

# TECHNOLOGY REVOLUTION HOW TO MAKE MOST

\* B.M.Naik

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## SYNOPSIS

*World experience tells us that now the economic development is technology driven. The limiting factor for growth and prosperity of a nation is not oil, minerals, land, water but it is the scientific and technological capability of people. This is a bold writing on the wall which the people and its Government have to read. Any neglect is however, likely to be too damaging for generations.*

*Nations like Japan, Germany, U.S.A. by virtue of their technological superiority are found capturing the world market and emerging as epicenters of our interdependent world. The ever emerging technologies are giving shocks to the economies of most of the nations including U.K., U.S.S.R., China and it is no wonder if Indian economy receives it. The tremors are experienced with varying intensity depending upon the level difference, more the level difference bigger it is.*

*There is a invasion by new technology on human civilization which ought to be realised. This invasion is not military, or by force, but it is willful with the hope of bettering life. It is however, creating problems such as high rate of inflation, unemployment, adverse B.O.P. etc. for nations; which are technologically backward. Any attempt to keep a nation isolated is further more damaging. The alternative available is therefore only to master the New technology, which is like a road roller chasing a man in a narrow lane. The man must run faster lest he will be run over.*

*There is a vast ocean of opportunities at national and global levels arising out of emerging technologies. In today's rapidly changing techno-economic environment ability of people, especially engineers to learn and relearn newer technologies has become a determinant factor.*

*The professional status of engineers and rewards to meritorious depend on their learning rate, and those who cannot cope with may have to face problems. The researchers, students and teachers would have to learn at a much faster pace to be able to reap the benefits from technology revolution.*

*This is a world full of opportunities that too of high pay off, which, however, are available to only those who can master the latest technology. Acquisition of technological capability on continuing basis is found from world experience to be the only way to acquire economic and political power. It is therefore argued that the engineers of today have to be more innovative, imaginative, and of world class standards.*

*The fault is not so much with the political system, bureaucracy or social system as much it is with the system responsible for educating people in scientific and*

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*technological subjects. The transformation of society to healthy status can be achieved by only upgrading the efforts of Science and Technology education.*

## **INTRODUCTION**

In today's high velocity environment, Engineers are a matter of great significance to any nation. 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 more 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 infact taking away miseries from the lives of millions of people. They are the ones, who build projects for prosperity and endure the same for generations. The engineers certainly deserve to be proud of their key role in changing world.

This is an age of discontinuity, so said the famous management expert, PERRER DRUCKER. Things would happen much differently than they occurred in the past. This 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. The environment in which we live is no more static, but is fast changing, due to variables which are too many and unpredictable. In an indeterminate environment the main driving force shaping the civilization is however, noticed to be the, 'TECHNOLOGY CHANGE'. Engineers are called upon to take into account all the variables both favourable, and 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.

## **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 of engineers progresses faster than other, Japan has highest number 170 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 plan periods. The responsibilities cast on engineers are quite heavy and 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, because of mass awakening of people and frequent political interference.

Once Pandit Jawaharlal Nehru was on visit, to Nagarjunsagar Project. He was happy to see the execution of works in full swing. He went near a worker carrying stones on his head, and asked 'what he is doing'? The worker replied, 'He is carrying stones'. The worker was not able to say where the stones are used and for what? Pandit Nehru called his supervising

engineer and told that he is not a good engineer. He was surprised to listen the comment. He said he has done his B.E. with first class distinction, designed the works properly and is executing in time; as per schedule. Pandit Nehru said, this is good but not enough. You have to educate your workmen in what they are building and explain to them what contribution they are making in nation building, which brings about emotional integration of an individual with the project. The role of engineers in projects is to carry all the people, officials, non-officials, workmen, contractors with, to educate them and to enable them to have pleasure in participation of the process of development. Engineers ought to have higher negotiating ability with imaginative will and skill and harness the energies of others for the cause, without feeling as an interference.

Engineers are not only technologists they have to be much more than that, as 'CHANGE AGENTS' Change managers, who 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**

Persently, 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 enhance the capability of man to do mechanical works.

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 an poses serious problems to those who are sluggish and caught unawares. Those engineers who are leaders in technology stand to gain while others are bound to loose. With the onslaught of technology AUTOMATION/ROBOTIZATIONCAD/CAM is becoming the trend of time. Work methods tools, knowledge and skill required on the part of engineers are under going 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 loose them.

### **ABILITY TO CHANGE MATTERS MOST**

The change is so fast many people and many nations find it difficult to cope up 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 so, the third world countries have no good future. There is almost a complete SHIFT in employment pattern, from manual to computerised producing much greater output but requireing higher knowledge 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.

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Unions are found to obstruct computerization and automation. 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 substandard goods at high price. This, however does not and cannot 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 the create new jobs for unemployed, while on other hand existing jobs are being lost due to incompetency of employed people, and inflexibility to adopt to technological changes.

Joblessness is found to be more rampant in countries which do not use hi-tech. Joblessness is less in those nations which use hi- tech. For example Japan, where 95 % of world's robots are employed in production, it is producing goods of superior quality at cheaper price. They are able to capture markets all over the world and feed more work to their people 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 does 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 adopted now a liberal approach. Countries where engineers do not keep pace with advance technologies cannot stand world competition. They may be Gold

Medalists once, but loosing their remain so all the time which is not easy, they would be loosing 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-materials 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 any thing else and hence government of India have resorted to all round modernization, for example, sectors like steel, fertilizer, sugar, construction. increased world wide communication has made it possible for other to sell their goods in India, so also for us to sell our goods abroad. The nations are becoming more interdependant. 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 countries.

Becoming engineers, getting jobs and timely promotions, although important, are not enough. We have to learn to raise our head high for high quality, reliability and finish yet cost competitive by world standards. This demands that we aspire and put in hard work 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

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facts, may enable us to understand where we truly are., It may inspire and give force to our thoughts and actions.

Our population is about 84 crores which is 16 % 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 raw-cotton, 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 exporting 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 4339 while that of Japan is 13,135. Output of industrial goods of Japan with eleven crores population is 50 times more than India of 84 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 their capacity utilization is also 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 organisations and engineering personnel. If we examine multinationals 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 than in Japan; manday 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 15,000 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 continuous theory to influence practice. Without our own research it is not possible to anticipate and prepare for technological change. It demands establishing research cells at more places and earmarking more funds especially for mixing of scientists at international levels. It requires collaborative research, mutual co-operation between various Government Departments, private and public sectors, industries and above all willingness to learn and adopt a change. It demands conceptual ability and vision on the part of higher up. There is a saying 'where there is no vision people perish'. We

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have to learn to develop vision of this CHANGING WORLD.

New technologies like CAD/CAM/CIM; Computer, Micro -electronics, genetics engineering offer tremendous opportunities, which however, in today's comparative and fast changing world are shortlived. The product life cycle has become much smaller 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 AWAITING FOR ENTREPRENEURS**

Privitization is becoming the trend world over. It is obviously because privitization is found to make more productive utilization of resources. The systems and subsystems structurally tend to be more efficient; as compared to governmentization. That is why countries like USSR are also having 'PERESTROIKA'.

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 'Wind 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 for which however, they would have to become

entrepreneurs. In large size organisations, the engineers would have to be innovative, imaginative and doing the work with latest knowledge & technology. Such engineers are known as Intrapreneurs. They work within a corporate structure with the same spirit 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 time that the experienced engineers make a note of the winds of change' and resort to establishing professional companies instead of working as employees.

### **MODERNISE MEN TO ACHIEVE EXCELLANCE**

Government of India have launched the programme of modernization of almost all sectors of economy, like Textile, Steel Fertilizer, Power, Jute etc. Modernization means new jobs, new skills, new products, huge capital investment, and displacement of labour. Among all the factors the most important is the displacement and reemployment of people. Inservice persons tend to become surplus and persons with new knowledge are required to be appointed. This change has to be managed very skillfully. Otherwise the technology for no fault of its own goes in dispute. Modernization of men must precede the modernization of plant and equipment, to avoid problems. Chairman of Sony corporation Mr. Akio Morita in his book 'MADE IN JAPAN' has said 'when the technology was changed from Analog to Digital we RETRIANED our men, and they made changed from Analog to Digital we RETRAINED our men, and they made SONY a forerunner in the world. Form where else we would have got such experienced persons'.

This problem is faced not only in India but in every country where new technology is being adopted. Hi-Tech certainly leads to regeneration of employment. But there is a shift in the pattern of employment. New jobs requiring higher intellectual capability, training and knowledge are generated. The old type of jobs requiring hand skills are saying goodbye and new jobs are coming in at a much faster rate. This has been proved amply by experiences in U.K., U.S.... where jobs in coal, textile and steel have gone out and new jobs far in excess in Electronics, Computer have come in. In India, the requirements of computer software engineers is 300 times more than supply, while of the other hand a large number of youths seen employed. This is a paradoxical situation arisen because we are not preparing for future and wish to cling to old jobs. If the jobs have to wait for proper persons, it is a destructive situation than when the persons have to wait for the jobs.

This is a time characterised by rapid, 'Technology CHANGE'. Those who change and learn faster stand to gain, if a country attempts to shelter its old production lines instead of exposing them to global, competition, it cannot succeed.

### **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 employees 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 properly.

### **HUMAN RESOURCE CAPITAL COUNTS**

In the annual statement of accounts of an organisation good charactered accountants are now taking stock of not only physical resources, like plant equipment but also of human capital especially their technological 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 have also made a note of development taken place elsewhere in the world and initiated a programme to facilitate developing capabilities of engineers in all 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. Countrywide class room programme on T.V. is also started.

Relearning is considered to be an insurance against obsolescence by engineers and their employers. In some countries like China, Germany it is obligatory for ever engineers and his employer, to arrange training of one month duration every year and it is a precondition for promotions. Japan has highest rate of modernization i.e. 10 % followed by USA 7.5%. This 10% modernisation 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 %; our national and state budget 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. This is why zero

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based budgeting is introduced by the government.

### CAN WE BE MORE INNOVATIVE ?

Friends, 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 to hi-tech to become world class engineers. We have to become intrapreneurs to install and follow modern methods, technologies which are competitive by 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 to CHANGE to our advantage. Without which the opportunities so generated are dying and being lost in favour of those who are technologically more capable from western world.

### CONCLUSION

The nations future, is linked to the speed with which, the people, learn &

relearn science & technological subjects. Faster the adoption of newer technologies in professions and vocations, faster is the technological & economic development. It is therefore imperative that earlier the nation realises this, faster it can regain its economic balance.

Hi-Tech promotes only efficient industrialization and generate productive, high quality employment. 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 everemerging ideas of Technological Change and competition. Engineers would have to their eyes wide open to see the developments taking place world over and with their intellectual ability assimilate and adopt them to our situations. It is a high time that we give a new direction to our thinking, raise our head high in international society. The nation looks at all engineers with high hopes. There is no doubt that with our skill and will we shall be able to make most of the technology revolution.

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