

Canals, Tanks, and Wells: Irrigation under the Vijayanagara Kingdom

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Abstract:

This paper aims to compile the ancient knowledge related to the establishment of irrigation systems, specifically during the Vijayanagara period from 1335 A.D. to 1565 A.D., covering a span of 230 years. It highlights the significant effort and creativity of the people of that era, as well as the foresight of the rulers and individuals, which played a crucial role in fostering a thriving economy, stable food production, and overall prosperity for the populace. The Vijayanagara empire extended from present-day Bellary and Raichur districts to encompass all of South India, with its capital located at Hampi, near modern-day Hospet in Bellary district. Numerous irrigation systems were developed, utilizing the waters of the Tungabhadra River through various anicuts that directed the flow from impounded reservoirs along the riverbanks to irrigate fields, alongside countless tanks and ponds constructed in the area, small-scale lift works along the riverbanks, and wells that accessed groundwater for irrigation. The exemplary practices in managing and maintaining these water resources ensured that the irrigation systems remained in good condition, benefiting farmers for generations. While modern irrigation techniques have advanced significantly, they also face challenges such as reservoir siltation and land becoming waterlogged and saline. Nevertheless, many hydraulic, construction, and management principles from the ancient Vijayanagara period are noteworthy, and the techniques and lessons learned by our ancestors in the successful construction and management of irrigation systems will continue to inspire future generations in the effective management of Karnataka's rich water resources.

Keywords: Karnataka history, Vijayanagara empire, Canals, Tanks, and Wells.

1. Introduction:

Irrigation systems were highly developed in ancient India, particularly in Karnataka. Evidence comes from old structures that still supply water, traditional methods that remain in use, and many inscriptions studied by historians. These sources show that irrigation was not a single system but a wide group of practices suited to different soils, rivers and rainfall patterns. Farmers drew water from wells and ponds, while rulers and local communities-built tanks, anicuts, canals and channels to store or guide it. An anicut is a low

barrier built across a river or stream. It raises the water level and directs part of the flow into canals for fields. These methods were essential because rainfall in much of Karnataka was limited and uneven. Some areas received rain for only a short period, while other parts faced long dry months. The western Ghats formed a major exception, as they received heavy rainfall. Several rivers rise in this hill range and then flow eastwards across the plains of Karnataka. The Tungabhadra is one such river. Its waters supported farming in areas that could not depend on rain alone. Streams and smaller channels also supplied villages, although their flow often changed with the seasons. Tanks played an important part in this system. They collected rainwater during the wet season and stored it for use during dry months. Farmers could draw water from them through channels or use wells that were replenished by seepage. Canal systems carried river water across wider areas, allowing cultivation beyond the immediate riverbank. These arrangements also helped communities manage sudden rain and reduce the loss of water flowing away from fields. Inscriptions provide information about the construction, repair and management of these works. They record the actions of rulers, local chiefs, religious institutions and village groups that supported irrigation. Some inscriptions also refer to land grants, water rights and duties linked to the upkeep of tanks and canals. Such records show that irrigation required regular care. Embankments had to be repaired, channels cleared and water shared among farming communities. Many large irrigation works were built in the former Vijayanagara Empire, especially in the regions now linked with Bellary and Raichur. The rulers developed systems that supported settlements, crops and the wider needs of their kingdom. Similar works were built in the Cauvery basin, where river water helped sustain agriculture across the plains. Several of these historic systems continue to function, although modern farmers have added new channels, pumps and other equipment. Their continued use shows how older water works can support present-day agriculture when they are repaired and adjusted to current needs.

The Vijayanagara empire extended from the current Bellary and Raichur districts to encompass all of South India, with its capital located at Hampi, near present-day Hospet in Bellary district. Numerous irrigation systems were developed, utilizing the waters of the Tungabhadra River through various anicuts, which directed the flow from small impounded reservoirs to the riverbanks for field irrigation. A multitude of tanks and ponds were created in the area, along with small-scale lift works along the riverbanks and wells to access groundwater for irrigation. The exemplary practices in managing and maintaining these water resources ensured that the irrigation systems remained effective, benefiting farmers for generations. While modern irrigation is highly advanced and extensive, it faces challenges such as reservoir siltation and land salinization. Nevertheless, many hydraulic, construction, and management techniques from the ancient Vijayanagara period are remarkable, and the strategies and insights gained by our ancestors in the successful construction and management of irrigation systems will continue to motivate future generations in the effective management of Karnataka's valuable water resources.

2. Various Type of Irrigation Systems Built during the Vijayanagara Empire

This document briefly outlines the irrigation systems that were developed and widely implemented, highlighting the understanding of hydraulics, as well as the foresight and professionalism exhibited by the

builders and rulers of that era in creating such an extensive network of irrigation throughout the Vijayanagara empire.

- **River anicuts**

The Vijayanagara Empire, with its capital located in present-day Hampi on the right bank of the Tungabhadra River near Hospet, thrived due to the prosperity and well-being of its citizens. This success was largely attributed to the significant emphasis placed on utilizing the waters of the Tungabhadra River for irrigation. The construction of countless tanks along streams and wells played a crucial role in enhancing agricultural productivity, which was vital for food security and the overall prosperity of the population during that era. The irrigation structures built during this time are a testament to the creativity and expertise of the people who diligently worked to establish and maintain an extensive network of irrigation systems throughout the empire. Building these irrigation facilities was considered a noble and religious act, second only to the construction of temples.

During the Vijayanagara period, the inhabitants possessed the expertise to utilize river waters for both irrigation and drinking. The newly established capital at Hampe required a greater supply of water to support its growing population's drinking needs and the agricultural demands associated with it. The existing tanks and wells proved inadequate for the expanding populace, prompting the need to harness river water for agricultural and other purposes. This document outlines some significant anicuts built across the Tungabhadra River, which redirected water flows to agricultural fields through a network of canals, along with their planning and notable features. Over 12 anicuts were constructed along the Tungabhadra River in the Bellary district (Fig 1). These structures were essential for the settlements in Vijayanagara and its surrounding regions, with similar projects undertaken to build river anicuts throughout the Vijayanagara empire. One such small dam, known as the Turtha anicut (Fig 2), was constructed in 1399 A.D. across the Tungabhadra River, near the present-day Virupaksha temple in Hampe, on the northern side. The canal originating from this anicut, referred to as the Tunrtha canal, remains operational today, having undergone necessary modifications to meet contemporary requirements. A distinctive aspect of the anicut is its incorporation of the existing rocky islands in the river, which are linked by the structure. The right bank canal, known as the Turta canal, is characterized by its swift water flow, attributed to the rocky landscape and steep gradient. This canal continues to serve agricultural purposes.

An anicut, built in 1521 AD about thirty kilometers west of Hampe, has two parts on either side of a river island. The Basavanna canal on the right and the Korragal canal on the left are now supplied by the Tungabhadra reservoir, as the ancient anicut was submerged by the Tungabhadra dam in the 1960s. Additional anicuts like Hosakote, Bella, Ramasagara, and Kampli utilize river islands for structural safety and water management. Innovative use of stone aqueducts and site selection maximized agricultural output and met domestic water needs, illustrating advanced planning in historical water structures throughout the region. Other notable anicuts include Siraguppa, Desanuru, and Vallabhapur.

- **The construction features of river anicuts**

The anicuts were constructed in Tungabhadra river making use of the natural rocky islands in the river and selecting sites where width of river was narrow. Rocky river beds were selected enabling natural

features to be made use of in the alignment of the anicut. The anicuts were constructed of large sized stones. The stones were laid one above the other with heavier ones at the bottom and no lime mortar was used. This was done intentionally so as to allow the silt to pass through the joints. Also, care was taken to minimize the width of the joints as much as possible. there was no deep foundation for these anicuts as rocky bed was available. The stones were fixed in to the groves cut in the river bed. Anchoring of the stones to the bed was done by iron or by stones. The height of the anicuts was usually not more than four to eight feet. In some case, only half the anicut was constructed leaving the other half free. This was enough to raise the water level in the river. In some cases, the top level of the weir was kept different for different reaches of the anicut. This ensured passage of flood waters over the weir with different velocities and ensured safety of the structure. Thus, the arrangement of the anicut planned specific to each anicut ensured raising of water level thus allowing water to the canals leading to the fields. Safety of the anicut was given prime importance which they learnt by many failures of anicuts.

- **Tanks**

The construction of tanks was a major activity encouraged and supported by the Vijayanagara rulers. These water bodies supplied water for farming, drinking, and the needs of cattle. They were especially important in areas far from rivers, where people could not depend on river channels throughout the year. River anicuts, or small dams built across rivers to divert water, could support fields and settlements near the riverbanks. Their reach was limited, however. They could not carry water to distant parts of the empire. Tanks helped fill this gap by storing rainwater close to villages and cultivated land. Tank building also supported the wider growth of agriculture. A tank could collect water during the rainy season and release it later, when crops needed it. This reduced the risk of relying only on direct rainfall. Stored water could be led through canals to fields, allowing farmers to grow crops during dry periods. The same supply helped meet the daily needs of people and animals. In this way, tanks formed an important part of local settlement and farming systems. The builders paid careful attention to the shape of the land and the movement of water. They selected sites where rainwater naturally gathered, often across shallow valleys or low areas between rising ground. Such places offered a suitable catchment, meaning an area from which rainwater could flow into the tank. The size and position of the tank depended on the land around it, the expected flow of water, and the needs of nearby fields and settlements. The large number of tanks built across distant parts of the empire shows how carefully these natural features were assessed.

Many tanks were built in a series where the land allowed it. In this arrangement, the surplus water from an upper tank flowed into a lower tank on the same stream or drainage line. Water therefore passed through several storage points instead of running away after the first tank became full. This method increased the amount of rainwater available for farming and reduced the pressure on any single tank. It also improved safety, since excess water could move in a planned direction rather than breaking through an embankment. The main parts of a tank were designed for clear and practical purposes. The embankment held back the stored water and had to withstand the pressure created by the tank. Builders often placed stone revetment on the upstream face. This stone covering protected the embankment from waves, flowing water, and erosion. Without such protection, repeated wetting and the force of moving water could weaken the bank. Sluices allowed the stored water to leave the tank in a controlled way. These openings were connected to

canals that carried water towards agricultural fields. By regulating the flow, the sluices helped farmers draw water when required and prevented the sudden release of large volumes. Some tanks had more than one sluice, allowing water to reach different areas or fields at separate levels. The position of each sluice depended on the ground and the intended course of the canals. A waste weir provided an outlet for water when the tank filled beyond its safe level. During heavy rain, water could rise quickly. The waste weir carried the surplus away and reduced the danger of water spilling over the main embankment. This feature was essential because uncontrolled overflow could wash away the bank and damage the tank. Together, the embankment, stone protection, sluices, canals, and waste weir formed a carefully planned water system.

The quality of this work shows that the builders possessed a sound knowledge of water flow and land levels. They understood how contours affected the movement of water, how canals needed to be placed, and how much water a tank could safely hold. They also recognised the importance of choosing the right site. A tank built in the wrong place might fail to collect enough water, flood nearby land, or send water away from the fields that needed it. The scale of tank building across the Vijayanagara Empire is also significant. Tanks appeared in many areas, including places beyond the direct reach of rivers. Their spread suggests that local catchments were carefully assessed and put to productive use. Each tank linked rainfall, storage, canals, and cultivated land. Where several tanks stood along the same stream, the system allowed water to be stored and reused as it moved through the area. These works were more than simple reservoirs. They formed planned irrigation networks that supported farming, settlements, people, and cattle. Their embankments protected stored water, their sluices directed it towards fields, and their waste weirs protected the whole structure during floods. The tanks built under the Vijayanagara rulers therefore provide clear evidence of practical skill in site selection, construction, canal design, and the management of rainwater.

- **Wells**

The river anicuts and tanks served as the main sources of water for irrigation and various other purposes. However, these alone could not fulfill the irrigation demands of the region. Consequently, open wells and spring wells were established, primarily by individuals, in areas not served by anicut canals and tanks. Groundwater was utilized for irrigation and other requirements by lifting it through mechanical means. The conveyance system implemented by the builders warrants attention. From the wells, intricate conveyance canals with stone aqueducts supported by vertical stone columns were constructed to transport water. The builders possessed an understanding of gravity and gradient, which facilitated the flow within the channels. Burnt earth pipes were employed for water conveyance, and in some instances, multiple rows were utilized to ensure a reliable water supply, as well as the safety and durability of the pipes. Additionally, flow regulation was achieved through the use of shutter-type sluices. All these techniques highlight the advanced level of expertise that existed during that period. The natural springs available were utilized for direct irrigation of fields or for supplying water to tanks. Significant emphasis was placed on the maintenance of these structures through regular desilting and upkeep, funded by contributions from beneficiaries in proportion to the area they benefited.

- **Lifts**

When the water level lay below the fields that needed irrigation, farmers had to raise the water before it could reach the land. This problem occurred near wells, rivers and streams, where water was available but could not flow naturally into the fields. Farmers lifted it by hand through organised labour or used bullocks to operate simple lifting devices. Such work required steady effort, especially when water had to be raised repeatedly during dry periods.

Inscriptions also refer to the use of water wheels. These wheels helped draw water from a lower level and move it towards nearby farmland. Their use shows that farmers employed more than one method to overcome differences in height between the water source and the cultivated fields. The method chosen depended on the local water source, the amount of land to be watered and the labour or animals available. Water lifts were widely used in the Vijayanagara Empire. They were best suited to small areas because they could not move as much water as large tanks, canals or channels. Even so, they helped farmers irrigate plots located close to wells, rivers and streams. By raising water to the required level, these devices extended cultivation beyond land that could be watered by natural flow.

- **Water management**

During the Vijayanagara era, careful attention was given to the upkeep of irrigation works. Canals, tanks, sluices and other water structures supported farming and helped communities secure water for cultivation. Their value depended not only on their construction but also on regular repair. The rulers and local communities understood that even a well-built irrigation system could weaken when exposed to heavy rain, floods, silt, plant growth and other natural forces over many years. Maintenance work covered several tasks. Silt had to be removed from the beds of canals and tanks because it reduced the space available for storing and carrying water. Vegetation was cleared from the channels so that weeds and roots did not block the flow. Workers repaired leaks in tanks and canals, since even small breaks could lead to the loss of stored water. Breaches in the banks were closed before they grew wider, especially after periods of heavy rain. In tanks, sluices were repaired to control the release of water, while waste weirs were kept in working order so that excess water could leave safely. These works helped prevent damage to the main structure and protected nearby fields. The upkeep of irrigation works also required regular watch and ward. People had to observe the condition of tank bunds, canal banks, sluices and other structures. They needed to report damage and arrange repairs before the next irrigation season. Without such care, a blocked canal could stop water from reaching fields, while a damaged sluice could release too much water or fail to supply it when needed. Maintenance was therefore a continuing duty rather than a task carried out only after a system had failed.

Different arrangements were used to meet the cost of this work. In some cases, land grants were provided for the maintenance of irrigation structures. Income from these lands could support workers and pay for repairs. Money was also invested, with the interest earned from it being set aside for future maintenance. In other places, local persons were authorised to collect water taxes. They could retain a part of the revenue and spend it on clearing canals, repairing banks and maintaining tanks. Other local sources of income were also linked to irrigation. Money collected from fishermen in return for fishing rights in tanks could be used for repairs and upkeep. Taxes gathered within the area provided another source of support. These

arrangements spread the cost of maintenance and connected the use of water resources with the care of the structures that supplied them. Local committees played an important role in managing this work. They supervised the condition of irrigation systems, collected or controlled funds and arranged the necessary labour and repairs. Their involvement allowed maintenance decisions to be made close to the villages and fields that depended on the water supply. Since these committees understood local needs, they could give attention to blocked channels, damaged banks or faulty sluices without waiting for every matter to be handled by the central authorities. Through these measures, the Vijayanagara state and local communities protected many irrigation works from gradual decline. Regular cleaning, inspection, repair and funding kept canals and tanks useful over long periods. As a result, a large number of irrigation systems remained in good condition and continued to support agriculture during the Vijayanagara era.

3. Conclusion:

The ancient knowledge behind irrigation in India is well recorded, especially during the Vijayanagara period, which lasted from 1335 A.D. to 1565 A.D., a span of about 230 years. Researchers have studied this knowledge through archaeological excavations, inscriptions, old records and other documents linked with the empire. These sources show that the rulers, engineers, local leaders and private donors who planned and built water systems understood the basic principles of storing, directing and distributing water. Their work was not limited to one type of source. They drew water from rivers, streams, tanks, wells and underground supplies, then guided it towards fields, settlements, temples and other public places. The success of these systems depended on careful planning. Builders had to study the slope of the land, the force of flowing water and the seasonal rise and fall of rivers. They also had to choose safe sites for dams, tanks and channels. Storage structures held water during the rainy season, while channels and smaller drains carried it to areas that stood at a lower level. Wells supplied water where surface sources were not reliable. Individual lifting devices helped farmers raise water from wells or channels and take it to nearby fields. Together, these methods formed a linked system that supported farming and daily life across a large and varied territory.

The rulers made a sustained effort to control and guide rivers. River anicuts, which are low diversion dams built across a river, directed part of the flow into irrigation channels without stopping the entire river. Tanks collected rainwater and runoff, reduced the loss of water during wet months and released supplies during dry periods. Some tanks were connected to other tanks or channels, allowing water to move through a wider area. Such arrangements helped reduce the effect of uneven rainfall and gave cultivators a more dependable water supply. This work required more than skilled construction. The systems also needed regular care. Channels had to be cleared of silt, embankments repaired and damaged stonework restored. Wells required cleaning, while tanks needed attention to their bunds, sluices and outlets. Inscriptions and records provide evidence that rulers, officials, religious institutions, local groups and individuals took part in building or maintaining these works. Their involvement shows that irrigation was both a public duty and a shared responsibility. Water supported agriculture, but it also sustained towns, markets, temples and growing populations. The scale of this effort is one of the most striking features of the Vijayanagara period. Across the empire, a wide network of anicuts, tanks, wells, channels and lifting devices helped meet the

need for food production and drinking water. Builders adapted their methods to local conditions rather than relying on one standard design. They worked with rivers, rocky ground, slopes and seasonal streams, using materials and techniques suited to each place. Many of these systems continued to function long after the empire had ended, and some remain in use today. Their survival points to sound design, strong construction and continued maintenance. It also shows that the rulers and communities who created them planned beyond their own time. The irrigation works of Vijayanagara offer valuable lessons in water storage, river control, local management and the careful use of natural resources. Their example continues to inspire later generations studying sustainable water systems and the history of engineering in India.

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