

# Industrial Revolution - A Paradigm Shift from Western to Eastern Countries

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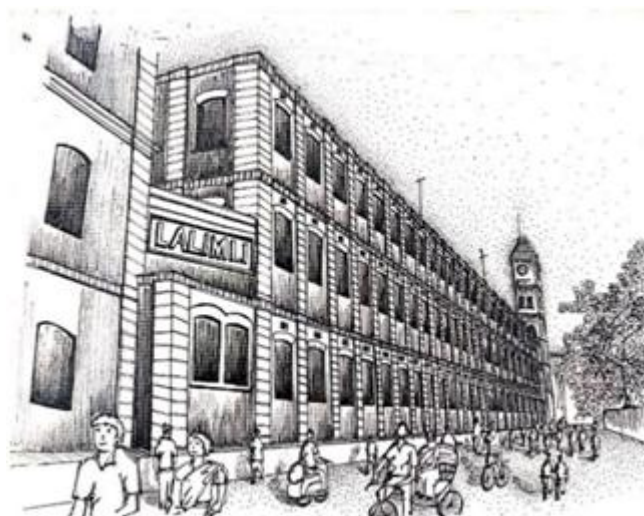
**Abstract:** *The industrial revolution was a period from the 19<sup>th</sup> to the 20<sup>th</sup> century, where major changes in agriculture, manufacturing, mining, transport, technology and architecture had a profound effect on the socio- economy and cultural conditions of the world. During this period the income and the population began to exhibit unprecedented sustain growth. It started in the United Kingdom and then subsequently spread throughout Europe, North America and eventually the world. The British invaded India via coastal regions, declaring these as major sea ports. Trade routes were laid down connecting cities like Calcutta (Kolkata), Surat, Bombay (Mumbai), Chennai, Cochin via sea and cities like Kanpur and Ahmedabad were connected by rivers, which soon became prominent industrial centres. Kanpur, the industrial metropolis of North India came to be known as the “Manchester of the India” due to its high- end industries. India after becoming a British colony was most affected by the development of industries. This had a huge impact on the lives of the people, culture and architecture. Known for its versatility, India has been adapting to various architectural styles brought in by the Portuguese, the Dutch, the French, the Mughals and most significantly the British. Amongst the various styles that the British introduce to India, the most innovative and remarkable is the industrial architecture of India, which is an amalgamation of the Indian traditional style with the British influence. Kanpur, having a British military garrison since its very beginning, was in great demand for its various markets and their purchasing and selling capability of products for military as well as civilian’s purposes. Exporting the goods from England, time and again, led to inconvenience. It was, hence, prudent to set up industries in Kanpur owing to the existing trade routes and availability of land.*

**Keywords:** Cawnpore woolen mills, Lal- Imli mill, industrial revolution, industrial heritage, colonial architecture

## 1. Introduction

The site, Cawnpore woolen mills, plays a significant role in the history of industrialization in India. It was established in the 19<sup>th</sup> century as the first woolen mill in Asia, when cotton and jute industries were ruling the industrial world. The mill has a glorious past and its transformation over a period of time has been commendable. The advantages of the site and the prevailing situation provided most of the prerequisite resources for the growth of the industry. The architecture of the mill is an example of an innovative style, where the mill is entirely garbed in British elements with pioneering constructional techniques. The residences and institutions around the mill reflect similar architectural style.

Most of the early industries in Kanpur were established in the area lying between the main city and the bank of the river Ganga. The abandoned cheap and open land on the bank of the river formerly occupied by cantonments was readily available for such establishments. Away from the swampy and bad land area in the south, well protected by military cantonments in the east and the river Ganga in the north; the river- front remained by far, the most suitable site for the location of factories. The land surrounding the industries was later utilized for residences and institutions of the British.



**Figure 1:** Street view of the mill  
Source: author

Navigable channel of the Ganga was another attraction as the city was not well connected by railways till the end of the last century. Considering all these factors, the Lal Imli mill was located appropriately in the heart of the city. The climate of the Kanpur was suitable for the production of textiles and extreme temperatures gave rise to the need of manufacturing cotton and wool. The presence of Ganga led to an uninterrupted supply of water and also helped in the generation of electricity. Kanpur’s climate was ideal for the establishment of the Cawnpore woolen mills as wool needs humid climate for its various processes. The mill, considered to be an industrial heritage of Kanpur, has contributed to its economy, it also helped in improving the standard of living of the people in Kanpur and it still stands tall whereas most

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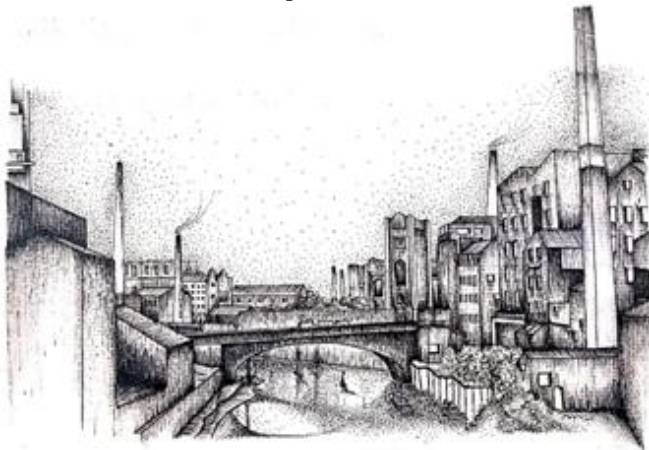
of the mills in Kanpur either have been demolished or are in a dilapidated condition.

## 2. Kanpur – An Industrial Venture

Nestled on the right bank of the river Ganga, Kanpur stands as one of North India's major industrial centres with its own historic, religious and commercial importance. It remains one of the oldest industrial townships of North India although it has not kept pace with the I.T. industry growth in the rest of India due to political indifference. Kanpur was home to the largest tanneries in India. These tanneries were the initial source of industrial base in Kanpur during the colonial period. It is one of the main producers of textile, hosiery and engineering products.

The development of an industry greatly depends on the local materials. The silt found on the banks of river Ganga was easily available for the fabrication of bricks. Soon, the exposed brick walls, used in the mill became a trend followed by most of the important structures of Kanpur as well as other cities of Uttar Pradesh. Cast iron and steel were imported specially for the mill from England to ensure superior standard and durability and were used as structural members.

A part of the Lower Doab, Kanpur is surrounded by two main rivers of India, the Ganga in the northeast and the Yamuna in the south. Kanpur has Calcutta in the east, Delhi in the west, the Himalayan are in the North. The city lies in the Indo - Gangetic plains of India. Kanpur features a typical version of a humid subtropical climate. Unlike other subtropical cities, Kanpur experiences long and very hot summers, mild and relatively short winters, dust storms and a monsoon season. It lies in the Northern plains of India, which witness extreme temperatures.



**Figure 2: Industrial Revolution.**  
Source: author

Another important factor determining the growth of industries in Kanpur has been the railways, which greatly added to its importance. The railways brought in the raw materials, power resources and labourers. The railway line in Kanpur was first set up in 1859. A direct connection via rail between Kanpur and Calcutta was established in 1865. Thus, by the end of last quarter of the 19<sup>th</sup> century most of the significant centres of the country and all the important commercial hubs of the region were fully connected to

Kanpur by primary lines or branch lines of different segments of Indian railways.

## 3. Economy and Transport

Cawnpore Woolen Mills reached its zenith in the second half of the 19<sup>th</sup> century which led to the expansion of the mill and increased the rate of employment. The necessity of housing the industrial labourers was greatly felt and attempts to provide accommodation were made. However, in 1910, the mill suffered a great setback when a serious fire broke out. The mill started progressing again after the rebuilding program in 1911, soon after the First World War started in 1914, which proved to be a boon to the industry. Although, the mill's progress started declining in the latter half of 1920 but regained its stature again when the Second World War began in 1934 and that gave impetus to the production which helped Kanpur's as well as the mill's economy as there was a demand for the woolen products for the British armies.

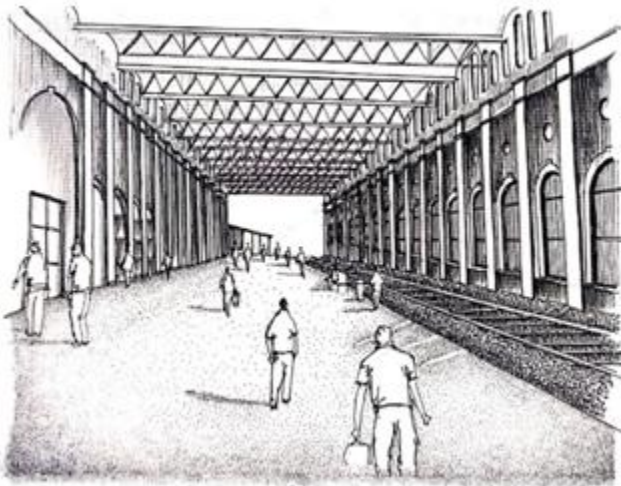
As compared to the labour prices in England, the cost of labour in India was considerably cheap and was easily available. Also, as Kanpur developed to be an industrial centre, the employment opportunities increased manifold. Hence, people from neighbouring cities, districts and states migrated to Kanpur and were employed in the mill.

The first railway line, was set up in Kanpur in 1859, was an important factor in determining the growth of industries. Kanpur had the benefit of having a big rail junction and a roadway centre that was well connected with other parts of the country. Internal railway lines were laid down in the last quarter of the 19<sup>th</sup> century, which helped in the transportation of raw materials and finished goods and increased the town populace, new areas for industrial evolution and trade.

## 4. Railways

The growth of rapid and economical transportation by railways provided a thrust for the industrial expansion of Kanpur as goods and raw materials began to circulate easily, safely and swiftly in comparison to the water transport of the Ganga.

The raw materials for the mill were imported from Australia and the coal for the powerhouse came from the Jharkhand. The development of the railways led to the continuous expansion of the mill and the growth of trade added to the foreign exchange of India. Due to the industries, there was an increased need for the railways, which led to their advancement.



**Figure 3:** Old Cawnpore railway station.

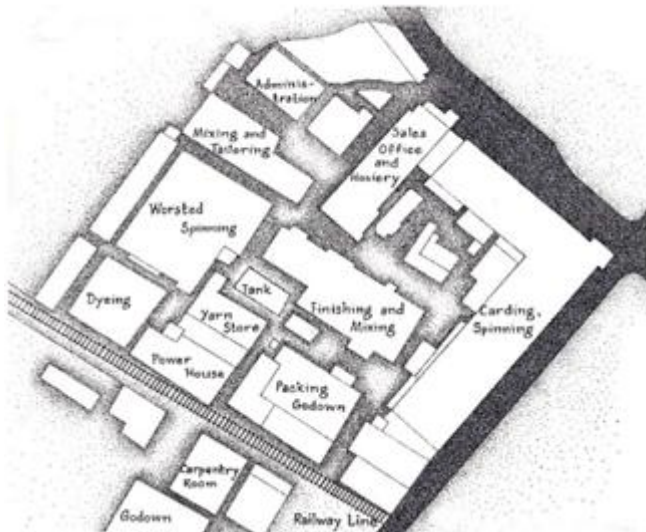
Source: author

## 5. Function based Planning

Manufacturing of woolen cloth involves various affairs, which have been designated to different buildings considering the chronological order of the manufacturing process. The connectivity of the complex with the help of bridges and the zoning of the buildings is based on these processes. This juxtaposition of the buildings also helped in the inspection of work by the British officers.

The English were technically advanced and the construction methods and systems used for the industries in Britain were worthy of emulation. These influences are visible in the mill but with alterations with respect to Kanpur's climate and availability of materials.

The nearly square plan and the layering of spaces of the Cawnpore Woolen Mills complex makes it neutrally oriented. The thick brick walls keep the interiors cool in summer and retain the heat in winter. Windows at a high sill level and the arched doors act as both protective and a buffer elements and also help in cross ventilation. The courtyards provide the structures with adequate light and ventilation.



**Figure 4:** Layout of Lal Imli Mill

Source: author

## 6. Self Sufficiency

Due to low rainfall, the mill had provisions for rainwater harvesting. The flat roofs had troughs running parallel to their widths that would direct the water into the pipes, which vertically descends from all the piers. Gutters surrounded the periphery of the buildings and would drain all the rainwater to the central water tank, thus help in water conservation. The technique of rainwater harvesting was pertinent, hence it was undertaken and bore wells were dug for a continuous supply of water to the central water tank. This was the source of water for streaming, which is one of the important procedures for manufacturing woolen products. Thus, supply of water from the river Ganga and Central tank made generation of electricity easier, which thus resulted in the construction of the powerhouse.

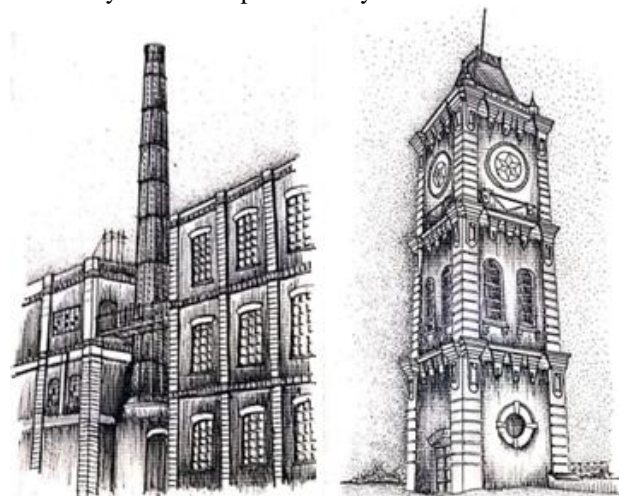
The powerhouse not only provided power and electricity to Lal Imli but also to the other mills and residences in close proximity. A purification plant for the contaminated water used in the mill was also set up to enable re-use of water. These methods used in the mill made it a self-sufficient industry and are still prevalent in Indian industries.

## 7. Architectural Features of Lal - Imli Mill

### a) Clock Towers and Chimneys

The Lal Imli Mill boasts two clock towers out of which the first clock tower was meant for the workers located in the central part of the mill complex which was donated to the Kanpur Sanghralaya. The second clock tower was meant for the Kanpur citizenry as well as for the functioning of other mills and is in use since its installation in 1920. The British specially imported the clock from Switzerland. The alarm bells of the clock towers regulated the schedules of all the activities around.

The mill also features two towering chimneys, which were used to drive out the smoke that was produced during wool manufacturing processes. One of the reasons for the chimneys to be very high was that then skyline of Kanpur, which was not more than 2-3 storeys high would not be disturbed by the smoke produced by the mill.



**Figure 5:** View of external clock tower and octagonal chimney.

Source: author

### b) Bricks, Walls and Arches

In India, the history of brick dates back to the Indus valley civilization where sun – dried mud bricks were used. The custom – made bricks used in the mill were burnt and moulded in fire kilns called as “Bhatta’s” as per British standards. The burning of the bricks toughened them and increased their durability. The brick bonds are strengthened not by cement but are glued using ethnic ingredients like jaggery paste, bay leaves, urad dal (Black Gram), chunna (lime) and silt from Ganges. These novel components also help in eliminating moss from the brick walls. Brick has been used extensively in the foundations, plinths, beams, columns, walls, arches, flooring, roofing, ducts, staircases, pathways, etc.

Partly load bearing, the wall thickness of the buildings varies on every floor. The differentiation between two floors can be determined by the presence of floor bands on the external facade. The piers are at regular intervals and openings in the walls are in the form of segmental arches which help in load transfer. Most of the walls showcase series of English Bond. The arched doors and windows grant the mill its most distinctive character. Segmental, Bull’s eye, Basket handle arches are used to give facades a majestic effect. The arches ornamented with elaborate keystones and drip moulds clearly depict English influence. These drip moulds are at three level; sill, lintel and cornice level. The mill has undergone changes that are both physical and functional. Physical changes can be seen in terms of arched windows that have been boarded up with bricks to safeguard the machines.

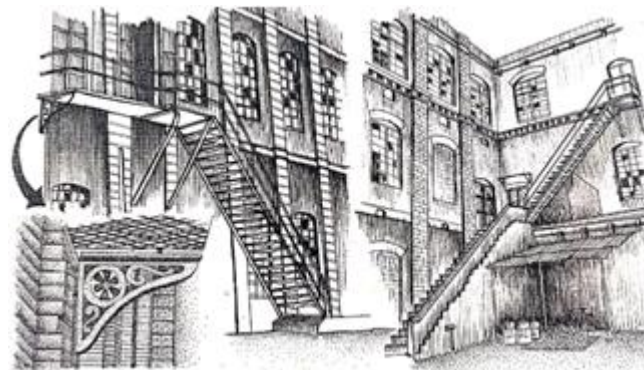
### c) Floors and Ceilings

Since all the structures are composite in nature, huge spans have been maintained in most of the buildings by constructing brick jack arches along the ceilings. These arches rest on I- sections which in turn are laid on stanchions. The I- sections are bolted together by mild steel rods which run through the jack arches. The flooring has been covered in Kota stone, sandstone and in some places it was later finished with cement.

### d) Staircases and Lifts

The types of staircases seen in the mill are of cast iron and brick masonry. Cast iron staircases run parallel to all the structures throughout the mill and provide appropriate circulation. These staircases are single- flight. Since most of them are situated on the exteriors of the structures, they act as excellent fire exists. The staircases are pre-fabricated and have British motifs on the balusters and on the brackets on which the staircases rest. These brick staircases are supported by arches present underneath them.

Another example showing that the mill was advanced was the presence of mechanized lifts in the structures for shifting, carrying, and relocating the goods and wool productions from the ground floor to the upper floors and vice versa. The lifts used power generated at the powerhouse of the mill.

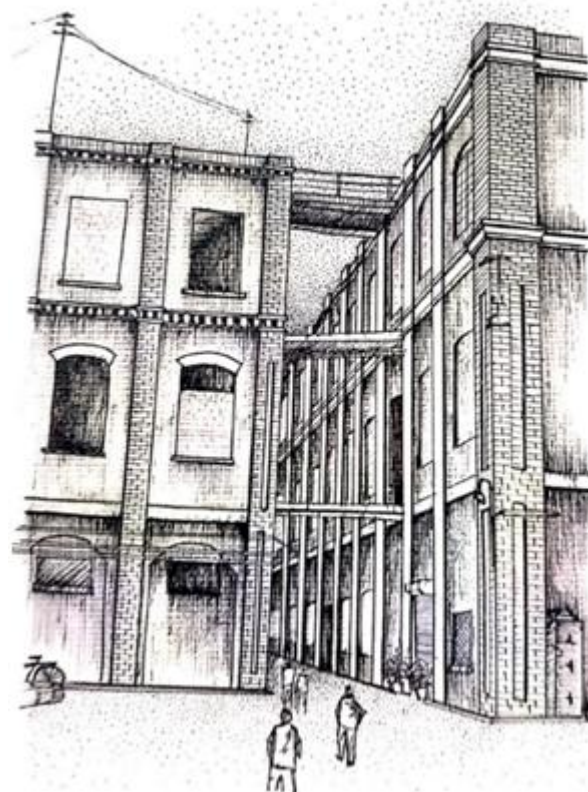


**Figure 6:** Cast iron and brick staircases  
Source: author

### e) Steel Members, Stanchions, Bridges and Trolley System

Initially, the steel members were imported from England but the exchange of I – sections stopped after the invention of steel in India by Tata in 1907. The use of steel is visible in flooring, columns, trusses, staircases, etc. Different type of columns like I- sections, railway sections, rolled I- sections as well as circular stanchions have been used. The placing of these slender columns at regular intervals help in maintaining equilibrium and transfer of axial loads.

The interconnecting bridges that fasten all the structures are a vital feature of the mill. These bridges acted as excellent navigable courses for the mill staff and goods and eliminated the inconvenience of walking up the structures again and again. They also facilitated movement of the officials while scrutinizing daily mill activities from one structure to another. Internal cast iron tracks fostered in shifting of the goods via trolleys.



**Figure 7:** Bridges connecting structures  
Source: author

### f) Central Water Tank

The central water tank is one of the other important facets of the mill design and helps in sprinkling and steaming (an essential procedure of wool making). It also channelizes the water from the Ganges to the mill. Also, different water pipes generating from all the divisions of the mill converge at the water tank and in return transport water to the respective blocks. It also acts as a courtyard for social interactions.

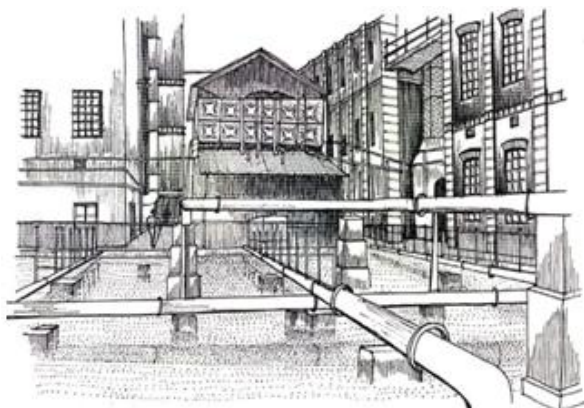


Figure 8: Central water tank

Source: author

### g) Floor Bands and Courtyards

All the exterior walls of Lal Imli have floor bands, which are a stark British feature. These floor bands have been used to enhance the look of the structures. Vents are provided above all the windows, to allow movement of the air even when the windows remain shut. Later, the windows were covered with bricks to control humidity and huge exhaust fans were incorporated with air ducts.

The small verandahs and green patches form interactive spaces between the structures. Also, most of the time, the courtyards enjoy ample shade because of the large buildings surrounding them.

The other striking features of Lal Imli are the entrance porch, the walkthroughs and the verandahs which add to the beauty of the mill and are all in exposed brick work. Deep verandahs insulate the inner structure.



Figure 9: View of courtyard

Source: author

### h) Fire Extinguishing System and Air Cooling System

Post the fire in 1910, it was necessary to ensure safety of the mill and hence, a fire fighting system was set-up. The fire

extinguishing pipes were laid down in all the structures and the nozzles of the pipes would be concealed with wax which would in case of fire, causing the water sprinklers to start working instantly.

During its region, the mill was technologically ahead because it had air cooling facilities for the high ranking officials. It had provisions for water tanks on the first floor, which would cool the air and transfer it through ventilators present on the ceiling of the administrative block.

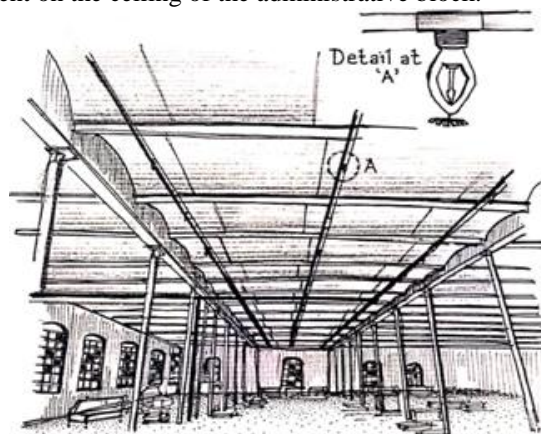


Figure 10: Detail of fire extinguishing system

Source: author

## 8. Conclusion

The scene of the industries of Kanpur was pleasant before the independence. However, post-independence, the functioning and administration of the mill was passed on to Indian entrepreneurs, which was the main reason for its downfall. In 1980, the mill was handed over to the government of India. Since 1990, the mill is almost defunct with only 5% of the work being carried out.

Due to political indifference and lack of governance the mill's operations are waning, beside it is such a huge asset, resource for all of us that should be utilized all over again with some adaptive reuse process. Therefore, some appropriate measures should be taken that involves both aspects of protection and conservation of Lal- Imli mill along with the urban renewal of the city and the site. So that it will help's in generating local employment and revenue that eventually boosts-up our economy.

## References

[1] (District Gazetteer)

## Author Profile



**Alok Kr. Kureel** had done his B.Arch. degree from bundelkhand university, Jhansi in 2018 and currently pursuing M. Arch degree from Faculty of Architecture & Planning, Lucknow Dr. APJ Abdul Kalam Technical University Lucknow, India. From last one-year author is busy in completing his research project on the topic Adaptive reuse of an Industrial Brownfield area. The main aim of his thesis is to rehabilitate and revitalize a defunct British India corporation textile mill (Lal-Imli Mill) in Kanpur.