Reaching back into our Past in order to create our Future

Researching our Engineering heritage

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Engineering has existed ever since Man gave up the pastoral, nomadic life and decided to farm crops and raise livestock in *situ* in settled communities. From these settlements there developed towns and cities.

Ways and means were found to provide for basic needs that overcame the limitations placed by seasons. Water had to be available during periods of dry weather or drought. Water had to be managed and controlled during rainy periods and when rivers flooded. Water had to be stored in a safe manner. Sanitation and drainage and garbage disposal had to be catered to. The corpses of the dead had to be disposed of. Low-lying areas had to be protected from flooding.

Likewise, buildings has to be designed and built for a variety of purposes: From granaries to dwelling houses, from palaces to temples, from the Treasury to barracks for troops.

Rivers had to be bridged. Road networks built. With the discovery of the wheel, vehicles had to be invented. Starting from what could be pushed or pulled it developed into a vehicle that could be harnessed to a draught animal, i.e. bulls, donkeys, horses, reindeer and even dogs. Brakes had to be invented to stop these vehicles from rolling to their destruction on slopes.

Every need of Man had to be engineered and developed. That was a series of small steps, one thing leading to another until we come to the 19th century. From the accumulated knowledge and the understanding thereof came an amazing burst of creativity as Man explored new avenues. The more he discovered the more vistas opened up.

The discovery or invention of numerals led from simple arithmetic to complex mathematics and on to physics and mechanics and so on. This process has never been still though it may have waxed and waned due to the vagaries of time and circumstance. When it waxed, Man progressed and prospered. When it waned, Man's creative genius was directed to baser things and the instruments of war were invented.

Mining and metallurgical engineering, for example, could be traced back to ancient Turkey and Iran about 4,000 BC. Traces have also been discovered at Bellanbendi-pellessa in the valley of the Valave Ganga. Civil engineering also enjoys a hoary past going back to before the pyramids were first built in 2,500 BC and the Sumerian irrigation canal system about 3,000 BC. Then, there is Chemical engineering that traces its history from the preparation of Sulphuric acid about 1,500 BC; our own system of indigenous medicine and surgery traces its origins to before king Ravana about 2,400 BC. The spinning wheel as the progenitor of Industrial Engineering goes back to at least 4,000 BC. The eponymous hero, Vijaya, found Kuveni spinning and the Mahavamsa tells us that what he discovered was a full-blown civilization on the Island. It does not take much imagination to figure out that civilization could not exist without engineering in all its specializations and sub-sectors. The fact is that a robust civilization developed in this country, on this Island and was underpinned by a truly astonishing knowledge of engineering.

Man

As an applied science, engineers put power and materials to work for Man. They used these materials to construct dams and sluices, canals and smaller channels, bridges, buildings and roads. They built surface drainage and sewerage and sanitation systems. One ancient source claims that Anuradhapura was 16 miles by 16 miles, a big city by even today's standards. In the course of their work, engineers discover new materials and sources of energy. For example, what do we know of how they harnessed the flow of rivers, the wind, and the sun to power machines that have since perished?

In order to do this an engineer must know and use principles of science and mathematics. Those principles are universal-the same yesterday, today and tomorrow-and they discovered them and used them. Engineers must not only think clearly but also write and speak clearly so that instructions could be understood. How was this done? Certainly, ancient engineers learned by trial and error and had to learn from their own mistakes. But then, how did they record these experiences for posterity? They designed, organized and controlled men, materials, and money-that's called 'management' today and they motivated superiors as well as subordinates to see things their way. How did they do it?

As the wise king, Solomon, observed, 'there is no new thing under the Sun'. It has always been there and so we could say that almost all branches of engineering existed in some form or manner. For example, geophysical and geological engineering, chemical engineering, construction, research, development, design, production, planning test, operating, and consulting engineer along with the Engineering Teacher have all been here before.

Utilized

The science and art of engineering was utilized to do two things: To build and to destroy that which was built. So much so that engineering in the 19th Century was military engineering and non-military engineering had to be named 'civil' engineering to differentiate it from the predominant 'military' branch of engineering. However, from there it has developed along two tracks: That of benefit to Man in a purely civil sense and that of military use such as the atomic bomb and its refinements today.

Sri Lanka, this little 65,000 square kilometre Island that hangs like a teardrop from the Indian sub-continent has had a millennia old heritage in major irrigation and civil engineering works.

Mostly uncovered in the 19th Century and then restored to full working order, these magnificent works continue to be viable, serving the people descended from the anonymous, even unknown builders of yore.

In examining the stupendous irrigation network made up of diversions, canals, channels, reservoirs (called 'tanks'), ingenious valves, sluices, and other attendant works, one discovers that from the earliest times - probably pre-historic - there is a step-by-step progression in the development of the intricate network. Those early engineers learned by doing through practical experience and the handed-down expertise of their teachers.

Looking at how complex and interrelated and interdependent a major engineering work is, one is intrigued as to how the ancient engineers conceptualized and then executed these works. What exactly were their mathematics, their physics, and their mechanics? What sort of numerals did they utilize? Did they count in tens like we do and use a decimal system? What sort of instruments did they use? Without the aid of computers, how on earth did they compute and do so accurately? What did they write on - in sandboxes, on slates, on ola leaves? How did they survey land and do levels with such astounding precision? Did cadastral survey form part of their formidable armoury of tools? No one knows.

Managed

Surely, one could ask, how could they have done what they did without CPM/PERT? How were men and materials managed? How were the logistics organized? How were the finances handled? How were men accommodated and fed? What were the sanitary arrangements? How were accidents, minor injuries and major ones taken care of? How were materials tested? What were the criteria used? How was the critical mass of a bund determined? And so on and so forth, the questions come up but without any satisfactory answers up to date.

That brings up the question: Do we care to find out? Do we need to find out? If we do, could it be an amazing new breakthrough in engineering? Will we discover new techniques long lying dormant because 'modern' engineering mesmerizes us? These are questions that should be addressed, seriously, with a view to discovering our engineering roots. Merely talking about our engineering heritage without actually exploring it is sheer hypocrisy and dishonours those ancient pioneers. They created something that continues to benefit us today and will continue to do so in the future if we don't destroy ourselves before that.

Did it ever strike you that what those ancient forebears did was not only environmentally friendly and ecologically sound but also eminently sustainable? This was long, long before there was a "Green Lobby" anywhere in the world! If we begin to explore our past with a view to enhancing our future, will we discover the matrix from whence all this knowledge emerged? Will the insight gained by such research once again make Sri Lanka the "Granary of the East" and a "Land flowing with milk and honey" as referred to by ancient writers who recorded for posterity what they saw with their own eyes?

Certainly, the powers-that-be needs to wake up and support efforts to seriously inquire into Sri Lanka's unique heritage. It has been obscured because of the brainwashing our people got as a result of the negative side of Colonialism and its continuation in the post-colonial world.

This world, today, is dominated by the dark side of science and technology where pride of place is given to Weapons of Mass Destruction and the mental make up of "Might is Right." Sri Lanka's enduring heritage is a living one-not metaphorically - but literally because it is a gift that sustains life.

The dagoba symbolizes spiritual emancipation; the tank symbolizes physical emancipation. One from the dark forces of superstition and the other from the fetters of poverty. The unique religio - culture that developed on this Island always sought to harmoniously balance the spiritual and the physical into one wholesome entity-the civilized Man. The goal was contentment and that, by all accounts, was accomplished for various periods at different periods of time until rudely interrupted by invasion from without or rebellion from within. It is a worthwhile goal to pursue for any engineer and research may uncover the methodology of realizing that goal.