

UNIT IV

Science, Management and Indian Knowledge System

Pyrotechnics in India

Pyrotechnic is the science of using materials capable of undergoing self-sustained exothermic chemical reactions for the production of heat, light, gas, smoke and/or sound. The use of firecrackers is not new to India. While they originated in China, the crackers soon made their way into India through trade and military contact. The earliest evidence we have of firecrackers in India dates back to the Mughal times. Some historians have pointed out that the knowledge of materials used to make firecrackers existed in India as back as 300 BC. Historians believe that knowledge of gunpowder existed in India back in the 8th Century. Sanskrit texts such as the *Nitiprakashika of Vaisampayana* which was compiled in the 8th Century mentions a similar substance. But the potential of gunpowder had not been realized during this time. Though a section of historians is of opinion that Indians were aware of the existence of saltpetre as *agnichurna* or a powder that creates fire. It is believed that Chinese pyrotechnic formulas were brought to India around 1400 AD and then modified with the use of Indian substitutes for the Chinese ones not available in India. Gunpowder became an article of warfare at the beginning of the 16th century. The Indian craftsman learned the technique from the Mughals and were able to evolve suitable explosive compositions. Fireworks and pyrotechnic shows existed as a form of royal entertainment in many medieval Indian kingdoms during festivals, events and special occasions like weddings. 16th or 17th century Sanskrit treatise contains a description of preparation of the gunpowder using saltpetre, sulphur and charcoal in different ratios. From 16th century onward, rockets too began being used in wars waged in India. The rockets consisted of a tube of soft hammered Iron tube closed at one end and strapped to a shaft of bamboo, with a sword often fitted at the other end. The iron tube contained well-packed black powder propellant. Though not very accurate, when fired they could cause damage as well as panic among the troops. The British took a few rockets to England for study, which ended up boosting rocket technology in European warfare.

Trade in ancient India

During ancient times Hindus were the masters of the sea-borne trade of Europe, Asia and Africa. Till about the beginning of the 18th century most of the Nations obtained to a large extent its supplies of fine cotton and silk fabric, spices, indigo, sugar, drugs, precious stones and many other works of art

from India in exchange of gold and silver. This traditional prosperity of India began to vanish only at the dawn of the Industrial Revolution in the west.

In industrial production ancient India was far ahead in comparison with other countries of those times. The skills of the Indians in the production of delicate woven fabrics, in the mixing of colours, the working of metals and precious stones, the preparation of essences and in all manner of technical art, has from early times enjoyed a world-wide celebrity. For instance, surgical instruments of great delicacy and accuracy were manufactured in India and it was from Indians that the art of tempering steel was learnt by other people. Factors favouring India to emerge as the number one country in trade, commerce and manufacturing activities were-

1. The Hindu mercantile community was very enterprising and known for their entrepreneurship, trustworthiness and resilience.
2. Indian goods were known for its excellence. The skilled artisans of India manufactured varieties of goods which people in other parts of the world could not find elsewhere.
3. In the art of building ocean going huge ships, ancient Hindus were far ahead of others. With the knowledge of sea routes, monsoon winds and other navigational aspects they were able to sail to distant corners of the earth with their goods.
4. Fairs were an important means for commercial activities and were held in every part of the country. Huge number of people assembled at these fairs for the purpose of exchanging merchandise as well as discussing religious and national topics.
5. The peace and prosperity that prevailed in the country gave a great impetus to inter-provincial and inter-state trade.

Infrastructure

To facilitate trade and commerce roads were constructed all over the country from east to west and from north to south. These roads were provided with mile stones and planted with trees. The river Ganga and its tributary were used for carrying goods. During the Mauryan times the Great Royal Highway more than 1600 kilometers in length connected the capital Patliputra with Taxila and the North-West Frontier. Another long road of great commercial importance ran through Kasi and Ujjain and linked the capital with the great sea-ports of Western India. Yet another road linked the capital with the port of Tamralipti. It was through this principal port in Bengal that India carried extensive trade with China, Ceylon, Java and Sumatra. Some of the important towns of trade were Arikamedu, Kaveripattanam, Madurai, Cranganore, Nagapattanam, Mahabalipuram, Calicut, Cochin, Mangalore, Tamralipti, Pataliputra, Vidisha, Ujjaini, Kausambi, Mathura, Taxila, Aihole, Paithan, Surat, Lothal, Sopara, Broach, Kalyan, etc.

Trade during the Vedic times

The Rig-Veda contains several references to sea voyages undertaken for commercial and other purposes. God Varuna is credited with the knowledge of sea routes followed by ships. Later when urban culture flourished in cities like Harappa and Mohenjodaro, India had established trade and commercial relations with Sumer, Egypt and Crete. Lothal in Gujarat was one of the biggest port towns of that period with a huge dockyard constructed out of brick. In the Old Testaments, we have reference to trade between India and Syrian coast dating back to 1400 B.C. According to the chronicles of the Jews, during the reign of King Solomon (c.800.B.C.), a navy equipped by Hiram, King of Tyre, undertook a triennial voyage to the eastern countries and brought back with-it gold, silver, ivory, apes, peacocks, Almug trees, jewels and precious stones.

From 1st century AD commodities greatly in demand in Roman world from India were spices, perfumes, precious stones, muslins and cotton. All these commodities were paid for in gold and silver by the Roman traders.

During the Mauryan age

During the Mauryan reign manufacturing activity was abuzz and Greek writers refer to the manufacture of chariots, wagons, arms and agricultural implements and building of ships. Strabo mentions richly embroidered dresses in gold duly adorned with precious stones and also flowered robes made of fine muslin. The fact that one committee of the municipal board of Patliputra was entrusted with the supervision of manufactured articles in the metropolis indicates the existence of good manufacturing industries in the Mauryan period.

There were considerable number of foreign residents in Patliputra and they were in all probability were traders. Sweet fine wines, pigments, glass-vessels and costly vessels of silver were some of the articles imported in India while India exported fine silks, muslin, spices, perfumes, medicinal herbs, indigo, sandalwood, pearls, ivory, iron, steel, etc.

Gupta and later period

While the Mauryans carried on their trade mainly with the east through the Kalinga ports, the Guptas not only increased their eastern trade effectively but opened up the western sea-borne trade and this led to unprecedented economic prosperity. In Bengal, Tamralipti was the principal port, while in Tamilnadu, Kaveripattanam and Tondai were the principal ports. In the Malabar, coast Kottayam and Muziris (modern Crangnore) were the main ports through which brisk trade was carried with the Eastern Archipelago and China. The Arabs used to visit the west coast to purchase goods like teak, drugs, perfumes, shoes, black salt, spices, indigo, textiles, muslin, etc. Indian commodities were very popular in Arabian countries. Many of these Arabs settled in the west coast and the Hindu rulers

allowed them to practice their religion. Ships from China, Sindh and the Persian Gulf used to anchor at Broach and merchandise from every country was found there and was sent from there to other countries.

In the 15th century Calicut became one of the busiest ports in the west coast and merchants from South Africa, Abyssinia, and Arabia brought their merchandise to this port for distribution in India. Many ships from Pegu and Malacca on their way to Red Sea halted at Calicut and carried Indian goods for distribution to various directions. Some of the items exported were cloths, rice, iron, saltpeter, sugar and spices while pearls, copper, coral, mercury, vermilion, elephants and horses were imported.

The Trading Class

The traditional trading class in India was the Vaisyas. Later we find this profession being followed by Parsis, Banias and Marwaris in Bombay Presidency, the Lingayaths in Karnataka region, Chettis and Komatis in the Madras Presidency, Khattris in Punjab and Marwaris in Bengal and Assam. The Vaisya community was the richest being of the business class and was represented in district councils. This class contributed much to the cultural progress of the country. Some of them excavated caves and build temples while others were well versed in folklore and astrology.

India's Dominance up to Pre-colonial times

From the beginning of the historical period, India enjoyed a favourable balance of trade, thereby accumulating stocks of gold. India's trade dominance continued in later times. In Mughal times, Abul Fazal's Aine Akbari records that 40000 vessels were engaged in trade in the Indus and its tributaries of Punjab. While studying the Indian economy in the few centuries preceding British rule, economics historians have pointed out India's high trade surplus with most of her trading partners in Europe, West Asia or Africa. This was the result of efficient low-cost products such as cotton or spices, but also of well-organised communities of traders. Indian merchants generally operated as guilds, a structure that provided them with greater security, shared and reliable information and effective access to good as well as markets. India and China controlled nearly 60% of the world's GDP 2000 ago. They were the premier economic and trade powers from early times until the colonial era. The Colonial rule coincided with the steep decline in India's overseas trade dominance and overall production, as the rules of trade and industry began being dictated by the colonial master