

"Technology Change" -- Opportunity or Problem for Engineers

By B.M.Naik

ABSTRACT

The article presents in brief the implications of "Technology Change" on working of engineers, and their employing organizations. In rapidly changing socio-techno-economic environment of today, characterised by political interference, the role and responsibility of engineers in both technology and human handling have changed.

This is a world full of opportunities, especially for technocrats who can manage FUSION OF NEW TECHNOLOGY with natural resources to produce goods and services, so urgently required to upgrade vast masses which are living below the poverty line. Acquisition of technological capability is found to be the only way to gain economic and political power in the changing world, and the same is so crucial for well being of the people. It is therefore suggested that the engineers of today, unlike in the past, have to draw more on their innovative/research ability; make an attempt to enlarge their vision to cover GLOBAL MARKET and to become WORLD CLASS engineers.

Introduction

Engineers in today's high velocity environment are a matter of great significance and importance to any society and country. It is obviously because they are the ones who are generating and assimilating new technologies and using the same to make the lives of people comfortable. They are working hard to provide water to thirsty, food to hungry, houses to homeless, illuminating lives by providing electricity, constructing roads, bridges and producing various kinds of

industrial goods. They are in fact making a great value addition in nation building and in taking away miseries from life of millions of people. They are the ones, who build projects to bring prosperity and also they work hard to endure the same for generations. The engineers certainly deserve to be proud of their key role in the changing world.

This is an age of discontinuity, so said the famous management expert, Petter Drucker. Things would happen much differently than they occurred in the past. This

* Principal, S.G.G.S. College of Engineering, Nanded.

is coming to realisation when we notice that a revolutionary change in social, economic and political systems is taking place all round the world. There is a fast upsurge in the aspirations of people accompanied by political interference especially in developing countries like India. The environment in which we live is no more static or slow moving, but is fast changing, not knowing which are the crucial variables, internal or external, and when they would come in to play. In an indeterminate environment the main driving force shaping the civilization is however, noticed to be the, "TECHNOLOGY CHANGE", with which all engineers are concerned. Engineers are called upon to take into account all the variables some of which are favourable, and others disturbing, and yet steer the progress of projects in a proper direction. The factor, TECHNOLOGY CHANGE, is to be noted specially, studied carefully and adopted, for making most of ones own potentials and abilities.

Engineers are prime movers :

Engineers are considered to be the engines of growth. They are the primemovers. It is they who largely determine the FUTURE of a society and function like insurance against obsolescence and backwardness. A society which is comprised of more number of engineers progresses faster than other, Japan has highest number 170 per thousand population, USA has 70, UK 50 and in India there are only 3 per thousand population (1981). It can thus be imagined how scarce and important the engineers are to the Indian society.

More and more engineering projects, complex in nature, with massive investments are taken up for implementation during the five year plans. The responsibilities cast on engineers are quite

heavy and in addition, time bound. It however, needs to be viewed as an opportunity to prove capacity and to serve the people. Engineers have been accepting them gladly and equipping themselves with knowledge, skill and attitude to discharge them in a professional way.

Besides engineering they have to display skills in human handling, a spirit of co-operation, working together and carrying with all others associated with diverse background, which is so essential today because of mass awakening of people and frequent political interference.

Engineers are not merely technologists; they have to be much more than that as "CHANGE AGENTS" change managers, they love change and shape future, they manage change from low productivity to high productivity, from low technology to high technology, from low income to high income.

Technological revolution offers both opportunities and problems :

Presently, we are passing through a period of TECHNOLOGICAL REVOLUTION. TECHNOLOGY CHANGE is faster than ever before. The previous industrial revolutions increased only the mechanical power/muscle power of human kind. Steam engine, diesel engine etc. enhanced the capability of man to do mechanical work.

The present revolution is characterised by computers, Genetic engineering etc. which provide an auxiliary brain to human kind to enhance the BRAIN POWER and raise the intellectual capability. They are bringing about almost a complete transformation of human civilization. It is said that the revolution is likely to be much more

powerful than could be imagined at this juncture of time. Shall we not like to use this new power for the welfare of our society ?

Every change offers opportunities to those who are capable for and poses serious problems to those who are sluggish and caught unaware. Those engineers who are leaders in technology stand to gain while others are bound to lose.

With the onslaught of technology AUTOMATION / ROBOTIZATION AND CAD / CAM is becoming the trend of time. Work methods tools, knowledge & skill required on the part of engineers are undergoing a complete change. Many new jobs like software engineers are being created, but people are not to be found to fill them up. At the same time old types of jobs are becoming obsolete and employees clinging to them are tending to lose them. Engineers would have to acquire new knowledge on continuing basis.

Ability to change matters most :

The change is so fast that many people and many nations in the world find it difficult to cope with the CHANGE. Technology change has infact led to restructuring of the economy of the entire world. World Bank Report 1989 has expressed grave concern that due to "Technology CHANGE", huge resources are flowing from developing world to developed world; and have raised a question "can this ever be reversed" ? Unless it is done , the third world countries have no good future. There is almost a complete SHIFT in employment pattern, from manual to computersied, producing much greater out put but requiring higher knowlede and higher capacity on the part of engineers.

Does hi-tech lead to unemployment ?

A myth is prevailing that hi-tech is pushing up production and productivity but at the expense of employment. People wrongly feel that hi-tech takes away jobs. Unions are found to obstruct computerization and automatoin. This is partly because in advanced age they do not wish to learn new things, and wish to keep doing what they did for years although it is irrelevant and at the cost of production and productivity.

The employers also have a resistance for change. New technology means new plant, new machinery requiring additional funds. They have a tendency to keep using old, out of date, less productive production lines and feeding consumers with substandard goods at high price. This, however does not and can not continue for long, for other companies overtake them and those who do not change with time become sick, throwing many people out of jobs. On one hand efforts are on to create new jobs for unemployed, while on the other hand existing jobs are being lost due to sickness in industries.

Joblessness is found to be more rampant in countries which do not use hi-tech. Joblessness is less where hi-tech is in use. For example Japan, where 95% of world's robots are employed in production, is producing goods of superior quality at cheaper price. They are able to capture market all over the world and feed more work to their people than they can do and generate surplus for further employment.

To illustrate, we all are using CASIO calculators. The calculator market of India is not available to Indian manufacturers and do not provide jobs to Indian workers, but it has become available to Japanese only by virtue of their superior technology.

Sheltering the industry from foreign competition is found to lead to sluggishness and incompetency. Therefore, Government of India and several countries in the world have now adopted a liberal approach. Countries where engineers do not keep pace with advancing technologies can not remain productive, but unless they remain so all the time, which is not easy, they would be losing their value and demand in profession, and are susceptible to go out of business.

Industry is now technology driven :

The industry today, has become technology oriented; what it means is that the "TECHNOLOGY" is the prime factor for successful performance of an industry. Availability of funds, markets, raw material etc. are all secondary. Some deficiency in them is tolerable but no deficiency in technology is tolerable. The gains arising out of technological upgradation are far more than the gains out of anything else and hence Government of India has resorted to all round modernization, in steel, fertilizer, sugar, construction and other sectors. Increased and quick world wide communication has made it possible for others to sell their goods in India, so also for us to sell our goods abroad. The nations are becoming more interdependent. There is a political disturbance in KUWAIT and we in India get economic shocks. Globalization of economy has crept in trade and commerce providing hints to engineers that they would have to be more competitive. For survival and progress they should be comparing themselves to their counterparts in other developed countries.

Becoming engineers, getting jobs and timely promotions, although important, are not enough. We have to learn to raise our heads high in the profession at international levels. We have to produce goods of high

quality, reliability and finish yet cost competitive by world standards.

This demands that we aspire and put in hard work to become WORLD CLASS ENGINEERS.

Indian Scenario :

A little comparison between India and the developed world, is worthwhile noting. The picture is gloomy, but still a look at facts, although harsh may enable us to understand where truly we are. It may inspire and give force to our thoughts and actions.

Our population is about 83 crores which is 15% of the world's population. We have the third largest S & T personnel, abundant raw materials and huge markets, yet our industrial production is less than 1% of world production. The import is much more than export, leading to adverse situation in balance of payments. The share of India in export market is continuously going down from 2.25% in 1950 to 0.40 in 1990. The export is largely consisting of raw materials like iron ore and not much of value added goods. Although export is increasing in absolute figures yet in terms of the % of world trade, it is going down, which simply means that others are progressing faster than India. India's share in sunrise technologies like computer at world level is less than 0.0001%. Our income per capita per year is 360 dollars, one of the lowest in the world. The human Development Index of India is 439 while that of Japan is 13,135. Out put of industrial goods of Japan with eleven crores population is 50 times more than India of 83 crores people. We are quite rich in natural resources like iron ore, coal, minerals, land, water etc. But they are underutilised, and wasted.

The productivity in various industries

is too low. On an average it is 1/29 th of Japan, 1/10th of Korea, and 1/8th of china. The time and cost overruns in project implementation are too high, and subsequently their capacity utilization is too low. We are constructing for example, 100 crores project at 400 crores, and subsequently using it as if it is a project of Rs.25 crores. This is largely on account of incapacity of our organizations and engineering personnel. If we examine multi nationals operating in India, in the same environment, the capacity utilization is found to be more than 100%.

This speaks about low capacity of Indian companies. The cost of steel produced per ton is the highest in the world. The electricity consumed per ton of steel produced is almost double that in Japan, mandays consumed are three times more. This is true in almost all other sectors.

The above comparison is presented here simply with a view to understand dispassionately where we are. This is not to say that we are not progressing at all. It simply means that other countries are progressing faster and the gap between the two is widening.

Can and should we anticipate and prepare for technological change ?

India has all along been importing technology from foreign countries. We are clearly a technology follower so far. We have never been a technology leader. We have more than 15000 foreign collaborations in India. Paradoxically we have been exporting engineering talent, "Brain Drain" to UK., USA. Can the situation be reversed for the better? If yes, how ? are some of the questions which we first grade fellow engineers have to address to ourselves.

Adoption and implementation of "Sunrise technologies" is the urgent need but is not an easy job. To cope with ever emerging technologies, demands a serious attempt of research, permitting continuously, theory to influence practice. Without our own research, it is not possible to anticipate and prepare for technological change. It demands establishing cells at more places and earmarking more funds especially for mixing up of scientists with international levels. It requires collaborative research, mutual co-operation between various Government Departments, private and public sector, industries and above all willingness to learn and adopt a change. It demands concept ability and vision on the part of higherups. There is a saying "Where there is no vision, people perish. We have to learn to develop vision of this CHANGING WORLD."

New technologies like CAD/CAM/CIM; Computers, Micro-electronics, genetic engineering offer tremendous opportunities, which however, in today's competitive and fast changing world are shortlived. The product life cycle has also become much small due to rapid change in technology. How a country anticipates and responds to the rate of change of technology and the competitive environment now decides its health and viability. There is a saying, "An early bird, catches worms." Can we engineers be smart enough, fast enough, and innovative enough to take full advantage of the opportunities offered by technology revolution? Do we perceive the challenges ? Do we accept them and prepare for them ? otherwise, we will have no FUTURE.

Bright future awaits for entrepreneurs :

Privilization is becoming the trend world over. It is obviously because privilization is found to make more

productive utilization of resources. The system and subsystems structurally tend to be more efficient; as compared to Governmentalization. That is why countries like USSR are also having "PARESTROIKG."

Privitization, however, demands entrepreneurship and intrapreneurship among the engineers. Now it is not enough for engineers to be good in design and technical things. They must learn and master the art of synthesising and bringing about a fusion of various kinds of resources like men, materials, machines, and money.

The "Winds of CHANGE" all over the world indicate that more opportunities are available to private sectors. The technology change provides many opportunities at national and international levels. It is for engineers to see in advance and avail of such opportunities for which however, they could have to become entrepreneurs. In large size organisations, the engineers would have to be innovative, imaginative and doing the works with the latest knowledge and technology. Such engineers are known as Intrapreneurs. They work within a corporate structure with the same spirit with which an entrepreneur works.

Many schemes providing incentives are designed by Government to promote entrepreneurship. Venture funds scheme is introduced for innovative and academic entrepreneurs who can use untried technology in production at the risk and cost of venture capital firm.

Incubators, Technology Parks are being established. It is an occasion that the experienced engineers make a note of the "Winds of change" and resort to establishing professional companies instead of working as employees.

Continuing engineering education is the key to progress :

All that a country and each organisation in private or public sector has to do is to train its existing employees continuously so that they master hi-tech. The advent of hi-tech has given birth to new concepts like " Continuing Engineering Education- life long education." If an engineer has to develop his ability to the full extent, he must spend one month every year to learn new technology. The employers also would have to arrange for their training. This aspect is covered in Human Resource Development. It is now essential for every country and organisation that the "Intellectual capital", Human Capital, are built up properly.

Human resources capital counts :

In the annual statement of accounts of an organisation, good chartered accountant are now taking a stock of not only physical resources, like land, plant equipment but also of human capital especially their technological and intellectual capability.

U.S., Japan and other industrially advanced countries are developing a continuously learning society. The progress and prosperity now depends on the rate of learning. They are using satellite and other hi-tech in education in universities. India Government has also made a note of development in this field elsewhere in the world and initiated a programme to facilitate developing capabilities of engineers in all aspects/sectors. Universities and engineering colleges are setting up continuing Engineering Education programme to improve competency of inservice engineers. National productivity council, Institution of Engineers and various companies are establishing training

departments to train their employees. Country wide class room programme on T.V. is also started.

Relearning is considered to be an insurance against obsolescence of engineers and their employers.

In some countries like China and Germany, it is obligatory for every engineer and his employer to arrange training of one month duration every year and it is a preconditions for promotions. Japan has highest rate of modernization i.e. 10% followed by U.S.A. 7.5%. This 10% modernization means 10% of budget of that organisation or nation goes to activities which are new and not performed in previous year. Our rate of modernization is hardly 1% and our national and state budget gets exhausted in non-plan activities which we have been performing from years, and continue to remain performing even if in changed times they have become irrelevant. Number of zero Yield or non performing assets have increased substantially. That is why Zero Based Budgeting is introduced by the Government.

We can be more innovative :

We, the engineers of India, have been using our potential to the extent of only 10%. 90% of it is not being tapped. We all have to aim at high, and reorient our attitude towards

hi-tech to become world class engineers. We have to become intrapreneurs to install and follow modern methods, technologies which are competitive and nothing less than world standards. The world is changing and so we must change with it or else suffer the consequences. Hi-Tech is bringing about a change in economy work methods, organisation structure and social values. We must welcome them without any reservation, and prepare ourselves to manage the CHANGE to our advantage.

Hi-Tech promotes only efficient industrialization and generates productive, high quality jobs. Expansion of continuing education programmes to reduce adverse effect on adoption and implementation of hi-tech is the need of the hour. We have to learn to swim on the evermerging fields of Technology Change and in the face of all round competition in world.

Conclusion :

Engineers would have to keep their eyes wide open to see the new development taking place world over and with their intellectual ability assimilate and adopt them to our situations. We ought to bear the points in mind and give a new direction to thinking to raise our head high in international society. The nation looks at all engineers with high hopes. I have no doubt that with our skill and will.. We will fulfill the same.
