Contribution of ancient india towards science and technology history essay

India’s name was originally derived from the name of a river, Indus River. This is because the civilization in India begins from riverbanks which are the Indus River and the Ganges River. The two famous cities of India’s history, Mohenjo-Daro and Harappa have played an important role in the knowledge of Indian civilization. These cities were well planned with wide and straight streets built with brick houses. These cities also had systematic drainage and sewer system.

The contribution of ancient India towards science and technology can be divided into a few sub parts such as mathematics, astronomy, medicine and a lot more. The prehistoric human activity in Mehrgarh (now known as Pakistan) is the initiator of the history of science and technology. Then it continues through the Indus Valley Civilization.

The Harappan civilization (4000-3000 BC) had evident the earliest technological progress among the other Indian subcontinents. Archaeological remains prove the existence of well-planned urban centres which has roads and drainage system which is built systematically. For that time, the drainage system can be said to be amazing since they were built underground and it is constructed in a manner to allow for regular cleaning.

There were also evidence of fire and flood control measures to protect the farms and also villages. A well planned irrigation systems also been applied at that times. Textiles were produce by using cotton which was grown by them.

Larger private dwellings (flats) were built with multi-stories. Standardized fired bricks were used to build homes and separate cooking areas and toilets

were built also. Various public function buildings such as public baths were also been built together with grain and goods storage facilities which will be used for trade.

Urban centres were often situated near riverside or sea-ports. Precise weights and measures were in use. Lothal the port of early manufactured products from smelted copper and bronze were developed as export centres.

Kilns an oven for burning and smelting copper blocks and casting tools were in existence. Other metal tools such as curved or circular saws, pierced needles and also bronze drills with twisted grooves were found exist. At that time, the drill was used for production of items with unparalleled precision.

The urban centres in the Harappan region were trading with each other and also with counterparts in Babylon, Egypt, the Persian Gulf and possibly the Mediterranean. The duration of the Harappan civilization was quite long, and included much of modern Sindh, Haryana, Gujarat, Punjab Rajasthan, and Western UP. But before its disappearance, there is also indication of considerable social decay and disintegration.

The excavations from the later phases of the Harappan civilizations show that the population pressures had led to the greater disorder in building construction. The breakdown of social practices had led to smaller urban dwelling and unplanned settlements.

The civilization on the Indus Plain had vanished fully between 1800 to 1700 BCE. The degeneration of these people is still unknown to the history. There a few suspected causes for this degeneration. One is the shift in the Indus

River. Another is that the water along lower portion of the Indus River was dammed by the people without realizing the consequences such as flooding up the river. Other suspected reason is the decline in rainfall which cause decline in agriculture and the people might have abandoned the cities to search for food.

Years later, a small number of people from a different culture start settling in some of the abandoned cities. The archaeologists call this “ squatter period”. Then the squatters disappeared. The knowledge of Mohenjo-Daro and Harappa civilization vanished until archaeologists discovered it in the mid 19th century.

The technologies in India became very sophisticated since the complex Mohenjo-Daro and Harappan towns to Delhi’s Qutub Minar. The design and planning of water supply, traffic flow, complex stone work, natural air conditioning, and construction engineering is being implemented in daily life.

At the time of British colonial rule, western education was introduced in India. This effort had given a rise to a native class of civil servants and exposed many Indians to foreign institutes of higher studies. After independence, the knowledge of science and technology in Republic of India has been given more importance. Studies on automobile engineering, information technology, communications as well as space, polar, and nuclear sciences has been introduced.

In forthcoming sections, we are going to discuss in detail about the ancient India’s civilization and their contributions towards science and technology in the present world.

3. 2 Ancient India's Contribution towards Mathematics

Around the period of 400 AD to 1200 AD, scholars such as Bharmagupta, Bhaskara II and Aryabhata had made important contributions. Indian mathematicians are the first one to record the decimal number system we are using today. The founding of the zero as a number, arithmetic, negative number, trigonometry and algebra proudly goes to the Indian mathematicians.

In almost all the area of Mathematics there is a founding by the ancient Indians. In Arithmetic they found the decimal system, zeros, negative numbers, number theory, floating point numbers, infinity, transfinite numbers and irrational numbers. In Geometry, square roots, cube roots, transformation Pythagorean triple and Pascal's triangle were found. For Mathematical logic, formal grammars, formal language theory, the Panini-Backus form and recursion were found and for Algebra, quadratic equation, qubic equations and quartic/biquadratic equation were pioneered. Trigonometric functions and trigonometric series were discovered in Trigonometry, while Fibonacci numbers, earliest forms of Morse code, logarithms, algorism, indices and algorithms were found in general Mathematics.

The excavations at Mohenjo-Daro, Harappa and the other places in Indus Valley Civilization had uncovered the evidence of the use of " practical mathematics" in their daily life. A proportion of 4: 2: 1 is used for the dimension of the bricks for stability of the brick structure. A standardised weight also been used based on their ratios. Those people in ancient India

have used their knowledge of basic geometry. This can be proved by their way of measuring weights in regular geometrical shapes.

A ruler was designed in the Indus civilization to standardize the measurement of length in a precisely. The ruler is called the Mohenjo-Daro Ruler. It is opproximately 1. 32 inches or 3. 4cm which was divided into ten equal parts. The dimension of the bricks in the ancient Mohenjo-Daro is often the integral multiples of this unit of length.

3. 3 Ancient India's Contribution towards Constructions Field

The Harappan civilization is said to be the world's first city to build well-planned streets with underground drainage, hydraulic engineering, air-cooling architecture and civil sanitation. The measurements and weights were standardized. The oven-baked bricks were invented using these guidelines in India. There are many pioneer ideas for items of civil engineering was invented such as irrigation systems, drainage systems for water, water storage tanks carved from a rock, river dams, granaries with ducts and moats, platforms, middle-class style homes, private bathrooms in homes, and drainage. There is even a dockyard in the civilization.

Stairs was found in the ancient town of India. This proves the existence of multiple-storied buildings. The ancient Indians also have pioneered many engineering tools for surgery, construction, warfare and etc. For example, hollow drills, the needle with the hole on its pointed end and the true saw.

3. 4 Ancient India’s Contribution towards Usage of Materials

In many parts of ancient India, copper was a very famous technology. A smelting furnace found in Naikund(Maharashtra), India dated back 800BC. Recently it is discovered that iron was very well known in Ganga Valley. Swords made of Indian wootz steel[1]were very famous in Persian courts.

Rust-free steel was an Indian invention and remained as an Indian skill for centuries. Delhi’s famous iron pillar, dated 402 CE is considered a metallurgical wonder and shows a very few signs of rust. The famous Damascus steel swords were made from Indian steel imported by Europeans. The acclaimed Sheffield steel in UK was Indian crucible steel. The best brains of European science worked for decades to learn to reverse-engineer how Indians made crucible steel and in this process, modern alloy design and physical metallurgy was developed in Europe.

Another important Indian contribution to metallurgy was in the isolation, distillation and use of zinc. From natural sources, zinc content in alloys such as brass can go no higher than 28 per cent. A major breakthrough in the history of metallurgy was India’s discovery of zinc distillation whereby the metal was vaporized and then condensed back into pure metal.

Brass in Taxashila has been dated from third century BCE to fifth century CE. The earliest confirmed evidence of zinc smelting by distillation is Zawar. This is the earliest place for zinc smelting and production of metallic zinc by distillation process anywhere in the world.

Europeans learnt it for the first time in 1743, when expertise was transferred from India. Until then, India had been exporting pure zinc for centuries on an industrial scale. At archaeological sites in Rajasthan, retorts[2]used for the distillation are found in very large numbers even today.

Once zinc had become separated into a pure metal, alloys could be made with the required zinc component to provide the required properties. For instance, strength and durability increase with higher zinc component. In addition, copper alloys look like gold when the zinc component is higher than 28 per cent. Most early brass objects found in other countries had less than 10 per cent zinc component, and, therefore, these were not based on zinc distillation technology.

It was in Zawar, Rajasthan, where this first became industrialized on a large scale. Zinc mines have been found in Dariba (11th century BCE), Agucha (sixth century BCE) and Zawar (fifth century BCE). These mines have pots and other manufacturing tools of these dates, but the mining could be even older.

Unsurprisingly, developments in metallurgy also had their impact on artillery (large guns) production. According to A. Rahman (Science in Medieval India), by the 16th century, the heaviest guns in the world were being cast in India and a variety of weapons were being manufactured in the subcontinent. The Jaigarh cannon factory was one of India’s best and before the crucial battle of 1857, the Jaipur Rajputs laid claim to owning Asia’s largest cannon. Yet, none of the Rajput cannons were ever used to confront the British who succeeded in conquering the sub-continent without ever having to fight

against the country’s best equipped armies, thus demonstrating that technological progress is not an end in itself.

3. 5 Ancient India’s Contribution towards Usage of Nature Resources

Many interesting findings have recently come out about the way forests and trees were managed by each village and how a careful method was applied to harvest medicines, firewood and building material in accordance with natural renewal rates.

Discoveries concerning the manufacture and application of natural and artificial dyes were first implemented by Indians. Block printing and dye and other textile-dyeing techniques were popularized. The use of mordants[3]in colour-fast dyeing of textiles became known as did the knowledge of lacquers that could be applied to wood or leather. Paints that could be used on different building materials were developed and elaborate techniques were employed to prevent fading and loss of colour during the heavy monsoons.

Indian farmers developed non-chemical, eco-friendly pesticides and fertilizers that have modern applications. These traditional pesticides have been recently revived in India with excellent results, replacing Union Carbide’s[4]products in certain markets. Crop rotation and soil technology that has been passed down for thousands of years are traditional practices which India pioneered.

Historically, India’s agricultural production was large and sustained a huge population compared to other parts of the world. Surpluses (excess of

production/supply) were stored for use in a drought year. But the British turned this industry into a cash cow, exporting very large amounts of grain even during food shortages. This caused tens of millions of Indians to die of starvation in the 19th century.

Given the importance of fresh water in India, it is no surprise that the technologies to manage water resources were highly advanced from Harappan times onwards. For example, in Gujarat, Chandragupta built the Sudarshan Lake in late 4th century BCE, and was later repaired in 150 BCE by his grandson. Bhopal's Raja Bhoj Lake, built in 1014-1053, is so massive that it shows up in satellite images. The Vijayanagar Empire built such a large lake in 14th – 15th century CE that it has more construction material than the Great Wall of China. Scientists estimate there were 1. 3 million man-made water lakes and ponds across India, some as large as 250 square miles. These are now being rediscovered using satellite imagery. These enabled rain water to be harvested and used for irrigation, drinking, etc. till the following year's rainfall.

3. 6 Ancient India's Contribution towards Medical Field

Genuine cures were listed with unscientific practices without clear distinction. But during the rational period in India the emphasis on the scientific method led to a much greater level of accuracy with respect to the efficacy of different medicines and medical procedures.

The more accurately the Indian medical practitioner was able to observe reality, understand bodily functions and test the efficacy of popular medical techniques, the more successful were the prescribed cures. Dissection of

corpses and careful monitoring of different diseases was an important component in the study and practice of medicine. With greater success in treatment came greater confidence and allowed medical practitioners to conduct surgical procedures using a variety of surgical tools though it’s unsophisticated in comparison to modern surgical equipment.

Procedures for inducing unconsciousness or numbing body parts that were to be operated on were required and developed. Tools for excision, incision, puncturing, probing, organ or part extraction, fluid drainage, bloodletting, suturing and cauterization were developed. Various types of bandages and ointments were used as were basic procedures for ensuring cleanliness and limiting contamination. The caesarian section was known, bone-setting reached a high degree of skill, and plastic surgery developed far beyond anything known elsewhere at the time. Indian surgeons also became proficient at the repair of noses, ears and lips lost or injured in battle or by judicially mandated mutilation.

Traditional cataract surgery was performed with a special tool called the Jabamukhi Salaka, a curved needle used to loosen the lens and push the cataract out of the field of vision. Brahmanic hospitals were established in what is now Sri Lanka as early as 431 BCE. Ashoka also established a chain of hospitals throughout the Mauryan empire by 230 BCE. While all ancient societies cherished and admired the skills of the medical practitioner, it was the more determined adoption of the scientific approach that enabled Indian medicine to make a quantum leap over the older medical systems of the time.

Progress in medicine also led to developments in chemistry and chemical technologies. The manufacture of alkaline substances, medicinal powders, ointments and liquids was systematized, as were chemical processes relating to the manufacture of glass. Advances in food processing (such as manufacture of sugar, condiments and edible oils) took place as did the manufacture of personal hygiene products and beauty aids (such as shampoos, deodorizers, perfumes and cosmetics).

3. 7 Ancient India's Contribution towards Shipping, Trading, Geography and Astronomy

India was the major shipbuilder at that time until the British destroy it. The Middle Age Arab sailors and the Portuguese purchased their boats in India. India and China had built some of the world's most sophisticated ships.

India also was very famous for trading. It is well known for trading items such as diamonds, gun, powders, brass ornaments, copper, bronze, metal made swords, wootz steel, iron made indigo dye, textile and much more.

Geometric compasses with the linear scales made of ivory were found by the archaeologists. Even before Europe, the compass and other navigation tools were already been use by the people in Indian Ocean. Only few people know that Vasco da Gama hired an Indian naval pilot, named Kanha to captain his ships and take him to India. Indian ships have been sailing deep-sea shipping since 2000 years ago. They have been sailing to islands such as Andamans, Lakshdweep and Maldives. A sacred scripture named Kautilya which describes the good and bad times were been using as a guidance for seafaring.

The astronomy is one of the major part in ancient history. The astronomical concepts in India comes from the Vedas(religious literature of India). The references to the astronomy can be found in the Rig Veda which is dated back around 2000BC. The Vedic Aryan have worshipped the Sun, Stars and Comets. The Indians also has prepared lunar calendars according to the lunar cycle. This calendar is still in use till today.

Aryabhata, the famous mathematician and astronomer had gave a great calculation about space that is almost correct. He presented his theory of heliostat, which means that planets revolve around the sun about a millennium before than the theory presented by Galileo.

3. 8 Summary

India’s name was originally derived from the name of a river, Indus River. This is because the civilization in India begins from riverbanks which are the Indus River and the Ganges River. The two famous cities of India’s history, Mohenjo-Daro and Harappa have played an important role in the knowledge of Indian civilization. These cities were well planned with wide and straight streets built with brick houses. These cities also had systematic drainage and sewer system. Other founding in these cities are the fire and flood control measures to protect their farm and village, planned irrigation system, textile from cotton, public baths, separate cooking areas and toilets in homes, grain and goods storage facilities for trade, kilns for burning and smelting metal, and metal tools. The civilization had vanished between 1800 to 1700 BCE leaving behind the abandoned cities. The cause of the degeneration is still unknown to the history.

The contribution of ancient India can be divided into a few categories such as, Mathematics, construction field, usage of materials, usage of nature resources, medical field, shipping, trading, geography and astronomy.

In Mathematics field, ancient India has contributed new theories in arithmetic, geometry, mathematics logic, algebra, trigonometry, and general Mathematics. Practical mathematics for measuring and weighing are been used by the ancient Indians.

The Harappan civilization is said to be the world’s first city to build well-planned streets with underground drainage, hydraulic engineering, air-cooling architecture and civil sanitation. The measurements and weights were standardized.