



# VAAK – Vilasa वाक् – विलास

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1448/1, 5th Cross, K.M. Puram  
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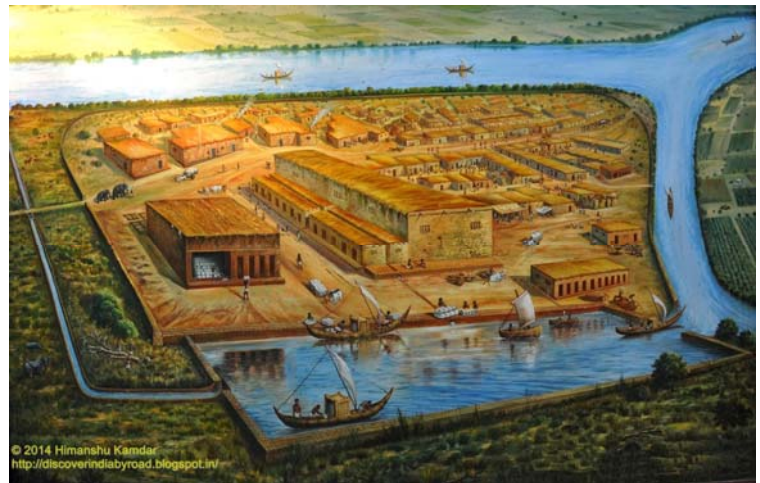
## Water Management in Ancient India

The history of water management in India goes back a long way. Mohenjo-daro and Harappa were highly developed cities in the ancient times. These cities were well-organized and built of brick and stone. Their drainage systems, wells and water storage systems were ahead of their time, which set their civilization apart from all other ancient civilizations and stand out as a phenomenon to be marveled at.

Every village in the Sindhu-Saraswati basin - where these civilizations existed - had a water storage tank. Some of these structures still stand today, as a proof of these prosperous times. In these cities, all houses, including those that were at the periphery were linked to the respective city's central drainage network.

The Indus Valley Civilization that flourished along the banks of the river Indus and other parts of western and northern India had the most well developed urban water supply and sewage systems in the world. This civilization maintained high standards of hygiene and sanitation, and had enclosed drains that were laid beneath the streets of the towns.

About 80 kilometers from Ahmedabad in Gujarat stands the ancient Harappan town of Lothal. Today this town has a landscape that is sun burnt, parched and has little natural wealth – true to its name, which in Gujarathi means 'mound of the dead'. But, 4,000 years ago, this city was a thriving port, and was counted among the principal centres of the Indus Valley Civilization.



*Apart from using sophisticated town planning concepts, there is tangible evidence of integrated land and water transport practices (terraquaculture), that seems to be quite advanced.*

Terraquaculture in Lothal was based on lunar farming cycles and made effective use of seasonal flooding. It involved an integration of the city's infrastructure with its ecosystem. Waterways were created for transport within Lothal; there were canals for irrigation and aquifer wells for domestic water supplies. Lothal's residents had developed intricate drainage systems and sophisticated brick cisterns for cleaning and purifying water. These were equipped with aeration chambers and lime and charcoal filters. Mining, manufacturing and other industries were located near waterways and linked through networks of river ports, canals, shipyards and warehouses. The people in these cities knew the results of integrating water management with industrial life.

Another excellent example is the well-planned Harappan city of Dholavira, in Gujarat, excavated in 1989. There was a flourishing civilization here well before 3000 B.C., which continued for more than a millennium. The desert climate and dry conditions of the region, where several years could pass without any rains, perhaps prodded these people to innovate sophisticated water conservation systems of channels and reservoirs, the earliest found anywhere in the world and completely built out of stone. They were used for storing the fresh water brought by rains or to store the water diverted from a nearby rivulets.



In ancient times, houses in parts of Rajasthan would have a rooftop water harvesting system. Though rains are scarce in Rajasthan, rainwater from these rooftops would trickle down and flow into underground tanks.

Perhaps, one of the oldest water harvesting systems in the world can be seen at a place near Pune, called Naneghat. A number of tanks were made out of the rocks for providing drinking water to travellers along this ancient trade route. This area had rock-cut cisterns, ponds, tanks and wells that were used for water harvesting.

These developments were not confined to any one particular place and could be seen across the region. Underground earthen pipes were constructed many years ago to carry water to distant places. Some of them can still be seen in place like, Burhanpur in Madhya Pradesh, Golconda in Andhra Pradesh, Bijapur in Karnataka, and Aurangabad in Maharashtra.

The Chandragiri Fort in Andhra Pradesh had 2 rainwater-harvesting systems in the 10th century. One was used for creating water self-sufficiency for its residents, considering the unpredictability of wars. The other structure provided water to the fort's moat. Both the fort and the moat are in a dilapidated condition today. However the harvesting system is still functional. There is a granite hill that allows almost all the rainwater to collect in a huge open reservoir of 2.6-million gallon capacity, at the foot of the hill.

A great deal of scientific thought and planning appears to have gone into its construction. Its architects have rightly adopted a conservation method that involves catching water flowing down the steep granite hill slopes which, by its very steep nature did not allow any habitation to grow around it, and thus ensured purity of water. The enclosure of trees around the reservoir minimizes loss due to evaporation, and the lotus plants in it are said to have a purifying effect on water. The water is un-treated and pure, which is good for human consumption.

At Inamgaon in Maharashtra, excavations have revealed irrigation channels and systems of water harvesting and water distribution dating back to 1600 BC. The rock pillar inscription of Skanda Gupta (456 AD) at Junagadh describes the repairs of Sudarshan Lake built 300 years prior. The Kanheri caves (1st century AD) and other Buddhist caves have a system of water harnessing and distribution, which are serviceable today. Apart from these, thousands of other water-harvesting systems existed all over the country and were maintained by rulers and the residents.

Over the last 200 years, the country has lost much of its big and small traditional water harvesting sources. Delhi for instance, has allowed nearly 274 stepwells, built during the Mughal rule, to dry up. The story is no different in other major cities of our country. Taking a leaf out of the fascinating past of water management and conservation in India, water can be harnessed through rainwater harvesting, recycling effluent water and creation of a viable network of tanks, rivers and distributaries.

#### Membership of VAAK

Membership application form of VAAK can be downloaded from [www.vaak-india.org](http://www.vaak-india.org)

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## Sanskrit - the only unambiguous natural language on the planet

We bring the readers excerpts from an article written by NASA researcher, Rick Briggs which appeared in AI (Artificial Intelligence) Magazine, in Spring of 1985

In the recent years, much time, effort, and money has been expended on designing an unambiguous representation of natural languages to make them accessible to computer processing. These efforts have centred around creating schemata designed to parallel logical relations with relations expressed by the syntax and semantics of natural languages, which are clearly cumbersome and ambiguous in their function as vehicles for the transmission of logical data. Understandably, there is a widespread belief that natural languages are unsuitable for the transmission of many ideas that artificial languages can render with great precision and mathematical rigor.

But this dichotomy, which has served as a premise underlying much work in the areas of linguistics and artificial intelligence, is a false one. There is at least one language, i.e., Sanskrit, which for the duration of almost 1000 years was a living spoken language with a considerable literature of its own. Besides works of literary value, there was a long philosophical and grammatical tradition that has continued to exist with undiminished vigour until the present century. Among the accomplishments of the grammarians reckoned a method for paraphrasing Sanskrit in a manner that is identical not only in essence but in form with current work in Artificial Intelligence. This article demonstrates that a natural language can serve as an artificial language also, and that much work in AI has been reinventing a wheel millennia old.

The discovery is of monumental significance. It is mind-boggling to consider that we have available to us a language which has been spoken for 4 to 7000 years that appears, to be in every respect a perfect language designed for enlightened communication. But the most stunning aspect of the discovery is this: NASA the most advanced research centre in the world for cutting edge technology has discovered that Sanskrit, the world's oldest spiritual language is the only unambiguous spoken language on the planet.

Sanskrit is the most ancient member of the European family of languages. It is an elder sister of Latin and Greek from which most of the modern European languages have been derived. The oldest preserved form of Sanskrit is referred to as Vedic . The oldest extant example of the literature of the Vedic period is the Rig-Veda . Being strictly in verse, the Rig-Veda does not give us a record of the contemporary spoken language.

The very name "Sanskrit" meant "language brought to formal perfection" in contrast to the common languages, Prakrits or "natural" languages. The form of Sanskrit which has been used for the last 2500 years is known today as Classical Sanskrit. The norms of classical Sanskrit were established by the ancient grammarians. Although no records are available of their work, their efforts reached a climax in the 5th century B.C. in the great grammatical treatise of Panini, which became the standard for correct speech with such comprehensive authority that it has remained so, with little alteration until present times.

Based on what the grammarians themselves have stated, we may conclude that the Sanskrit grammar was an attempt to discipline and explain a spoken language.

Until 1100 A.D., Sanskrit was without interruption the official language of the whole of India. The dominance of Sanskrit is indicated by a wealth of literature of widely diverse genres including religious and philosophical; fiction (short story, fable, novels, and plays); scientific literature including linguistics, mathematics, astronomy, and medicine; as well as law and politics.

With the Muslim invasions from 1100 A.D. onwards, Sanskrit gradually became displaced by common languages patronized by the Muslim kings as a tactic to suppress Indian cultural and religious tradition and supplant it with their own beliefs. But they could not eliminate the literary and spiritual- ritual use of Sanskrit.

Sanskrit being a language derived from simple monosyllabic verbal roots through the addition of appropriate prefixes and suffixes according to precise grammatical laws has an infinite capacity to grow, adapt and expand according to the requirements of change in a rapidly evolving world.

Why has Sanskrit endured? Fundamentally it generates clarity and inspiration. And that clarity and inspiration is directly responsible for a brilliance of creative expression such as the world has rarely seen. The Ancient and classical creations of the Sanskrit tongue both in quality and in body and abundance of excellence, in their potent originality and force and beauty, in their substance and art and structure, in grandeur and justice and charm of speech and in the height and width of the reach of their spirit stand very evidently in the front rank among the world's great literatures. The language itself, as has been universally recognized by those competent to form a judgment, is one of the most magnificent, the most perfect and wonderfully sufficient literary instruments developed by the human mind, at once majestic and sweet and flexible, strong and clearly-formed and full and vibrant and subtle, and its quality and character would be of itself a sufficient evidence of the character and quality of the race whose mind it expressed and the culture of which it was the reflecting medium.

Another hope for the return of Sanskrit lies in computers. Sanskrit and computers are a perfect fit. The precision play of Sanskrit with computer tools will awaken the capacity in human beings to utilize their innate higher mental faculty with a momentum that would inevitably transform the world. In fact the mere learning of Sanskrit by large numbers of people in itself represents a quantum leap in consciousness, not to mention the rich endowment it will provide in the arena of future communication.

Sanskrit has always inspired the hearts, mind and souls of wise people. The great German scholar Max Muller, who did more than anyone to introduce Sanskrit



to the West in the latter part of the 19th century, contended that without a knowledge of the language (Sanskrit), literature, art, religion and philosophy of India, a liberal education could hardly be complete -- India being the intellectual and spiritual ancestor of the race, historically and through Sanskrit.

The fact is that Sanskrit is more deeply interwoven into the fabric of the collective world consciousness than anyone perhaps knows. After many thousands of years, Sanskrit still lives with a vitality that can breathe life, restore unity and inspire peace on our tired and troubled planet. It is a sacred gift, an opportunity. The future could be very bright.

### 'Darbha'grass, a natural preservative

Darbha (*Desmotachya bipinnata*) is a tropical grass considered a sacred material in Vedic scriptures and is said to purify the offerings during such rituals.

At the time of eclipse, people place that grass in food items that could ferment and once the eclipse ends the grass is removed.

A systematic research was conducted jointly by the Centre for Nanotechnology and Advanced Biomaterials (CeNTAB) and the Centre for Advanced Research in Indian System of Medicine (CARISM) of the SASTRA University, Thanjavur, under the supervision of Dr. P. Meera and Dr. P. Brindha, in which cow's curd was chosen as a food item that could ferment easily. The findings of this research identify the tropical grass "Darbha" as an eco-friendly food preservative.

Five other tropical grass species, including lemon grass, Bermuda grass, and bamboo were chosen for comparison based on different levels of antibiotic properties and hydrophobicity.

Electron microscopy of different grasses revealed stunning nano-patterns and hierarchical nano or micro structures in darbha grass while they were absent in other grasses.

On studying the effect of various grasses on the microbial community of the curd, darbha grass alone was found to attract enormous number of bacteria into the hierarchical surface features. These are the bacteria responsible for fermentation of cow's curd.

During eclipse, the wavelength and intensity of light radiations available on the earth's surface is altered and the blue and ultraviolet radiations, which are known for their natural disinfecting property, are not available in sufficient quantities. This leads to uncontrolled growth of micro-organisms in food products during eclipse rendering them not suitable for consumption. Darbha was thus used as a natural disinfectant on specific occasions, say researchers at SASTRA University.

Further, the scientists say that darbha could be used as a natural food preservative in place of harmful chemical preservatives and the artificial surfaces mimicking the hierarchical nano patterns on the surface of darbha grass could find applications in health care where sterile conditions were required.

### Research work at CART

Sri Venkateshwara College of Engineering (SVCE) in collaboration with VAAK has established a research centre called Centre for Advanced Research on Technology (CART) at SVCE, Bangalore. This centre will conduct research on all the ancient scientific and technical concepts using modern science and technology. We bring you a glimpse of the research work that is being carried out at CART:

### Ancient methods of water treatment

A high level of fluoride in the water is a problem faced in many parts of our country. High levels of fluoride in water lead to many illnesses such as dental and skeletal fluorosis. Ancient Indian technology mentions of simple and effective methods to bring the fluoride levels to acceptable range. CART has taken up research on treatment of water based on these ancient methods.

Tulasi (Basil or *Ocimum Sanctum*), Vetiver (Khus) and Drumsticks (*Moringa Oleifera*) are supposed to have effect of lowering fluoride levels. These are being tested for their fluoride lowering properties. Various strengths of these substances are mixed with water to which a known concentration of fluoride has been added. The active substance is stirred well and allowed to interact for a given period of time. Then the fluoride content in the water is measured. Preliminary studies have shown that all the three materials reduce the concentration of fluoride in water. Now further detailed studies will be conducted to find out the concentration of the active substance and the duration of its interaction with water, at which we will get the optimal fluoride lowering activity. This will also give us the relative merits of these three substances in terms of lowering fluoride content in water. Once this is established, this principle will be used to design a domestic water treatment unit which will be a low cost device, not dependent on power.

### Principles of Management in Ancient Indian works

We can find many references to the code of conduct, dos and don'ts for a ruler / leader, in our ancient Indian literature. While they might have been advices given to a ruler or a leader, they are also very much applicable to the top executives of today, whose job functions demand managing people, resolving conflicts, building up a team and maximizing the resources utilization, etc. So, the management students of SVCE will undertake studying some of our ancient classics with a view of finding out the management principles that are espoused in them. This will give them a wider approach and perspective to the subject of Management. Some of the subjects / texts chosen by them to begin with are:

- Principles of Management in Kautilya's Arthashastra
- Concept of leadership in Bhagavadgita
- Profile of a CEO according to Kacchit Sarga of Ramayana
- Manu's concept of a leader
- Kautilya's concept of wealth creation

**In the next issue of VAAK – Vilasa, we will cover the other areas of research work being carried out at CART.**