MECHANICAL ENGINEERING A HISTORICAL PERSPECTIVE

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BEGINNING

Engineering as implied by the modern usage of the term is of comparatively recent origin. But if one were to define engineering as using natural resources for the service of man, then it can be considered to be over thousands of years old. The hydraulic civilization of the Sinhala Kings can best be defined as a product of Engineering. The Great Wall of China, the Pyramids of Egypt have been "Engineered" by humans for whatever purpose that was deemed necessary at those ancient times. What name we give these builders today is a matter of opinion. Do we call them Engineers? Can a large tank like the Parakrama Samudra be built today without having Engineers of all the present day specializations, namely Civil, Mechanical, Electrical, Electronics, Agricultural, Materials, Chemical, Textile etc. We may have to add to this already long list, as Telecommunications, Computer Engineering, Defense Engineering are without doubt absolutely necessary to complete any modern project with speed and economy.

RELEVANCE TO SOCIETY

Of all these large number of specializations, Mechanical Engineering has a special place in supporting every one of these fields to great extent, while obtaining support from them to some extent. Design and construction of a modern road will definitely be handled by the Civil Engineers, but the entire range of operations from land clearing leveling, consolidation of the earth and paving will be carried out by huge machinery, which are products of Mechanical Engineering. The same applies for a large Electricity Generating station, whether hydro or thermal. The vast quantities of steel, copper aluminum, glass, rubber, plastics, cement, bricks, aggregate, asphalt had their origins in some mechanical engineering production unit. This is the modern state of the art in activity.

However if we go back a few centuries, things were a bit different. Civil Engineers put up the roads, bridges and buildings while the Mechanical Engineer with only the steam engine as the sole provider of motive power produced the machinery and equipment needed by the other fields as well as its own. The machinery were driven by one or two large steam engines with an overhead line shaft running the entire length of the factory. Belts with idler pulleys and long operating levers could start or stop the machine. Huge boilers fired by coal ran the steam engine with an overall efficiency of around 5 to 10 percent. In 1700 the steam engine was available but was despised as a smoky explosive monster, which belched out smoke, and steam, not to mention the grease and slime that always went with it. But by 1800 many factories were using steam engines in England. It is recorded that a wool carding machine having 3000 different automatic operations were carried out with high speed and precision, all powered by the once despised steam engine. Putting wool just cut from

the lambs at one end and getting woolen cloth at the other end of a huge machine became the order of the day. King Coal as it was called ruled the society.

The high speed steel products manufactured in Sheffield were wonders of automation and production. The benefits of low cost passed to the citizens the world over and England became the workshop of the world. This was pure mechanical engineering nothing else. There were no electrical goods as such at the time. The steam engine also produced colossal upheavals in the society. The engine could run all day and all night, but what of the operators, they are human and need rest. This was not made available at the beginning and workers fell down dead at their machines through fatigue, starvation or sometimes perhaps lack of enough ventilation.

STIMULI

The wars with Napoleon Bonaparte gave a stimulus to industry and large production units were established for the manufacture of arms as well as other consumer goods to be exported to every corner of the British Empire. They brought in money to England and also enough misery to the countryside. The villages that were virtually self sufficient in their needs of food, clothing and shelter collapsed. The village blacksmith could no longer hold his sway under the spreading chestnut tree. Large scale migration of workers to the factories in the cities emptied the village, wealth accumulated in the hands of a few in the cities. Oliver Goldsmith lamented in his poem "Deserted Village"

"Ill fares the lands to hastening ills of prey
Where wealth accumulates and man decay"

However at the end of the long suffering mechanical engineering did some good to England and to the world at large.

If Goldsmith is asked to describe in verse the present day English countryside he might harp on the large tracts of land kept neatly cultivated by huge machinery that does not appear to be giving out any obnoxious gas. A well-maintained Diesel Engine is not a monster but a faithful servant. The beautiful roads over which sleek cars take people in comfort from city to city through the countryside may fascinate him. Now what profession has made this happen? Surely it is mechanical engineering. He may not even lament about the cities, because most of them are quite neatly laid out, with comfortable homes, factories and offices. Of course the charm of a village whether in England or any other country will never be there in a city.

FOLLIES

Let us now look at what was happening in America the New World as it was called at that time. In 1862 the Morrill Act was passed by the Congress. Schools were started as far back as 1785 but it is only with the Morrill Act that they considered that higher education is essential for the proper development. Public land was given for a college of 'agricultural and mechanical arts'. The great State Universities of the modern day USA was born with this act. Railroads were also commenced at about this time.

Thus it can safely be assumed that Mechanical Engineering played an important role in the development of the modern USA commencing from as recent as 1862. The Maradana Technical School in Ceylon was well established by then !!. But where is Ceylon today. It is not even on the World Map. We have a Sri Lanka a country that never existed. All the older books in most languages agree totally that Ceylon was a corruption of the word Sinhale, which we have now lost for ever. Not only that we have lost a head start we got from the Ceylon Technical School. We are today importing from countries all types of consumer goods we should have been manufacturing and even exporting had we used the head start we got from the Maradana Technical School. The countries from which we import today were late starters, but their planners had heads.

In 1862 and again in 1864 the American Congress levied taxes on items imported from Europe to protect local industry from competition. Steel mills had been commenced and self-sufficiency was being planned. War orders boosted sales and the domestic market was getting bigger with increased migration of cheap labour from Europe. All these factors of development were pioneered by development of mechanical engineering as a means of supplying the needs of man. The entire story of development of the west is one of producing cheap goods in large quantities, that can be bought by the common man. The same applies to Japan, and in recent times to China, Korea and Taiwan. Perhaps before we sort out our "National Problem" we may see consumer goods from Vietnam flooding our markets. It is quite plain that we have not used Mechanical Engineering the way all other countries have used it. We thought that Mechanical Engineering is just grease and oil and shoddy products. What we wanted was glamorous buildings, televisions with bigger and bigger screens and more and more channels so that the lotus eaters of this country can watch, cricket and the disgusting teledramas.

We never thought of making any thing and every obstacle was placed in the path of mechanical production by the state as well as the " buy any thing foreign" locals. A very specific instance of this type of thinking was the imported mammoty vs the Lanka Loha mammoty of the then Hardware Corporation. The imported mammoty came without duty but the piece of steel to make the local mammoty was taxed at 25 percent. For all I know the same applied to many other local products. Perhaps the people who took these decisions have never read how nations eveloped. Until 1913 U.S.A. had protective tariffs to safeguard local industries from European competition.

We always lament on the so called "war" in the country and that it is difficult to develop a country when there is a war. All the western countries really developed their production capacities because of war. I wish to quote from the book "The American Union" by H.G. Nicholas published in 1948. " Industrial expansion of the U.S.A. continued until 1913 under the shelter of constantly heightening tariff wall. This was a direct consequence of the Civil War. Industry, in return, received a great stimulus from the war – it expanded in response to war orders and made many discoveries. The telegraph invented in 1844 by Morse had to wait for the war before it

was developed for general use." Mechanical engineering is nothing but manufacturing needs for day to day living but if some insist on wars, like Napoleon and Hitler then industry has to gear itself for this need. We are faced with the same situation only it is a matter of scale. We must realize that we are only half the size of England, which was able to establish an Empire on which the sun never sets. I am not saying that we should use mechanical engineering for such goals, but at least let us decide some day to make what we want.

The steel industry in Sri Lanka is another particular case of bad decisions that went against growth. The scrap steel was first disposed off by one set of decision makers and the other set did still better by disposing of the entire industry to a foreign company. History was anathema to all these uninformed (perhaps uneducated) people. It is not only the history of this country but world history that is important to a growing nation. But sadly we are only growing in numbers and not in development of skills and thinking. The number of "yes men" grow even at a faster rate. The early steel industry in Europe and America should be of immense interest to us. There was considerable suffering, the coal miners without whom nothing could be done, suffered immense hardships. But these countries are much better off than the countries that established the so called socialist enterprises. Invention and enterprise gradually reduced the amount of suffering of the manual worker and also improved his lot in life. He got better wages, food, clothing and shelter unlike in the socialist block that virtually went bankrupt in less than 100 years.

Coming back to the domestic situation it is very interesting to note that as far back as 1914, the great Sinhala reformist Anagarika Dharmapala having traveled widely in Europe and America called upon the British or at least the Christian clergy who wielded power and economy to teach our youth skills needed for production of every day needs like paper, pens, pencils, ceramics and textiles. This perhaps is the first call for establishing mechanical engineering in the country. We often try to find the latest information on any subject using the internet and totally disregard how things came about, the difficulties both financial, physical and psychological that confronted the pioneers not only in mechanical engineering, but in virtually every field of science or arts. I am not for once saying that we should reinvent the wheel, that is folly. But hard and continuous effort or "Veeriya Paramitha" is the only way to success.

FUTURE

In closing I like to place the reader in a happier mood. The world has changed the Socialist ideal is no more. Unfortunately we still have some people with this revolution and left movement as their only slogan. The fact is that it is not so. Like the word Engineering has changed, and Mechanical Engineering has changed drastically. Methods of mining for coal has changed, exploring for oil has changed. Transport of coal, oil and gas has changed. The shovel has been replaced by a hydraulic lever or a push button in an enclosed air conditioned cabin of a crane operator. He is not a "Peedithaya" any more, and he handles many hundred shovel-fulls with one touch of his finger. The same goes for the machinist or the

welder. Automation which was made possible by ingenious mechanical devices are now done with computers and servomotors with far greater speed and accuracy. A 20MB hard disk in 1970's had diameter of about 500 mm. In 2000 the 30GB hard disk can be put in the pocket. These were made possible by great strides in the perfection of sub micron technologies in mechanical components. But still we need large buses, trucks aeroplanes and ships to move people and goods. They have improved too during the last few decades. The material used per unit of man or material moved over a given distance has been reduced. The fuel consumption has been reduced both on land, sea and in the air. But a lot more remains to be done.

Power generation from fossil fuels are generally around 40 per cent efficiency but over 50 percent has been achieved in combined cycle plants. Total energy concepts where almost 95 percent of the fossil fuel's energy can be put to use and only 5 percent is rejected to the atmosphere is not too far if our planners not only in this country but all over the world decide to do so. The way forward is by finding technological solutions that are controlled by natural laws and governing equations which are the same for all mankind. The political thinking which varies from person to person should be replaced by scientific thinking. The sooner we do it the better for the whole overcrowded world and there is no better way of doing this except by the use of Mechanical Engineering for the good of man, animal and the environment

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Prof. P.A. de Silva was appointed as Emeritus Professor on his retirement after now forty years of meritorious service at the University of Moratuwa. He graduated in 1959 from the University of Ceylon with a B.Sc. Engineering specializing in Mechanical Engineering. In 1966 he was awarded a Colombo Plan Scholarship and obtained his Master of Science in Engineering, specializing in Refrigeration and Air Conditioning from the University of London King's College. In 1970 he obtained his Doctorate (Ph.D.) from the same University.

He also served as the chairman of the Ceylon Steel Corporation from 1977 to 1980, Chairman State Hardware Corporation, Sri Lanka Standards Institution from 1981 to 1984. He was also a Director of the National Engineering Research and Development Centre during the same period.