

The Magic Lamp of the Twentieth Century*

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On this day, which is being celebrated as the Engineers' Day, I have great pleasure in being present amongst you to pay a tribute to the memory of the late Shri M. Visvesvaraya. Shri Visvesvaraya was, by profession and training, an engineer. Yet, he was much more than that. He was a man of vision for the future of our country: vision which he attempted to translate into reality throughout his life. Today we have no dearth of people with a vision for the past; persons who will tell us in flowery language, how great India was in the long past. There is no shortage of people who will gladly point out scapegoats for our failures. Indeed, of speech makers India can boast of a surplus. What is needed are men like Shri Visvesvaraya who can look towards the future who can offer constructive suggestions free of political dogma and who can act rather than talk.

A look at Shri Visvesvaraya's life shows that he had not only appreciated the important role science and technology will be called upon to play in the future development of India, but he had also given a thought to the economic and social problems which accompany the rapid growth of science and technology. In a sense he may be called the father of planning. His book the 'Planned Economy for India' was written in 1934, in the British Raj. Conditions have changed since then and his ideas of 1934 may not be suitable for the problems of 1977. But, his awareness of the problems is remarkable and his approach towards their solution brings out the greatness in him. Today we are gathered here to discuss similar problems—problems which may arise in the future. That the key to the solution of these problems lies in the intelligent application of science and technology, no one will argue about. The real difficulty lies in the adjective 'intelligent.' Experience has shown; as I will describe later, that what appears to be an

expeditious solution today may generate more problems in the future.

When I think of science and technology in the present and future context I cannot help recalling the Arabian Nights story of Alladin and his magic lamp, a story most of us have read or heard in our younger days. The possessor of the magic lamp could summon a genie by rubbing the lamp and the genie would accomplish whatever was the command given. Science is the magic lamp and technology, the genie it produces. The story of Alladin is full of instances of the good done by the genie when the lamp was in good hands and the evils wrought by it when it fell into the hands of mischief makers. In the twentieth century man has seen the powers of science. He has seen them translated into such good technological achievements as the progress in agriculture, medicine, the construction of roads, bridges and dams etc. He has also seen the evil gifts of technology—the nuclear weapons and pollution, for example. Obviously this magic lamp of the twentieth century has proved to be a mixed blessing. Human nature being what it is, it will be too much to expect that the situation will dramatically improve in the near future. However, man is a rational animal and his rationality tells him to use this magic lamp for his own good. • He can and should bring all his rationality to bear upon this problem: that the situation should not get worse in the future. For, therein lie his hopes of survival.

How can the magic lamp be used for the future of humanity? The answer to this question is not clear cut, and this is reflected in the controversy about technology currently raging in the advanced countries of the West. As typical opposing view points in this debate I may refer to two articles which appeared in the Summer 1977 issue of the American Review.

In making a case for technology, Samuel C. Florman, an engineer interested in the relation of technology to general culture, cites a number of issues raised by anti-

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technologists and tries to answer them. For example, it is claimed that technology in the present age has run out of human control. Look at nuclear weapons, traffic jams, accidents, pollution. True, these are evils of a technological society – but should technology *per se* be blamed for them? Florman points out that 'technology is not an independent force, but merely one of the types of activity people engage in ... because they choose to do so.' He cites the example of the car. It has become popular because it does what people have wanted it to do : to move them quickly and independently from one place to another. If people begin to find the automobile-culture harmful, they will commission the technologists to invent something else, more suitable.

There are other arguments against technology, which Florman mentions : that technology produced a technocratic elite which dominates the majority of the less technologically gifted masses; that technology cripples man by cutting him off from the natural world in which he evolved; that technology forces man to consume things that he does not really desire ... and so on. Against all these points of criticism Florman points out that it is improper to single out technology alone for these evils, some of which persisted even before and without technology. The domination of masses of 'have nots' by a minority of 'haves' is not typical of the twentieth century. It has been there from time immemorial and its origin lies in the socio-economic conditions and, of course, in human nature. If at all, technology has improved the situation by improving the human awareness of such gaps. As to being cut off from Mother Nature, is it not through conscious human choice than under duress? And, was the primitive caveman really more comfortable than the present day suburban commuter? Nor does the human being consume certain things in spite of his wishes just because technology has manufactured them. The manufacture of these items is determined by human requirements, instead of vice versa.

The undercurrent of these arguments seems to be that whatever evils are associated with technology are not the fault of technology but the faults of other factors like human nature, economic conditions, political expediency and so on. To some extent these arguments are acceptable. They can certainly be used to counter the extreme reaction to technology which is expressed in the words "Scrap technology and go back to Nature". Nevertheless it cannot be denied that there are definite harmful effects from technology and that these arise from its misuse. The genie has often been asked to do bad things either deliberately or inadvertently.

Professor Rene Dubois who pioneered in the field of antibiotics has been a spokesman for the environment in this debate. In his article in the American Review (op. cit.) Professor Dubois has cited cases where a technological solution was initially welcomed as being beneficial and later scrapped as being harmful. The partial banning of pesticides is an example. More recently the fluorocarbons

which were used in spray containers have been found to be harmful to human beings. The passage of supersonic jets in the atmosphere could deplete the protective ozone layer. The recognition of the new problems arising from the technological solution of an old problem is something of recent origin. The abandonment of the offending technological remedy in such cases is an indication of rationality on the part of the human being. Professor Dubois emphasizes that clean environment is the right of every human being.

Yet technological solutions have threatened this right and continue to do so. Fertilizer is good for agriculture. But a fertilizer plant produces pollution making human life uncomfortable. Man would like to travel quickly from A to B. But the aeroplanes he has built are noisy and make the life of those who live near busy airports unbearable. Where should the blame lie in these cases? Although it would be unfair to blame technology *per se* for these, clearly their origin lies in the application of technology to solve human problems.

Pollution is an immediate and easily manifest consequence of technology. There are other, not so dramatically evident consequences which are equally serious (if not more!) in their implication for the future welfare of mankind. I describe three such consequences in what I consider to be an increasing order of importance.

The first is the growing reliance on automation. In the technology of mass-production man is having to rely more and more on the machine. When I cash a personal cheque in an Indian bank, before I receive the cash, the cheque passes through at least three persons' scrutiny – not counting the peon who might be employed to take it from one desk to another. There is an interval of 5 – 10 minutes (if not more) before I get the cash. In the United States if I present a cheque I will get the cash immediately from the teller. The checking is done electronically and the transaction recorded in the brain of a computer. Indeed many banks in the West do not need a human being to dish out the cash: there are automatic cash dispensers which work at odd hours of the night. There the computer scrutinizes the credentials (in coded form) and completes the transaction.

I give this example to show how machine is replacing man in doing the daily chores of life. Because of its greater efficiency mechanization will continue to increase. And of course this makes man more and more redundant. The threat of unemployment therefore looms large unless some other work is found for man. This threat will act – indeed it does act – as a brake on mechanization. Will our society be able to find more productive work for its members as the machines make their predicted advance?

The second point is also a consequence of mechanization. Mechanization generates more and more leisure and man has to find some occupation to utilize the 'free' time available. This problem will be felt increasingly in all walks of life of a technologically advanced civilization.

We in India are still faced with the problem of the daily bread and so this particular aspect of technology has not hit us to the extent it has begun to do in the West.

Idle man's mind is 'a devil's workshop. Ideally one could imagine the availability of increased leisure as a boon. Could one not employ it in fun and games, in creative hobbies like painting, music and literature where the machine has yet made little inroads or in travel? Yes, provided the economic and social conditions are conducive to these occupations. Unfortunately, the technological advance has come at such a breathtaking pace that the socio-economic development has been left behind. Thus we have redundant men with no money to indulge in these leisure-time activities. Even those who have money as well as leisure lack the maturity to employ their mind in the liberal arts. So we have all the unfortunate consequences of a devil's workshop: drug addiction, growth in crime, broken homes and so on. These are apparent more in the technologically advanced nations than in a developing country like India.

Finally I come to the problem which deserves our most urgent consideration — a problem which has resulted as much from the benefits of science and technology as from lack of proper education. This is the alarming and continued rise in the human population of the world. Thanks to the improvement of medical facilities, far fewer babies die at birth than did at the turn of the century; many formerly incurable diseases are now curable and the human life span has been lengthening. These factors have contributed to the growth of human population — and they will continue to contribute even more so in the future.

An immediate problem that comes to one's mind is how are these new inputs into human society to find work and basic amenities of life? An industrial expansion required by technological growth holds out some hope for more jobs. But this hope is not a strong one because, with increased technology will come more redundancy also, as I mentioned earlier. Thus smaller proportion of human work force will be needed in the future as mechanical productivity increases.

But this is not all. Imagine a Utopia in which there is enough work for all the adult human population. Even then there is another restriction. Does the Earth have enough resources to sustain such a large and rapidly growing population? Remember, the Earth has a finite surface area and a finite volume. However efficiently we employ technology to recover from the Earth what we need for our sustenance, the sum-total of whatever is in there is not going to last for ever. How long will the Earth be able to provide all our needs?

In India we are always conscious of the food problem. If the Monsoon is good we breathe a sigh of relief. We also look ahead and try to see how improved application of scientific agriculture can lead to more food in the future. If for some reason or other there is a shortfall, we have to import from abroad. However, this reliance on other

countries is at best a temporary measure. Even breakthroughs in our own agricultural technology will provide respites for a limited time in the future. Eventually our rapidly growing population will catch up with any increased food supply.

Unfortunately this menace is a slowly creeping one in terms of our day to day life. We are immediately conscious of pollution. We react strongly if obnoxious fumes from a factory enter our house. We protest readily against contamination of water. But as far as population control is concerned we see it only as a vogue concept which may be more relevant to a future generation. The sad fact of life is that the problem is with us here and now.

Just as technology has to some extent precipitated the problem, it is technology which will come to our aid in solving it. It can make available to us tools of mass-education which will convert the typical human being to a reasonable attitude towards population control. The hope of mankind lies in the statement I quoted earlier: that man is a rational animal. If he indeed is rational, he should be able to appreciate the vital issue involved. Population control has been achieved in many technologically advanced countries; so it is not something impossible to achieve.

Science and technology can also help in the future by producing a suitable contraceptive device which is more acceptable to the average human being than those which are available today. But in the last analysis, the use of such a device must depend on the voluntary and conscious decision on the part of the user. So mass education in this field is of paramount importance.

I will now end my talk with a brief discussion of another shortfall that is just beginning to be felt now and will be felt even more alarmingly in the future. I refer to the so called energy crisis.

The aftermath of the 1973 Middle East War focussed in no uncertain terms on the dependence of the present technology on oil. A short term view of the oil crisis shows how a few oil producing nations can hold the rest of the world to ransom if they choose to discontinue oil production. However, a long term view indicates an even more pessimistic outlook. The proven and projected oil reserve of the entire world are, after all, finite. Experts may differ as to how long these supplies will last—but they all agree that they will not last for the foreseeable future. By that I mean a time scale of the order of a few decades rather than a few centuries or millennia. For example, it has been estimated (see Wilson Clark 'Energy for Survival', Allied Publishers) that should the Western countries be forced to rely on their own combined reserves, America's oil will be depleted in 10 years. Of course the oil from the Middle East will prolong this time scale. It may also happen that vast quantities of oil are found unexpectedly, under the sea for example. But estimates made at present certainly warrant a search for alternative sources of energy. This is where the magic lamp will again be called into play.

Scientists are exploring various avenues of energy, starting from such old and tried devices as windmills to esoteric projects harnessing solar energy. Coal and nuclear fuel are available as alternatives but there are dangers of pollution. Technologists will be facing these problems for many years to come.

While coal, nuclear fuel, windmills etc limit the man's exploitation of the resources on the Earth, solar energy stands apart in that its source lies not on the Earth but some hundred and fifty million kilometres away. How much energy should we expect from such a distance? The Earth's share is estimated to be about 180 trillion kilowatts of power, far more than could conceivably be utilized by human technology (Wilson Clark, *op cit.*). The question now before scientists and technologists is, how to recover even a tiny fraction of this energy for the use of mankind. Unlike the other energy types mentioned earlier, solar energy will be available for hundreds of millions of years—if the astronomers have done their sums right! In this sense if the problem of harnessing solar energy is solved it will mark a breakthrough of far greater significance than the discovery of coal, oil or nuclear energy. By 'harnessing' I imply arriving at a stage where this form of energy can supply the bulk of human needs.

Such a breakthrough seems far away at present. Perhaps this is what will mark the achievement of the twenty-first century.

Until that, the future of our technology lies in the conservation of energy. Amongst the countries of the West, the United States consumes the most energy; it also wastes the most in unproductive uses. The awareness of this is slowly coming. President Carter made an impassioned plea for energy conservation, soon after taking office. It remains to be seen how far the efforts at conservation succeed in that country.

In India our problems are somewhat different. By comparison with the advanced countries our energy require-

ments are small. But they will increase as the technological culture advances. Today in our country we have a curious superposition of conditions ranging from the middle ages in Europe with all the poverty, insanitation, superstitions of the pre-technological era to the modern days of super technology with all its gifts and drawbacks. We cannot blindly copy any remedies being tried by the advanced countries to solve their problems.

This is where scientists and technologists of India have an important role to play. They can certainly learn the latest science and technology from the West but they have to try to adapt them to the different conditions of India. I mentioned the middle ages a little while ago. Imagine what a peasant of the middle ages would have thought of the modern technology. Well, you do not have to imagine! such a situation exists in India.

It is unfortunate that the scientist and the technologist in this country, who have to offer so much for its present and future development are made to feel inferior to the administrator and the politician. In a recent press release the Council of the Indian National Science Academy has deplored this state of affairs and has emphasized the need for consultation with the scientists and technologists in the process of decision-making. The Council has pointed out that 'in the advanced countries Professors and other skilled professionals are highly respected in the community similar to what used to be in ancient India.'

These are some of the thoughts that come to my mind on this Engineers' Day as we celebrate the Birth Anniversary of Shri Visvesvaraya : a man who not only felt keenly many of these problems but spent his lifetime in trying to solve them. I thank you for giving me this opportunity of airing my views on this important occasion.

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