MODERN TECHNOLOGY FOR ECONOMIC DEVELOPMENT

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"People must come to accept private enterprise not as a necessary evil, but as an affirmative good".

—**Eugene Black**

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Prof. S. Sampath*

The suddenness with which modern technology made its debut and the great advances that have taken place in the last three-quarters of a century are brought home to us by a story. A few years prior to 1900, a young man, who taught science, was living with a Bishop in Ohio in the U.S.A. One day the two began to discuss the future. The teacher remarked that very soon a person in Cleveland would be able to talk by telephone to another in New York; that, in the near future, people would travel in automobiles at 30 miles per hour; and, who knows, some day man will be able to speed through the sky in a flying machine. At this point, the reverend held up his hand stating that he did not want any of this heresy discussed in his house. The name of the Bishop was Wright; and he had two children, Wilber and Orville by name, who were destined to become the first men on earth to fly an air-plane.

A hundred years ago, there were none of the complications so familiar to us today. There were no electric generators or electric lamps; no bicycles or automobiles; no telephones, phonographs or movies; no X-rays or anaesthetics; no refrigerators or vacuum cleaners; no plastics or newsprint from wood; no dynamite and no atom bomb. Skyscrapers were still many years away, awaiting the development of construction-steel and elevators. Doctors knew no germs and hence antiseptics were not in use.

There was resistance to and general scepticism concerning the newly emerging products of technology. Steam

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locomotives were running but these were denounced. When Samuel Morse, the great inventor, asked for a Government appropriation for an experimental telegraph line in 1845, the legislators were inclined at first to make the grant to mesmerism instead. In 1865, a newspaper-editor wrote: "Well-informed people know that it is impossible to transmit voice over wires and, even if it were possible to do so, the thing would be of no practical value." Within a decade the telephone erupted from the laboratory of Alexander Graham Bell. The news of this invention was greeted on the other side of the Atlantic by Sir William Preece, Chief Engineer of the British Post Office, with the remark: "The Americans have need of the telephone, but we do not. We have plenty of messenger-boys." An American astronomer asserted the following: "No possible combination of known substances, known forms of machinery and known forms of forces can be united in a practical machine by which man can fly long distances". Soon afterwards, when the Wright brothers performed this feat, newspapers declined to report the event because the editors could not bring themselves to believe that it had actually happened. There was another public statement by an expert, typical of the times: "It is nothing less than feeble-mindedness to expect anything to come out of the horse-less carriage movement." In less than six years after this, the millionth car rolled off the Ford assembly line.

Inventions and products came through at a pace which showed unprecedented acceleration. It had taken 100 years to progress from Newton's basic principle to the practical reality of Watt's Steam Engine, but it needed only ten years to go from the nuclear fusion device to the fusion device. And in less than two years from the launching of the first simple, artificial earth-satellite, Sputnik—I, came the development of the interplanetary station that was able to photograph the other side of the moon. Kenneth Boulding, the economist, describes the pace of change thus: "The world of today is as different from the world in which I was born as that world was from that of Julius Caesar. Almost as much has happened since I was born as at all times before put together." To put it quantitatively, it is known that, at the rate at which knowledge is growing today, by the time a man reaches the age of 50, the knowledge around him would be 32 times as great as when he was born; or, in other words, 97 per cent of everything known in the world would be what had been gathered since he came into it.

Radio-Astronomer Bernard Lovell says: "Historians will see the Twentieth century as a clear-cut period of revolution more sharp and stormy than the age of exploration or the industrial revolution. Scientific activities are doubling now every ten years. There could be 2 million scientists working by the end of this century. Their efficiency may become poor because communication would be insufficient to prevent their duplicating each other's work. But long before this, the social consequences of so much science will produce new equations and demand new solutions."

To the youngsters of today, rocket-engines and supersonic aircraft, nuclear reactors and electronic computers, space-vehicles and all the wonders of modern chemistry and materials are not scientific marvels but commonplaces of their everyday living and experience. In our first college courses, more is taught in Calculus than Isaac Newton knew; and more about the nucleus of the atom than Rutherford knew. The overwhelming majority of all the material goods that we use in our daily life today have been developed during the last 60 years or so. And the pace of development is such that many of the things that will be in everyday use 10 years from now do not exist yet, nor do we know much about the materials out of which they will be made, nor the methods by which they will be produced. This applies not only to complex industrial equipment and products but also to foodstuffs and objects of daily consumption. The pace of technological advance would make even the most knowledgeable amongst us feel humble.

The Benevolent Character of Technology: Technology is not just a smoke-belching factory or a clanking machine. It comprises systems and techniques, besides machinery; and new ways of thinking about and accomplishing things.

It evolves through three self-reinforcing stages: the generation of a feasible idea; its practical realisaton; and the diffusion of the output through society. New findings are made everyday and, as more people are working in research and development than at any time before, these ideas are put to work more expeditiously than in the past. The rapidity of invention, exploitation and diffusion accelerates the cyclic process. New machines and systems do not merely produce newer machines and systems; they spark off new solutions to industrial, social, philosophical and even personal problems. The underlying processes alter man's intellectual environment and the way that he thinks, reasons and comes to terms with his environment, both natural and synthetic.

Pondering over the scientific advances and technological developments of recent times, U Thant, the then Secretary-General of the United Nations, said: "The central stupendous truth of today is that our developed economies have the kind and scale of resources that they decide to have. It is no longer resources that will limit decision. It is the decision-factor that will determine the scale of the resources." And he called this a revolutionary change, "perhaps the most revolutionary that has occurred in the long march of history."

The Electronic Computer ushers in an intellectual revolution: The Electronic Computer, which literally burst upon the world-scene in 1950, has a dominant role to play in this decision-making process. It symbolizes the spirit of change and the new capabilities of the modern world of science and technology more than any other single device. With its unprecedented power for analysis and storage, retrieval and dissemination of extremely varied kinds of data, in large quantities and incredibly high speeds, it has become a major factor in our knowledge-acquisition. Through its facilities for the modelling and simulation of complex systems, it aids problem-solving in a wide range of areas on a scale not dreamed of even 20 years ago.

In pure and applied sciences, computers now accomplish tasks previously considered impossible to complete. In weather-forecasting, space exploration, nuclear research, medicine, biology and health care, computers are playing crucial roles. On the industrial front, by their ability for instantaneous calculation and control of automated systems, they help to increase production, shorten delivery times and improve the quality of the products. They are powerful aids in engineering design and in on-line process control of continuous operations. In the planning of large-scale projects and optimisation of resources allocation, PERT (Programme Evaluation Review Technique) and CPM (Critical Path Method) techniques have now become commonplace.

Statistical studies and data storage, on a scale facilitated by the use of computer systems, make important contributions to environmental sciences, in meteorology, atmospherics, hydrology, oceanography, ecology and space.

Till computers arrived on the scene, it was difficult to introduce quantitative concepts in social sciences and economics as these are characterised by complex, non-linear relationships among stochastic variables and are not easily amenable to analytical treatment. Now computer-aided analysis steps in to convert sociology, psychology and economics into quantitative sciences—sociometry, psychometry and econometry.

When computers are introduced into an area or discipline, they are first used to perform specific computations and well-defined tasks. But soon the range of applications broadens; and comprehensive systems emerge. At this stage, computers begin to have a major influence on the level and efficiency of the related technology in the country in which they are put to use.

With advances in electronic technology, hardware costs are tumbling down. This would facilitate the establishment, in all countries, of large, time-sharing computer systems at a number of national centres. Side by side, a large variety of mini-computers, for special-purpose usage, will become available to many users at costs that they can afford.

At present, all the world over, computer utilisation suffers from an excessive preoccupation with commercial data-processing such as sales-accounting, inventory, production-accounting and pay-roll processing. The reason for this is that the speed and the information-handing capacities of computers tend to be rather well-utilised in applications of this type. The impact of computers on the process of transformation of the technological infrastructure through computer-aided design, inventory regulation and production control and decision-making through the techniques of operations research, simulation and optimisation is stll relatively weak. But the real worth and the pay-off from the computer lie in its ability to yield information of a type that enables the user to evaluate and make judgments on the various action-alternatives before him.

Computer usage is one of the complex features of modern technology that baffles and will continue to baffle and challenge those who are working toward the raising of living standards of people in developing countries. While computers should not be brought in as labour-saving devices or as symbols of prestige, their rational and intelligent use will bring in many rewards. Electronic technology today makes it possible for a developing country, with limited sources, to go ahead and plan a viable, national computer industry, suited to its requirements but based on modern techniques. It is a dominant characteristic of computers that their versatility, power and the intrinsic usefulness of the integrated information-systems that they create endow developing countries, with their own priorities, national goals and objectives, to share with the rest of the world the yields of this new technology and put it to meaningful use in the particular context of their own economic growth.

Communication Satellites end the age of isolation: Modern technology has made it possible to place Communication Satellites in orbit above the earth and, with the aid of a global communication network, to transmit information, on an instantaneous basis, between any two points on earth. In less than 12 years after the first Sputnik was launched from a Russian Cosmodrome, communication technology advanced to such an extent that 600 million people on earth were able to watch on their television-sets the momentous scene of man's first landing on the surface of the moon.

Many potential uses of Communication Satellite are fast becoming realities: control and guidance of commercial air-craft; linking of computers into a world-wide network; a global medical diagnostic service, fascimile transmission, in a few minutes, of entire copies of books, journals and news-papers from one part of the world to another; and direct dialling between subscribers across the continents.

Arthur Clarke, the well-known science-fiction writer, who indulged in 1945 in what then appeared to be the fantasy of Communication Satellites, speculates again in 1975 : "When we build and operate these systems, we will be able, remaining in our drawing rooms, to see all the museums in the world, attend all first nights, read any book and call up at will the knowledge of the ages stored up in the memory-banks of giant-computers. Communication satel-lites mark the end of the age of isolation. Thanks to a few tons of electronic gear placed about 20,000 miles above the equator, ours becomes the last century of the savage. For all mankind, the Stone Age is over."

Space Exploration brings rich dividends: In a century studded with many scientific and technological achievements, the exploration away from earth and into outer space will probably rank as the most momentous of all. The space exploration programmes of the 1960's, extending over a broad spectrum of activities, reached its climax with the Apollo 11 and Apollo 12 landings on the moon. While some deep space probes are in progress, in the current decade, the main thrust is to put to use many of the systems developed for space on earth in programmes designed to tackle problems arising from over-population, to protect the earth's environ-ment, to alleviate human suffering and to improve the quality of life.

As already mentioned, space systems are in use for national and international communication on an entirely new scale. They are increasingly used in navigation and weather-forecasting. Satellite technology, in conjunction with special sensors—multi-spectral systems, provides new and powerful tools for the survey of the earth's resources. It is possible, on a scale never attained before, to pinpoint sources of pollution in river systems, spot forest fires, locate areas of disease in crops and monitor weather and oceanographic conditions. Based on these observations, quick remedial measures can be organised against floods and storms and the onset of environmental hazards like earthquakes, tidal waves and volcanic eruptions.

The strong technological effort that was mounted in order to be able to launch unmanned as well as manned satellites is being reoriented to fit the frame of several down-to-earth applications. The central feature is the reliability-factor for products that can now be made to be long-lasting without needing intermittent servicing and time-consuming maintenance and repairs. Happy results have been achieved in a number of areas: transportation; food and agriculture; industry and manufacture; and health and medicine. The most dramatic results belong to the field of medical treatment and health-care; miscellaneous instruments and devices developed for use on and by astronauts are now deployed in medical institutions and doctors' clinics.

The success of the Apollo programme, envisioned by a great American President and fulfilled well within the prescribed time-frame, is convincing proof of what one nation can achieve by concentrating its scientific, technical, industrial and human resources and talents on the pursuit of a single goal which it judges to be important and meaningful. It is open to any country in the world to draw its inspiration from the American example and imbibe the spirit of the systems-concept and concerted effort and put it to judicious use in its attack on any of the problems that impede its economic development.

New Electronic Technology is a boon to the Common Man: In a period of less than 20 years, Electronics has moved from the era of electron tubes, through a decade of transistor electronics, into the new world of integrated circuits and systems. The transistor—the solid-state miniature replacement for the bulky and cumbersome electron tube—making its advent in the 1950s, opened the door to new levels of equipment complexity and small size, and was mainly responsible for new areas of development, such as digital computers and systems used in space applications. As new processing techniques evolved, with greater stress on quality-control and reliability, transistor manufacture paved the way for micro-miniaturisation and integrated circuit technology. Reliability, improved performance, small size, lower cost and greater sophistication are the hall-marks of this new technology, reliability being the most important consideration of all.

A significant feature of the new development is that while the supporting technical infrastructure is complex, exacting in standards and expensive to build—needing monitoring, measurement and control with the aid of sophisticated computer-systems, the products that flow out of this technology do so in prodigious quantities, for mass-consumption and at costs that, **per capita,** are astonishingly low.

Integrated Circuit Technology, progressing from small-scale through medium-scale to large-scale integration, causes a vertitable revolution in value-systems and has the potentiality, if wisely used, to bring within easy reach of the common man equipment and systems hitherto regarded as too sophisticated and meant only for the affluent. Thanks to i.c. technology, every household of the future will be equipped with a television set that can pick up broadcasts from satellites, both domestic and international. Many homes may find it within their means to instal a small computer-system to look after the family-budget and associated matters. Traders in the small-scale sectors will find it expedient to acquire electronic data-processing equipment to assist in recording sales, adjusting inventories, making out purchase-orders, prepare bills etc. Medical practitioners will vastly improve their diagnostic services with computing aids installed in their consulting-rooms. Video-telephones, efficient communication aids in a variety of public services, personal medical appliances, patient-monitoring and health-care systems in hospitals are a few illustrative examples of areas in which the new technology can make a significant contribution to the advancement of societies which could not afford these services till now.

Technology and the crisis in human affairs : In spite of all the spectacular advances in science and technology and the promises for the betterment of human welfare, the world finds itself today on the horns of a dilemma. Some countries, notably the U.S.A., Japan and West Germany, have achieved levels of industrial production and material prosperity and affluence on a scale not known before in history. There is side by side the picture of colossal poverty, disease and squalor afflicting a thousand millon people in different areas of the world. With the staggering rise, in recent years, of the cost of foodgrains and fuel, the countries of the third world are now falling into two categories: those that can generate wealth by exporting their natural resources and, in some cases, certain categories of manufactured goods; and the other desperately poor countries that have to import foodgrains and oil. The latter countries—the impoverished, international indigents—now being called the countries of the Fourth World, have a burgeoning population, paucity of natural resources and an under-developed industrial base. In the words of Robert McNamara, President of the World Bank: "There are some 900 million people in this fourth world who subsist on incomes of less than $ 75 a year, in an environment of squalor, hunger and hopelessness. They are the absolute poor, living in situations so deprived as to be below any rational definition of human decency." The list of these countries is headed by India and includes Pakistan, Bangladesh, Ethiopia, Chad and Haiti among others.

Modern technology provides us with the means to achieve many things for the common good. It also has many features that cloud our vision and limit our growth. This is the dilemma of our times.

II THE GEARING OF TECHNOLOGY TO HUMANE GOALS

The deleterious side-effects of modern technology provoke a plea by some for the halting of its forward march till we are able to work out satisfactory remedial steps against pollution, urban explosion and similar frustrating issues and devise ways to contain the armaments-race and the squandering away of the natural resources of the planet.

For relatively long periods, the benefits of technology went to a small section of the population. For the greater part of history, man was engaged in dealing with his natural environment and drawing out of it the sustenance for his living on earth. It is only within the last half a century that, with the newly fashioned tools of technology, he has expanded the range and sweep of his activities to such an extent that the problems posed by the synthetic environment created by him threaten the survival and growth of the human race.

We would do well to ponder over the fact that many of the problems that we face today cannot be solved by the jettisoning of technology but by the injection of substantial dose of new technology. This has to be sensitively appropriate technology.

It is often glibly assumed that there is enough technology available and trouble arises only from the rapidity of its advance. The eminent economist, Kenneth Boulding, counters this view when he says: "The spectacular changes which have taken place in the small segment of the earth's activity—such as in Computer technology and cybernation, should not blind us to the fact that, over a large part of human society, the great and intractable problem is how to advance technology—not how to deal with technology that is advancing too rapidly." According to this view, the emphasis should be on the advancement of science and technology in the many backward areas of the world. In accomplishing this task, the focus should be on compassion and concern for human consequences. Albert Einstein, the greatest scientist of all time, has articulated this wish in a simple way: "The concern for man and his destiny must always be the chief interest of all technical effort. Let us not forget it in the midst of our diagrams and equations." In this exhortation we may discern a note of disappointment that modern technology, in the hands of affluent nations, has not been adequately used for this worthy end.

The Hard Features of Contemporary Technology: The technology practised by developed countries and offered to the developing ones has many features that should cause worry. Its dominant feature, which is widely discussed in all forums, is that it causes pollution on a big scale. Factories continually discharge their effluents into the air, rivers and the sea. Smoke from industrial units and automobile exhausts surcharges the atmosphere and produces smog. Foodstuffs get contaminated with undesirable chemicals. Aquative life is endangered by the entry into water of the discharge of waste-heat from power plants. Nuclear devices, whether for military applications or peaceful purposes, put potentially lethal amounts of radiation into air and water. Agricultural soil is so handled that its structure deteriorates and the complex ecology of vital soil organisms is irreversibly altered.

There are several attitudes to the pollution problem. There are those who consider the effects of pollution a small price that we pay in return for the handsome dividends from technology. There are others to whom the preservation of the environment is of paramount importance and no effort should be spared regardless of cost in the development of more and more sophisticated technologies that will achieve the main objectives and at the same time keep the pollution under control. There is the third school, which is the most pragmatic of all, which notes that there are technologies which are intrinsically non-polluting, e.g., solar or wind-power devices, as opposed to those based on the use of fossil or nuclear fuel; such technologies should be identified and used for a variety of purposes; and, if not already available, should be developed.

We may note, in passing, other features of current technology in vogue in advanced countries which are not in tune with the development needs of poor countries. It is basically capital-intensive, designed to keep down the deployment of human labour; it takes from the bowels of the earth resources that have taken aeons of time to materialise and would thoughtlessly consume them in quick time; it lends itself to misuse in the hands of power-hungry politicians, as in the case of nuclear and medical devices which may be turned into bombs and biological weapons; it is highly centralised in set-up and operation and is hence prone to accidents and sabotage; it is characterised by its complexity and requires specially trained classes of people to operate it. From the point of view of developing countries, it offers no continuity with the traditional forms of their knowledge and skills; and the abundant manpower available has no meaningful tasks to perform in the repetitive, monotonous systems that are set-up for its furtherance.

Compelling Need for Alternative Technologies: Fears have been expressed that any alternative to modern technology is likely to be low-grade technology that remains untouched by current scientific knowledge. This is a misconception of the true nature and rationale of alternative technology. The new approach is one that will be based on a continuing endeavour to use all existing scientific knowledge in novel and hitherto untried ways.

It has been pointed out by many that the area of energy sources is one in which there is an imperative need for the adoption of alternate technologies. We realise that we cannot afford to burn up fossil fuels at the rate at which we are doing so at present. Nuclear energy programmes, being vigorously pursued in many parts of the world, represent a major quest for alternatives, but this area is full of difficulties, hazards and many intractable technical problems. The accelerated use of stored energy will result in thermal effects which in turn will cause long-term, undesirable climatic changes. A wise policy will be to use energy at a rate no higher than that at which it is naturally generated on earth. We should be content to use those forms of energy which arrive on earth in real-time. The alternative forms of energy technology should revolve around the following sources of power: wood, hydro-electric, geo-thermal, tidal, wind and solar.

The concept of alternative technology may be put to effective use in evolving novel and satisfactory designs for houses made from easily available local materials. There is the further exciting prospect of working, with appropriate technology, to equip these dwellings with their own in-house energy-supply and facilities for trapping and purifying water and for the processing of wastes.

Sewage disposal systems, borrowed from advanced countries, have many disadvantages. They are costly to instal; they use up water that is scarce; they cause pollution by the effluent discharge; and they impoverish the soil. There is a basic need, in poor countries, for a more rational decentralised scheme, operating at the community level and the family level, that treats the sewage and returns it to the soil. This is not a plea for the adoption of a low-grade or retrogressive technology to reduce cost; but for a form of technology that will be scientific but simple and uncomplicated, so as to be easily understood and operated by ordinary people.

Innovative steps in evolving economic methods of producing protein from algae or developing simple and safe means of contraception are examples of projects that may be undertaken to establish technologies particularly appropriate to the needs of developing countries.

Concluding his illuminating essay on "The Need for Alternative Technologies", Robin Clarke says: "It is true that alternative technologies also have their limitations. They do not function equally well under all conditions. But the important point is that by setting up a series of humane goals for technology to meet, technology is lifted out of the moral vacuum in which it has existed for so long. It can thus, once again, become a moral activity, although like all human activities, it will probably always fall short of moral perfection in one or another respect."

III TECHNOLOGY AND DEVELOPMENT IN THE INDIAN CONTEXT

For a fairly long time, developing countries stuck to the belief that economic growth would be the natural and effortless corollary of the transfer of capital equipment and work techniques from the advanced to the backward countries; and that all that the latter required was modern machinery from the former on easy payment terms and progress was assured. This has not happened and will not happen as there is no such facile pathway toward the realisation of an industrialised society.

Speaking on our national needs and aspirations, Prime Minister Indira Gandhi has made these observations: "I am concerned that so much of our scientific work is derivative and imitative. There is too much uncritical acceptance of capital-intensive methods. The willingness and ability to explore the possibility of using labour-intensive technologies are conspicuously lacking. The growth of technology in advanced countries leaves us in a perpetual state of having to catch up and the nearer we are to catching up the further we get from our people and their worries. We should pay greater attention to smaller problems which affect people's day-to-day life; use local materials and power resources; utilise intermediate technology to improve our traditional grind-stone or the wheels of our bullock-cart. There is and there can be no conflict between such technology and modernisation. On the other hand, it will help to make our rural people science-minded and encourage them to participate in the genuine tasks of development."

The process of development demands financial inputs. As these are scarce, we should make our investments in the most judicious manner and re-invest the initial returns for further development. Till an adequate capital base is built, we should curb our impatience and be prepared to do without the traditional consumer items. We should, in our own way, emulate the spirit of sacrifice and single-minded devotion that moved the entire population of Germany and

Japan and enabled them to regain prosperity from the devastation of World War II. Political and social factors are undoubtedly important in this process; but beyond a certain point, our development will be critically dependent on the state of our science and technology, the quality of our inputs into these areas and our capacity for efficient management of our resources.

We cannot build any worthwhile strategy if we pursue the will-o-the-wisp of everything that is up-to-date and is in current use in advanced countries. Nor will it be sagacious to be reconciled totally to technologies which are relatively low-grade and are less expensive in the first flush. To solve our problems, we need to use all the tools that we have and develop additional tools taking care to see that they are minimally capital-intensive and designed to make maximum use of our vast resources in man-power and materials. This approach should in no way bar us from the pursuit of modern methods and techniques in selected areas. This will be in keeping with our past tradition of intellectual activity and help to keep the country in the mainstream of scientific and technological advances.

The Indian Physicist, C. V. Raman, once remarked: "We do not have the wherewithal to make good motor-cars in this country. But we have the capacity to build good bullock-carts. Let us give up the former and concentrate our efforts on the latter." As against this, another scientist, Prof. M. G. K. Menon, has urged that in a number of areas we in the country should adopt and accept nothing less than the most modern techniques known in the world today: "This is not for hand-waving or prestige, but because it represents the best investment." The fields cited are several areas in modern electronics connected with computers, communication technology, defence and medical uses; methods of surveying earth-resources; techniques for the study, control and optimal use of our water potential; search for alternate energy technologies, covering the nuclear, tidal, geothermal, solar and wind-power possibilities. In our oil exploration efforts, we should strive for a judicious combination of the most modern techniques that can be used with methodologies and fixtures that suit our local conditions.

There is controversy as to whether a poor country like ours should make investments in satellite technology. The late Dr. Vikram Sarabhai was a vigorous advocate of our commitment to the establishment, in a suitable time-frame, of a domestic communication Satellite in our own sky. Such a satellite would bring us many of the fruits of modern technology: meteorological data collection and weather-forecasting on a new scale; remote-sensing of our natural resources; scientific capability in rocket-research. It would also make possible nation-wide television coverage and telecommunication links between our major cities. Paradoxical as it may seem, communication technology based on the use of satellites is more attractive for developing countries as the cost of establishing the system will only be a fraction of what would be required to realise a conventional network for telegraph, telephone, radio and television service such as advanced countries have built up over the years.

A few years ago, at the end of a lecture by Dr. Sarabhai, on the role of a communication satellite in carrying television programmes to the people residing in the country's over 500,000 villages, some one sought clarification on his stand with this query: "Most of our villages are in a primitive condition. There are no roads leading to them. They have no electricity, no shools and no hospitals. Most of them lack good drinking water. In this context, does the taking of television to these villages represent the right kind of priority?" The scientist's quick response was that we should, as a natoinal endeavour, put our best efforts into the creation of these basic amenities; this task will be aided and not impeded by the gifting of televison to rural India because this medium, if widely used, will bring culture and education into the homes of millions of our people and, by telling them how to use their resources and skills, change the quality of their life.

The acquisition of knowledge from the vast and expanding reservoirs of today will not by itself suffice. We should build and cultivate a scientific base in the country to receive this knowledge, adopt it, modify it and develop it further to fulfil our own peculiar needs. In the words of the late Dr. Homi Bhabha: "If technology is to be looked upon as the engine of the development process, then foreign technology is acceptable only as the super-charger of a domestic engine and never as the engine itself." In the context of today, the process of our economic development has to be an adaptive and assimilative one rather than a quest for the unknown and the untried.

To make quick progress, we need a new culture permeating our administrative machinery. We have inherited from our colonial rulers the legacy of a system that puts a premium on sets of rules, precedents and checks and balances. This does away with a creative outlook and impairs the efficiency of the system. In the mind of the administrator, there is a basic misgiving about the profit-motive and a tendency to associate profit with exploitation. We should snap out of this outmoded concept. While profit pursued for the sake of extravagant living cannot be justified, profit as the motive-power for saving is invaluable for the financing of economic development. It is this attitude that has made enterprises in advancd countries powerful instruments of growth and distribution.

There is a need, more urgent than at any time before, to create in the minds of people, at all levels, the will to perform their tasks, whatever they are, in a competent manner. John W. Gardner says: "A missile may blow up in its pad either because the chief designer made an error or the technician down the line did not adjust a screw properly. The end result is the same in both cases. We need good performance at all levels. We need good scientists and good carpenters; good teachers and good plumbers; and good cabinet ministers and good bus-drivers."

In a free society, such competence is an elementary duty. To make progress, we need more: a continual striving toward improved standards in performance. In all levels of activity, there is an aristocracy of excellence decided by the quality of the work done by the individual or groups of individuals.

In a recent address delivered in Madras, V. Krishnamurthy reminded us about the hierarchical nature of Indian society and the way that it inhibits the effectiveness of group-processes and team-effort and the tendency that it generates to be dependent always on advice handed down from above. "These shackles will have to be broken if we want to build a new India where everyone gets an opportunity for self-development and growth."

Economic development calls for a dynamic outlook in the whole gamut of relationships affecting the human being—social, political, industrial and psychological. The big challenge as far as we are concerned, is to be able to harmonise the imperatives of our tradition with the compulsions of modern planning. Advancing technology, properly understood, harnessed and rationally used, will be the horse that will draw the chariot of our development into the promised land of economic well-being and an improved quality of life for all of us.

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"Free Enterprise was born with man and shall survive as long as man survives."

—A. D. Shroff

1899-1965

Founder-President

Forum of Free Enterprise

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