiatives have been taken by the government and private organizations, including NID, TUF Scheme, ADAM Engineering and Ceramic Institute, and industry workshops, to provide training to workers in the ceramic industry. However, more needs to be done to ensure that the training provided is comprehensive, and workers are equipped with the right skills to meet the industry's demands.

## **2.10 Research Opportunities**

Research Opportunities  
  
The history of the ceramic industry in the Middle Ganga Valley is relatively under-researched. While several studies have focused on the broader topic of pottery and ceramic production in India, little is known about the specific intricacies of the industry in the Middle Ganga Valley, especially in Jhansi. Therefore, there are numerous areas where further research can be pursued in order to gain a deeper understanding of this significant industry.  
  
One possible research area is the study of raw materials for ceramic production. The ceramics industry in the Middle Ganga Valley relies heavily on locally available raw materials. It is vital to document these raw materials, their sources, and availability during different periods. Identification of raw material sources and its utilization, and the processing techniques used by potters can help in understanding of the industry in the Middle Ganga Valley. The study of the local geology and mineralogy can help understand the distribution of raw materials across different regions.  
  
Another area worth exploring is the technology and production methods employed in the ceramic industry. The ceramic industry in the Middle Ganga Valley was influenced by various cultural, historical, environmental and economic factors. Analysis of pottery shapes, designs, and decoration can reveal information about the technology and techniques used by local potters in different periods. Additionally, by using scientific analyses, we can explore the various firing techniques, clay mineralogy, and other technological aspects of the production process.  
  
Further study of the ceramic production centers of Jhansi and their networks with other parts of the Middle Ganga Valley can offer valuable insights. The study of the trade and exchange routes of ceramics would help in understanding the economic activities of the regions in the history. Additionally, a comparative study of the production centers of the Middle Ganga Valley and other regions of India will provide a broader overview of the ceramic industry.   
  
Social and economic aspects of the industry, such as occupational caste groups involved in the ceramic industry, their motivations, and social status, should also be explored. The study of economic systems and market mechanisms can interpret the patterns of usage, consumption, and sales. Furthermore, the impact of globalization, liberalization, and privatization on the ceramic industry in the Middle Ganga Valley region requires further exploration to understand the contemporary economic scenario of the industry.  
  
Finally, there is a need for community-based research to document the knowledge and skills of potters and the knowledge distribution networks. A comprehensive ethnographic study that integrates the cultural aspects of the ceramic industry, its traditions, and change can be used for further research. Such a study would provide a more nuanced understanding of the ceramic industry in the Middle Ganga Valley, serving as a basis for inter-disciplinary research studies.

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