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Impact of the network of canals, wells and Persian wheel on agriculture and economy in medieval India

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ABSTRACT

The network of canals, wells, and Persian wheels played a significant role in transforming agriculture and the economy in medieval India. Irrigation systems developed under the Delhi Sultanate and Mughal rulers improved agricultural productivity by ensuring a stable water supply to cultivable lands. Canals facilitated large-scale irrigation, while wells and Persian wheels provided effective methods of lifting groundwater for farming purposes. These technologies contributed to the expansion of cultivated areas, multiple cropping patterns, and the cultivation of cash crops such as cotton, sugarcane, and indigo. Increased agricultural output strengthened the agrarian economy and enhanced state revenue through land taxation. Irrigation networks also promoted trade, urban growth, and rural prosperity by supporting surplus production and market activities. Furthermore, the development of water management systems reflected the technological advancement and administrative efficiency of medieval Indian rulers. Thus, irrigation infrastructure became a crucial foundation for economic stability and agricultural development in medieval India.

Keywords: Medieval India, Irrigation Systems, Canal Networks, Persian Wheel, Agrarian Economy

1. INTRODUCTION

Agriculture formed the backbone of the economy in medieval India, and the prosperity of the state largely depended upon the productivity of agricultural land. Since the Indian subcontinent experienced irregular rainfall and diverse climatic conditions, irrigation became essential for sustaining cultivation and ensuring food security. In this context, the development of canals, wells, and Persian wheels emerged as important technological and administrative achievements during the medieval period. Rulers of the Delhi Sultanate and the Mughal Empire recognised the significance of irrigation for increasing agricultural output and state revenue. As a result, several canals were constructed, old water channels were repaired, and local irrigation systems were encouraged across different regions of India. Wells remained one of the most common sources of irrigation in villages, especially in arid and semi-arid areas, where groundwater was utilised for cultivation. The introduction and widespread use of the Persian wheel, also known as the rahat, represented a major advancement in irrigation technology, as it enabled efficient lifting of water from wells and rivers to agricultural fields. These irrigation systems not only expanded cultivable land but also facilitated the cultivation of commercial crops such as cotton, sugarcane, indigo, and wheat. Increased agricultural productivity contributed to surplus



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production, growth of internal trade, and development of market centres and urban settlements. Irrigation networks also strengthened the agrarian taxation system, which became a primary source of revenue for medieval rulers. Furthermore, these systems reflected the interaction between technology, state policy, and rural society in medieval India. The construction and maintenance of canals and wells often involved the cooperation of rulers, local chiefs, zamindars, and village communities, demonstrating the collective importance of water management in sustaining economic life. Therefore, the study of canals, wells, and Persian wheels provides valuable insight into the agricultural transformation and economic development of medieval India, highlighting the role of irrigation infrastructure in shaping rural prosperity and state stability during this period.

2. PURPOSE OF THE STUDY

The purpose of this study is to examine the impact of canals, wells, and Persian wheels on agriculture and the economy in medieval India. The study aims to analyse how irrigation systems contributed to the expansion of cultivable land, improvement in agricultural productivity, and growth of commercial farming during the medieval period. It also seeks to evaluate the role of rulers and local communities in the construction and maintenance of irrigation networks. The research investigates the economic effects of irrigation on state revenue, trade, rural prosperity, and urban development. Special attention is given to the technological significance of the Persian wheel as an efficient method of water extraction and its contribution to agrarian progress.

3. SCOPE OF THE STUDY

The scope of this study is limited to the examination of irrigation systems, particularly canals, wells, and Persian wheels, and their influence on agriculture and the economy in medieval India. The study mainly focuses on the period of the Delhi Sultanate and the Mughal Empire, when organised irrigation networks and water management techniques significantly expanded. It covers the technological development, construction, and utilisation of irrigation facilities in different regions of India and analyses their role in increasing agricultural production and supporting commercial crops. The research also explores the economic consequences of irrigation, including growth in land revenue, trade, rural employment, and urbanisation. In addition, the study considers the contribution of rulers, local communities, and landlords in maintaining irrigation systems.

4. BACKGROUND OF MEDIEVAL INDIAN AGRICULTURE

Agriculture was the principal occupation and the foundation of the economy in medieval India, supporting the livelihood of the majority of the population and generating substantial revenue for the state. The agrarian system during this period was largely dependent on climatic conditions, especially the monsoon, which determined the success or failure of crop production. Due to irregular rainfall and varying geographical conditions, irrigation became an essential requirement for agricultural stability and expansion. Medieval India witnessed significant



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developments in farming practices under the Delhi Sultanate and Mughal rulers, who introduced administrative reforms and encouraged irrigation projects to increase productivity and land revenue. Cultivation was carried out on both fertile river valleys and dry regions, leading to the use of diverse irrigation methods such as canals, tanks, wells, and Persian wheels. Major food crops included rice, wheat, barley, pulses, and millets, while commercial crops such as cotton, sugarcane, indigo, and oilseeds gained importance due to growing domestic and foreign trade. The agrarian economy was closely connected with taxation, as land revenue formed the main source of income for medieval states. Village communities, peasants, zamindars, and local chiefs all played important roles in agricultural production and water management. Technological improvements, including the use of iron ploughs and Persian wheels, further enhanced cultivation efficiency.

5. IMPORTANCE OF IRRIGATION IN AGRARIAN ECONOMY

Irrigation played a crucial role in the agrarian economy of medieval India by ensuring a reliable supply of water for agricultural activities and reducing dependence on uncertain monsoon rainfall. Since agriculture was the primary source of livelihood and state revenue, the development of effective irrigation systems became essential for maintaining economic stability and food production. Canals, wells, tanks, and Persian wheels enabled farmers to cultivate land throughout the year and supported multiple cropping practices in many regions. Irrigation increased the fertility and productivity of agricultural land, leading to higher yields of food grains as well as commercial crops such as cotton, sugarcane, indigo, and wheat. This growth in agricultural output generated surplus production, which encouraged trade and strengthened local and regional markets. The expansion of cultivation through irrigation also increased land revenue collection, which formed the financial foundation of medieval kingdoms and empires. Rulers of the Delhi Sultanate and Mughal Empire invested in irrigation works because prosperous agriculture directly contributed to political stability and administrative efficiency. Irrigation systems further promoted settlement in previously uncultivated areas and created employment opportunities related to construction, maintenance, and farming activities. The Persian wheel, in particular, improved water-lifting efficiency and allowed cultivation in dry regions where traditional methods were insufficient.

6. HISTORICAL DEVELOPMENT OF IRRIGATION SYSTEMS IN MEDIEVAL INDIA

The historical development of irrigation systems in medieval India reflects the growing importance of water management in sustaining agriculture and economic prosperity. In the early medieval period, irrigation practices mainly depended upon traditional methods such as wells, tanks, ponds, and small canals constructed by local rulers and village communities. These systems were particularly common in regions with irregular rainfall, where artificial irrigation was essential for cultivation. South Indian kingdoms such as the Cholas, Pallavas, and Kakatiyas developed extensive tank irrigation systems, while northern regions relied more



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on wells and river-based canals. With the establishment of the Delhi Sultanate, irrigation infrastructure expanded significantly due to the increasing need for agricultural revenue and stable food production. The Sultans recognised the economic value of irrigation and encouraged the construction of canals and water reservoirs. Sultan Firoz Shah Tughlaq played a major role in promoting canal irrigation by constructing canals from rivers such as the Yamuna and Sutlej to agricultural regions, thereby improving cultivation and settlement patterns. The growth of irrigation under the Delhi Sultanate contributed to the expansion of cultivated land and enhanced state income through land taxation. During the Mughal period, irrigation systems became more organised and technologically advanced. Mughal rulers maintained earlier canals, repaired damaged water channels, and supported the use of wells and Persian wheels for efficient irrigation. The Persian wheel became widely used for lifting water from wells and rivers, especially in northern India, enabling continuous irrigation and increased crop productivity. The Mughal administration also introduced revenue reforms that encouraged peasants to improve agricultural production through better irrigation facilities. Alongside imperial initiatives, regional kingdoms and local rulers continued to contribute to irrigation development by constructing tanks, embankments, canals, and step wells according to regional environmental needs. Rajput rulers, Deccan kingdoms, and South Indian states invested in water conservation systems to support agriculture and local economies.

7. WELLS AS A SOURCE OF IRRIGATION

1. Types of Wells in Medieval India

- **Ordinary Dug Wells**

Ordinary dug wells were the most commonly used wells in medieval India. These wells were manually excavated to reach underground water and were widely used in villages for irrigation and domestic purposes. They were simple in structure and suitable for areas where groundwater was easily accessible.

- **Masonry Wells**

Masonry wells were constructed with brick or stone linings to strengthen the walls and prevent collapse. These wells were more durable than ordinary dug wells and were commonly found in regions with deeper water levels. They provided a stable and long-lasting source of water for agricultural activities.

- **Step Wells (Baolis or Vavs)**

Step wells, known as baolis or vavs, were architecturally advanced water structures mainly found in Gujarat and Rajasthan. These wells contained descending steps leading to the water source, allowing people to access water even during dry seasons. They served both irrigation and domestic purposes and often became important social centres in medieval society.

- **Deep Wells with Persian Wheels**



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Deep wells equipped with Persian wheels and pulley systems were developed for efficient irrigation in agricultural regions. The Persian wheel enabled continuous lifting of water through animal power, making irrigation more effective and supporting large-scale cultivation in dry and semi-arid areas.

- **Community and Private Wells**

Some wells were privately owned by landlords and wealthy peasants, while others were community wells used collectively by villagers. Community wells promoted social cooperation and ensured water availability for agriculture and daily needs. The variety of wells used in medieval India reflected adaptation to regional climatic conditions and contributed significantly to agricultural growth and settlement development.

2. Techniques of Water Extraction

Various techniques of water extraction were used in medieval India to utilise well water efficiently for irrigation and domestic purposes. The simplest method involved drawing water manually with ropes and leather buckets, which was commonly practised in small villages and individual farms. In many regions, pulley systems were attached to wells to make water lifting easier and reduce physical effort.

3. Social and Community Participation in Well Construction

Social and community participation played an important role in the construction and maintenance of wells in medieval India. Since wells were essential for irrigation, drinking water, and daily domestic use, local communities actively cooperated in their development and preservation. Village communities often contributed labour, building materials, and financial support for constructing common wells that benefited the entire settlement.

4. Contribution of Wells to Rural Agriculture

Wells made a major contribution to rural agriculture in medieval India by providing a dependable source of water for cultivation throughout the year. In many regions where rainfall was uncertain and canal irrigation was unavailable, wells became the primary means of sustaining agricultural activities. They enabled farmers to irrigate crops during dry seasons and reduced dependence on monsoon rains, thereby increasing the stability of agricultural production.

5. Economic and Social Importance of Wells

Wells held great economic and social importance in medieval India because they supported agriculture, rural life, and local economic activities. Economically, wells provided a reliable source of irrigation that increased agricultural productivity and enabled farmers to cultivate crops throughout the year. This regular water supply contributed to higher crop yields, surplus production, and the cultivation of commercial crops such as cotton, sugarcane, and indigo, which strengthened trade and market activities. Increased agricultural output also enhanced state revenue through land taxation, making wells important for the financial stability of medieval kingdoms and empires. Wells further promoted settlement growth by encouraging



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cultivation in dry and semi-arid regions where farming would otherwise have been difficult. Socially, wells served as important centres of community interaction and cooperation in village life. Community wells were shared by local people for drinking water, irrigation, and household purposes, creating social bonds among villagers.

8. CANAL IRRIGATION IN MEDIEVAL INDIA

1. Construction and Administration of Canals

The construction and administration of canals in medieval India were closely linked with the economic and agricultural policies of rulers. Canals were mainly constructed by diverting water from rivers through excavated channels to agricultural lands. The process required organised labour, engineering knowledge, and financial support from the state. Rulers of the Delhi Sultanate and the Mughal Empire encouraged canal construction to improve cultivation and increase land revenue. Government officials supervised canal maintenance, water distribution, and repair works to ensure efficient irrigation.

2. Major Canal Projects under Sultanate and Mughal Rulers

Several important canal projects were undertaken during the Sultanate and Mughal periods. Sultan Firoz Shah Tughlaq constructed canals from the Yamuna and Sutlej rivers to irrigate dry regions of northern India, especially around Hansi and Hisar. These projects transformed barren lands into fertile agricultural areas and encouraged settlement growth. During the Mughal period, rulers repaired and expanded earlier canals to support agricultural production. Shah Jahan restored the Western Yamuna Canal, which became an important source of irrigation in northern India. These canal projects increased crop production and strengthened the agrarian economy.

3. Technological Features of Canal Systems

Canal systems in medieval India demonstrated considerable technological and engineering knowledge. Water was transported through gravity flow methods from rivers to agricultural fields. Embankments, sluice gates, and diversion channels were constructed to regulate water movement and prevent flooding. Some canals were connected with reservoirs and wells to maintain irrigation during dry seasons. Engineers considered land slope, soil condition, and water flow while constructing canals. Persian wheels were sometimes integrated with canal systems to distribute water more effectively to elevated fields. These technological features improved irrigation efficiency and supported continuous cultivation.

9. LITERATURE REVIEW

The study of irrigation systems and agrarian development in medieval India has attracted significant attention from historians, economists, and scholars of agricultural technology. Historians have emphasised that agriculture formed the backbone of the medieval Indian economy, and irrigation systems such as canals, wells, tanks, and Persian wheels played a central role in sustaining agricultural productivity. Habib (2011) explained that the medieval Indian economy was deeply dependent on land revenue, which encouraged rulers to promote



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irrigation facilities to increase agricultural output and state income. According to Habib, irrigation development under the Delhi Sultanate and Mughal Empire contributed to the expansion of cultivable land and supported the cultivation of food grains as well as commercial crops. Sharma (2005) discussed the long historical tradition of irrigation in India and highlighted the importance of water management systems from ancient to medieval periods. He noted that Indian rulers recognised the economic significance of irrigation and invested in canals, reservoirs, and wells to stabilise agricultural production.

Several scholars have specifically focused on irrigation technology and water-lifting devices in medieval India. Kaur (2018) examined agricultural implements and irrigation technologies, particularly the Persian wheel, and described it as one of the most important technological advancements of the medieval period. According to Kaur, the Persian wheel improved the efficiency of water extraction from wells and enabled irrigation in dry and semi-arid regions where traditional methods were insufficient. The study highlighted how animal-powered water-lifting systems reduced manual labour and supported large-scale cultivation. Singh (2020) analysed water resource development in medieval India and explained the role of canals, wells, tanks, and step wells in supporting agricultural expansion. The study observed that irrigation systems differed across regions depending on climatic and geographical conditions. Northern India depended more on canals and wells, while South India developed extensive tank irrigation systems. Singh further argued that irrigation technology contributed not only to increased agricultural productivity but also to technological adaptation and environmental management in medieval Indian society. Fatima (2012) examined Mughal waterworks and highlighted the advanced hydraulic knowledge used in Mughal gardens and irrigation systems. Her work demonstrated the technical understanding of water channels, embankments, and distribution systems during the Mughal period. The literature collectively suggests that irrigation technologies reflected a combination of local innovation and external influences, particularly Persian and Central Asian techniques introduced during the Sultanate and Mughal periods.

The agrarian economy of medieval India and its connection with irrigation systems have also been analysed extensively in historical studies. Habib (2013) provided a detailed explanation of the agrarian system of Mughal India and argued that irrigation was directly linked with land revenue administration and agricultural prosperity. He observed that irrigated lands produced higher yields and therefore generated greater revenue for the Mughal state. The Mughal administration encouraged agricultural expansion through improved irrigation and cultivation of commercial crops such as cotton, sugarcane, indigo, and wheat. Verma (2021) focused on irrigation, agriculture, and the rural economy of medieval northern India and concluded that irrigation systems significantly improved food production, trade, and village economy. According to Verma, the availability of regular irrigation enabled peasants to adopt multiple cropping practices and reduce the risks associated with monsoon failure. The study also



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highlighted the role of village communities, zamindars, and local authorities in maintaining irrigation systems and ensuring equitable water distribution. NIOS (2023) discussed medieval irrigation and agricultural economy in an educational context and explained that irrigation systems were essential for sustaining both subsistence and commercial agriculture. The source emphasised that irrigation contributed to rural prosperity, market growth, and urbanisation by increasing agricultural surplus. The literature further indicates that irrigation networks promoted internal and external trade by supporting commercial crop production and creating economic connections between rural and urban centres.

The reviewed literature also identifies several challenges and limitations associated with medieval irrigation systems. Scholars have noted that although irrigation improved agricultural productivity, its benefits were unevenly distributed across regions and social groups. Habib (2011) and Verma (2021) pointed out that wealthy landlords and zamindars often controlled irrigation resources, while small peasants faced difficulties in accessing water and paying land revenue. Climatic uncertainty, droughts, floods, and maintenance problems also affected the efficiency of canals, wells, and tanks. Singh (2020) observed that irrigation systems required continuous repair and community participation, without which they gradually declined. The literature further highlights regional inequalities in irrigation development, with fertile river valleys and politically important regions receiving greater state attention than remote or arid areas. Despite these limitations, historians generally agree that irrigation systems remained central to the agricultural and economic structure of medieval India. The studies reviewed emphasise the importance of state policies, technological innovation, and local participation in maintaining irrigation networks and sustaining agrarian production.

10. PERSIAN WHEEL (RAHAT) AND AGRICULTURAL TECHNOLOGY

1. Origin and Introduction of the Persian Wheel

The Persian wheel, also known as the rahat, was an important irrigation device introduced into India during the medieval period, mainly through cultural and technological contacts with Persia and Central Asia. Although simple water-lifting methods existed earlier, the Persian wheel represented a major advancement in irrigation technology because it enabled continuous and efficient extraction of water from deep wells and rivers. The device became widely used during the Delhi Sultanate and Mughal periods when rulers encouraged agricultural expansion and improved irrigation systems to increase productivity and state revenue. The Persian wheel was especially suitable for the dry and semi-arid regions of northern India where rainfall was uncertain and dependable irrigation was necessary for cultivation.

2. Structure and Working Mechanism

The Persian wheel was a mechanically advanced irrigation device designed to lift water efficiently from wells, rivers, and other water sources for agricultural purposes. Its structure generally consisted of a large vertical wheel fitted with a chain of earthen pots or buckets attached around its circumference. The wheel was connected to a horizontal gear system



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operated by animals such as oxen or buffaloes that moved in a circular path. As the animals rotated the mechanism, the pots descended into the water source, filled with water, and then rose upward to empty the water into channels that directed it to agricultural fields.

3. Spread of Persian Wheel Technology in India

The Persian wheel technology gradually spread across different regions of India during the medieval period due to its effectiveness in irrigation and agricultural productivity. Initially introduced through Persian and Central Asian influence, the device became popular during the Delhi Sultanate and Mughal periods when agricultural expansion received strong state support. Northern India, particularly the regions of Punjab, Haryana, Uttar Pradesh, and parts of Rajasthan, witnessed extensive use of the Persian wheel because these areas required efficient irrigation systems to overcome irregular rainfall and dry climatic conditions.

4. Role in Expanding Cultivable Land

The Persian wheel played a major role in expanding cultivable land in medieval India by making irrigation possible in dry and semi-arid regions where agriculture previously depended mainly on uncertain rainfall. Before the widespread use of this technology, many agricultural areas remained uncultivated because traditional methods of water extraction were slow and insufficient for large-scale farming. The Persian wheel enabled continuous lifting of water from deep wells and rivers, providing farmers with a dependable source of irrigation throughout the year.

11. IMPACT OF IRRIGATION SYSTEMS ON AGRICULTURE

Irrigation systems greatly increased agricultural production in medieval India by providing a regular and dependable supply of water for cultivation. Since agriculture depended heavily on monsoon rainfall, irregular rains often caused crop failure and food shortages. The development of canals, wells, tanks, and Persian wheels reduced this uncertainty and enabled farmers to cultivate crops more efficiently throughout the year. Irrigation improved soil moisture and fertility, leading to higher crop yields and better agricultural productivity. Large areas of previously uncultivated or dry land were brought under farming through improved irrigation facilities, particularly in northern and western India. Farmers could grow food grains such as wheat, rice, barley, and pulses on a larger scale, which strengthened food availability and rural stability. The development of irrigation systems encouraged crop diversification and the cultivation of commercial crops in medieval India. Reliable irrigation enabled farmers to cultivate crops that required large quantities of water and longer growing periods. Along with traditional food grains, cultivators increasingly produced commercial crops such as sugarcane, cotton, indigo, oilseeds, and tobacco in irrigated regions. These crops were highly valuable in local and international trade and contributed significantly to the growth of the agrarian economy. Irrigation allowed farmers to experiment with different crops according to soil conditions and market demand, leading to greater agricultural diversity. Commercial crop cultivation supported the development of textile production, sugar processing, dye industries,



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and other rural crafts. Increased trade in agricultural goods strengthened market centres and urban economies.

12. ECONOMIC IMPACT OF IRRIGATION NETWORKS

The expansion of irrigation systems in medieval India significantly strengthened the agrarian revenue system by increasing agricultural productivity and cultivated land. Since land revenue was the primary source of income for medieval rulers, the development of canals, wells, tanks, and Persian wheels directly benefited the state economy. Improved irrigation enabled farmers to produce higher crop yields and cultivate commercial crops such as cotton, sugarcane, and indigo, which increased the value of agricultural production. Irrigation systems contributed greatly to the rise of trade and the market economy in medieval India by increasing agricultural surplus and commercial crop production. The availability of reliable irrigation enabled farmers to cultivate crops beyond subsistence needs, producing surplus grains, cotton, sugarcane, indigo, and oilseeds for sale in markets. Agricultural surplus encouraged the growth of local trade networks and connected villages with towns and urban centres. Commercial crops became important commodities in both domestic and international trade, supporting industries such as textile production and sugar processing. The development of irrigation systems had a major impact on peasantry and rural society in medieval India by improving agricultural stability and increasing economic opportunities for farmers. Reliable irrigation reduced dependence on uncertain monsoon rainfall and enabled peasants to cultivate crops more regularly throughout the year. Higher agricultural productivity improved food availability and raised the standard of living in many villages. Irrigation also encouraged the cultivation of commercial crops, which allowed peasants to participate in local markets and earn additional income.

Rural settlements expanded around irrigated regions, leading to population growth and increased social interaction within village communities. Irrigation systems created employment opportunities and promoted artisan activities in medieval India by supporting agricultural expansion and rural economic growth. The construction and maintenance of canals, wells, tanks, and Persian wheels required large numbers of labourers, engineers, carpenters, masons, blacksmiths, and other skilled workers. Rural artisans produced tools, irrigation equipment, ropes, wooden wheels, and agricultural instruments necessary for farming activities. The expansion of irrigation systems contributed significantly to urbanisation and economic prosperity in medieval India by supporting agricultural surplus and commercial growth. Productive agricultural regions generated surplus food and commercial crops that supplied nearby towns and urban centres. Increased trade in agricultural products encouraged the growth of markets, transport routes, and commercial settlements. Prosperous agriculture attracted merchants, craftsmen, and administrators to urban areas, leading to the expansion of towns and cities.



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13. ADMINISTRATIVE POLICIES AND STATE SUPPORT

1. Irrigation Policies of Delhi Sultans

The rulers of the Delhi Sultanate recognised the importance of irrigation in increasing agricultural productivity and strengthening state revenue. As agriculture formed the foundation of the economy, the Delhi Sultans introduced policies to improve irrigation facilities and expand cultivable land. Among the Sultanate rulers, Firoz Shah Tughlaq made the greatest contribution to irrigation development by constructing canals from rivers such as the Yamuna and Sutlej to dry agricultural regions in northern India. These canal projects provided water for cultivation, encouraged settlement growth, and improved food production.

2. Mughal Revenue Administration and Irrigation

The Mughal Empire developed an organised revenue administration that was closely connected with agricultural productivity and irrigation facilities. Since land revenue formed the primary source of imperial income, Mughal rulers encouraged the expansion and maintenance of irrigation systems to ensure stable agricultural output. Emperors such as Akbar introduced revenue reforms that assessed taxes according to land fertility and crop production. Irrigated lands produced higher yields and generated greater revenue for the state. The Mughal administration repaired canals, supported the use of wells and Persian wheels, and encouraged peasants to cultivate commercial crops in irrigated regions.

3. Taxation and Maintenance of Water Resources

Taxation and maintenance of water resources were important aspects of medieval Indian administration because irrigation systems required continuous supervision and repair. The state collected land revenue from agricultural production, and part of this revenue was often used for maintaining canals, wells, tanks, embankments, and water channels. Irrigated lands generally produced higher yields and therefore contributed greater taxes to the state treasury. Government officials monitored irrigation works, organised repairs, removed silt from canals, and regulated water distribution among cultivators.

14. CHALLENGES AND LIMITATIONS OF MEDIEVAL IRRIGATION SYSTEMS

1. Climatic and Geographical Constraints

Medieval irrigation systems in India faced several climatic and geographical constraints that limited their effectiveness and expansion. Agriculture largely depended on monsoon rainfall, and prolonged droughts or irregular rainfall patterns often reduced the availability of water in rivers, wells, and tanks. In arid and semi-arid regions, groundwater levels were sometimes too deep for ordinary irrigation methods, making cultivation difficult. Floods during heavy monsoon seasons also damaged canals, embankments, and agricultural fields, disrupting irrigation networks and crop production.

2. Maintenance Problems in Canals and Wells

The maintenance of canals, wells, tanks, and other irrigation structures was a major challenge in medieval India because these systems required continuous repair and supervision. Canals



Kavya Setu

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often became blocked by silt, weeds, and debris, reducing water flow and irrigation efficiency. Embankments and water channels were frequently damaged by floods, soil erosion, and heavy rainfall, requiring regular reconstruction. Wells also faced problems such as drying of groundwater, collapse of walls, and mechanical failures in water-lifting devices like Persian wheels. Since maintenance depended heavily on labour and financial resources, poorly maintained irrigation systems often became ineffective over time.

3. Economic Burden on Peasants

Although irrigation systems improved agricultural productivity, they also created economic burdens for peasants in medieval India. Farmers were often required to pay land revenue and irrigation-related taxes to the state or local landlords. In some regions, peasants contributed labour and resources for constructing and maintaining canals, wells, and tanks, which increased their financial and physical responsibilities. Wealthier landlords and zamindars usually controlled major irrigation facilities, while small peasants had limited access to water resources and faced unequal distribution of irrigation benefits.

4. Regional Inequalities in Irrigation Development

Irrigation development in medieval India was uneven, leading to significant regional inequalities in agricultural growth and economic prosperity. Areas located near major rivers or under strong state control benefited from better canal systems and irrigation facilities, while remote and dry regions often lacked adequate water management infrastructure. Northern India, especially the fertile Gangetic plains and Punjab region, received greater attention from Sultanate and Mughal rulers because of their economic importance.

15. CONCLUSION

The network of canals, wells, and Persian wheels played a transformative role in the agricultural and economic development of medieval India. Irrigation systems became essential because agriculture was the backbone of the medieval economy and largely dependent on uncertain monsoon rainfall. The construction of canals under the Delhi Sultanate and Mughal rulers expanded cultivable land and improved agricultural productivity by ensuring a continuous supply of water to farming regions. Wells served as dependable local irrigation sources, particularly in areas where canal irrigation was limited, while the Persian wheel introduced an advanced and efficient method of water extraction that supported large-scale cultivation. These irrigation techniques enabled farmers to cultivate both food grains and commercial crops such as cotton, sugarcane, indigo, and wheat, contributing to surplus production, food security, and economic growth. Increased agricultural productivity strengthened the agrarian revenue system, promoted trade and market activities, and encouraged urbanisation and rural prosperity. Irrigation systems also created employment opportunities for labourers, artisans, engineers, and craftsmen associated with agriculture and water management. At the same time, irrigation development reflected the combined efforts of rulers, zamindars, merchants, and village communities in maintaining water resources and



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supporting agricultural expansion. However, medieval irrigation systems also faced challenges such as climatic uncertainty, maintenance difficulties, economic burdens on peasants, and regional inequalities in development. Despite these limitations, irrigation infrastructure remained a major foundation of medieval Indian society and economy. The technological innovations and administrative policies related to water management demonstrated the importance of irrigation in sustaining political stability, agricultural growth, and economic prosperity. Therefore, the study of canals, wells, and Persian wheels highlights the significant contribution of irrigation systems to the transformation of medieval Indian agriculture and the strengthening of its agrarian economy.

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