Role of Education in National Development

Dr. Mamta Pandey

Professor, Department of Physics, Govt. Science & Commerce Benazeer College, Bhopal (M.P.)

Abstract

Science by itself provide no direct benefit to individual, social and economic ills but without scientific progress no amount of achievement in any direction can ensure our good health, prosperity and security to the society in the modern world. It must be recognized that it is industry that produces products not the science, however it is the science which enables industry and for the effective development of new technology. There must be a continual interaction between scientist in the laboratory and engineers in the industry to effectively and quickly reduce scientific discovery to practical applications. Discovery of science when practically used create more jobs, higher wages, comfortable working hours more abundant.

Basic research in science develops new Knowledge and applied research develops new technology. In fundamental research there is little of any understanding of possible potential application at the time the work is done , while in strategic research practical applications are expected though there may be much of the unknown to explore and understand before one gets a those practical applications. For Example- Fiber optics is revolutionizing communications.

The fundamental research under pinning of this technology is the quantum mechanics developed in 1920 – 1940. The fundamental applied work was developed of the laser, optical fibre communication comes from combining advanced solid state laser with advanced materials.

Continues flow of scientific knowledge is very important to achieve high level of employment, to maintain a position of world leadership. Science has a great role in a skill development and its application to “Make in India” and develop our economy at a faster pace to reduce trade deficit, and dependence on other countries and also to achieve self-reliance.

Keywords – applied science technology, industry and skill development, society

Introduction

Science had been the mainstay in developing society since the beginning of civilisation. Science provided the knowledge and tools for ease of doing various otherwise difficult tasks and made our living comfortable. The most valuable service which science has rendered to mankind is that it has given it supreme self-confidence. It has given man the assurance that, instead of being a slave to his environment, he can control and modify it to suit his needs.

The modern scientific revolution began about 400 years ago with the work of Galileo, and the technology spawned from this ongoing revolution transformed the world? Indeed it has. A person brought somehow from only a hundred years ago would find today's world very different and even surprising. 100 years back the average life span was shorter, infant mortality was much larger, and disease carried off more people than did old age. Communications were primitive, only crude telephones existed and here was no radio or television. The average person knew little of the rest of the world. Transportation was slow and there were no autos or airplanes. There was no knowledge of the subatomic world, no computers, etc. Indeed, most of the work that people do today is in areas that did not exist back then and is based on the technologies derived from the scientific revolution.

One of the principle concern of our Society is economic security. It is discussed in term of technology policy, competitiveness, supporting hi-tech industry etc. and it is in these terms that science policy is being re-evaluated.

While there is consensus, that fundamental science is good, there is a danger that lack of understanding of how fundamental science leads to the development of new technologies and applications will end up and short changing the long term and thus damaging the prospects for succeeding at what the policy makers are trying to do. Basic discoveries are at the heart of the development of new technologies but they are many hurdles in the road before industrial applications are realised as well as large investment of both intellectual and financial resources. Advances in science when put to practical use mean more jobs, higher wages, shorter working

hours, more abundant crops, and more leisure for recreation, for learning how to live without deadening drudgery which has been the burden of the common man for the ages in the past. To achieve these objectives and secure a high level of employment and maintain a position of world leadership flow of new scientific knowledge must be both continuous and substantial. Science by itself does not provide any benefit to individual, social and economic ills, however, without scientific progress no amount of achievement in other directions can issue good health, prosperity and security to the society in modern world.

It must be recognised that it is the industry that produces products not the science. However, it is the science which enables industry and for the development, it is imperative to continue scientific research and discoveries.

As far as new technologies are concerned, in fundamental research, there is little if any understanding of possible potential applications, at the time the work is done, while in strategic research, applications are expected though, there may be much of the unknown to explore and understand before one gets to those practical applications. For example, Fiber optics is revolutionizing communications. These hair-thin pieces of glass or plastic can stretch thousands of miles under the oceans to connect continents, and can carry telephone, television, and computer communications in the most efficient and lowest cost way known to man. The "basic fundamental" research underpinnings of this technology is the quantum mechanics, developed in the 1920's through the 1940's particularly the work of Einstein on stimulated emission and absorption (the so-called "A" and "B" coefficients). The "fundamental applied" work was the development of the laser. Theory showed that the laser was not impossible, but it was not obvious that the required conditions could be achieved. The "basic strategic" research was a vast amount of work on the interaction of light with materials. Optical fiber communication comes from combining advance soli-state lasers with advanced materials. Virtually all of today's technologies can be described in these terms.

Fundamental research is necessary for the development of genuinely new technology. There is a strong temptation in times of economic difficulty to cut back on long-term research to reduce costs. This can benefit industry and the economy only in the very short run, for without long-

term research the engine of technology development will run out of fuel and we will all lose eventually. This loss can be very large if one's economic rivals do not cut back.

Science and technology have annihilated distances, brought the various parts of the world much nearer each other, enormously increased international trade and integrated the economy of all nations.

Societies have changed over time, and consequently, so has science. For example, during the first half of the 20th century, when the world was enmeshed in war, governments made funds available for scientists to pursue research with wartime applications — and so science progressed in that direction, unlocking the mysteries of nuclear energy. At other times, market forces have led to scientific advances. For example, modern corporations looking for income through medical treatment, drug production, and agriculture, have increasingly devoted resources to biotechnology research, yielding breakthroughs in genomic sequencing and genetic engineering. And on the flipside, modern foundations funded by the financial success of individuals may invest their money in ventures that they deem to be socially responsible, encouraging research on topics like renewable energy technologies. Science is not static; it changes over time, reflecting shifts in the larger societies in which it is embedded.

Science responds to the needs and interests of the societies in which it takes place. A topic that meets a societal need or promises to garner the attention of society is often more likely to be picked up as a research topic than an obscure question with little prospect for a larger impact. For example, over the last 15 years, science has responded to the HIV/AIDS epidemic with a massive research effort. This research has addressed HIV in particular, but has also increased our understanding of viral infections in general. Society's desire to slow the spread of HIV and develop effective vaccines and treatments has focused scientific research, which improves our understandings of the immune system and how it interacts with viruses, drugs, and secondary infections. Science is done by people, and those people are often sensitive to the needs and interests of the world around them, whether the desired impact is more altruistic, more economic, or a combination of the two, as demonstrated in the example below. In 1856, while trying to

make a synthetic version of the anti-malarial drug quinine, the young chemist William Perkin spied a glint of purple. He had stumbled upon a dye which produced a new color: mauve. The color was an instant hit, adorning women across Europe and enriching its inventor. This attention attracted other chemists hoping to make a similar impact (and a buck) — and the field of organic chemistry took off, buoyed by a fashion craze. The whims of society may sometimes seem frivolous; yet, even such trivial changes may end up changing the course of science.

We are all influenced by the cultures in which we grew up and the societies in which we live. Those cultures shape our expectations, values, beliefs, and goals. Scientists, too, are shaped by their cultures and societies, which in turn, influence their work. For example, a scientist may refuse to participate in certain sorts of research because it conflicts with his or her beliefs or values, as in the case of Joseph Rotblat, a Polish-born physicist, whose personal convictions profoundly influenced the research he undertook.

Rotblat *avoided* a particular research area because of his ethical views; other scientists have *chosen* research topics based on their values or political commitments. For example, Harvard scientist Richard Levins was an ardent supporter of socialism. After a stint as a farmer and labor organizer in Puerto Rico, Levins returned to the U.S. to study zoology, but not to focus on a small-scale concern, like the behavior of an individual organism or species. Instead, Levins invested himself in population biology and community-level interactions — areas with implications for issues he cares about: economic development, agriculture, and public health. Levins' political views don't change the outcomes of his scientific studies, but they do profoundly influence what topics he chooses to study in the first place.

And of course, the societal biases that individual scientists may have influence the course of science in many ways — as demonstrated by the example below …

In the early 1900s, American society did not expect women to have careers, let alone run scientific studies. Hence, women who chose to pursue science were frequently relegated to more tedious and rote tasks. Such was the case when Henrietta Leavitt went to work at Harvard College Observatory for Edward Pickering. She was assigned the task of painstakingly cataloguing and comparing photos of thousands of stars — mere specks of light. (In fact, at the time, women were preferred for such tasks because of their supposedly patient temperaments.)

However, even within this drudgery, Leavitt found inspiration — and a startling pattern in her stars. For stars whose brightness varies — called variable stars — the length of time between their brightest and dimmest points is related to their overall brightness: slower cycling stars are more luminous. Her discovery had far-reaching implications and would soon allow astronomers to measure the size of our galaxy and to show that the universe is expanding. But Pickering did not allow Leavitt to follow up on this discovery. Instead, she was sent back to her measurements, as was deemed appropriate for a woman at that time, and the study of variable stars was left for other scientists to pick up. Had society's views of women been more open-minded, this chapter in astronomy's history might have played out quite differently!

Before the scientific era, an agriculturalist eked out a precarious existence, his livelihood depending upon the vagaries of the weather.

Insect pests, locusts, drought devastated his fields. Now we have built huge dams to supply waters through perennial canals, manufactured fertilizers which enormously increase agricultural production, produced effective pesticides, learnt how to prevent soil erosion, introduced multiple cropping and devised other ways to improve output.

Population control would still be needed if food production is to keep pace with the growth in numbers, but the spectacular progress which scientific cultivation has made possible in the field of agriculture has belied all Malthusian fears. Progress in the industrial field has been even more spectacular, thanks to the application of science to industry.

The world, particularly the developed part of it, now enjoys a standard of living which in former ages was not even enjoyed by the wealthier classes. The higher standards of living have made it possible for the governments to provide the social services on a liberal scale.

The machine has not only relieved man of heavy burdensome tasks, but has also provided him with ample leisure in which he can engage himself in cultural pursuits, cultivate various kinds of

hobbies and travel. It is through science that he has been able to invent new sources of entertainment and education, such as cinema, radio and television.

The enormous popularity of these sources of entertainment proves how useful they are to mankind. Before the invention of the printing press, education was confined to a small section of the community and was of a predominantly religious character. The printing press revolutionised the art of publication and brought books, periodicals and newspapers within everyone's reach.

Democracy would have been impossible without the printing press. The modern media of mass communication are another fruitful source of education. are being spent on manufacturing weapons of mass annihilation and space exploration, the affluent nations are not prepared to help developing nations on a scale which would make a significant impact on their lives.

Many civilisations in the past perished because the people recklessly exploited natural resources, exhausted the soil and turned the land into a desert.

Impelled by the profit-motive, nations are still recklessly exploiting world resources without giving any serious thought to what would happen a few hundred years hence. When we know that man has to live on this planet for millions of years, this policy of exploiting natural resources and not judiciously conserving them is, to put it mildly, extremely short-sighted.

The same short-sightedness is being displayed over population growth.

Science has rendered great service to humanity by finding a cure for most diseases, by preventing the outbreak of epidemics which formerly used to kill millions of persons, and by curtailing the death rate in other ways. But unless men learn to curtail the birth rate as well, we will, before long, be faced with a population explosion.

Science has not proved that Malthus was wrong. It has only proved that for some time natural restraints on population in the form of wars, pestilences and famines can be held back. This planet can be made a decent place to live in only if man is wise. Science gives knowledge and power, but not necessarily wisdom.

The most effective way of preventing abuse of science and technology is to keep political power under control. Science has enormously strengthened the State. The administration has at its command resources for detecting opposition and subversive forces which no ancient State ever had. It can mould the mind of the masses far more effectively than ever before.

The fact is that, while science provides knowledge and power and affects life at several points, its use is determined by our culture and by our wisdom.

Science has made a most valuable contribution to the acquisition of knowledge and the development of a rational outlook on life. Not long ago, the masses were sunk in superstition. They attributed diseases to the wrath of the gods. They believed in ghosts, witches, magic and sorcery. Human and animal sacrifices were made to propitiate gods and demons. The appearances of eclipses and comets were regarded as most ominous.

Astrology was accepted everywhere as a science. Mythological accounts of the origin of the universe and movements of heavenly bodies were believed even by the educated. Anyone who offered a different interpretation based on scientific laws was severely frowned upon. Galileo came into clash with the Inquisition when he made the simple observation that the earth moves round the sun.

Newton himself believed in God and he held that a Creator was necessary to set the universe in motion, but once the process had started, it required no further supernatural intervention. The law of gravity came into conflict with the view of Providence as omnipotent, kind and generous who responded to prayers, achieved miracles and set things right.

Darwin's biological discoveries banished purpose and moral design from the universe. His theory of Evolution and the principles of the struggle for existence and the survival of the fittest leave no room for the view of the universe held by theologians. Modern astronomy does not inspire much hope and faith. Life, it holds, exists only on this planet. Though the universe has millions of years of existence, according to astronomers, it is ultimately moving towards dissolution. Science has helped man see the world and life in it really as they are.

But in doing so, it is said, it has deprived the people of their religious and spiritual faith. The principle of the struggle for existence and the survival of the fittest has been invoked to justify imperialistic wars. Science has created a problem for mankind by taking away its faith. It has also given rise to philosophic systems which do not favour disinterested pursuit of truth but judge what is true by the severely practical test of how far it serves the ends in view.

This indictment against science, however, is not fair. Science has exploded fairy-tales, mythological fantasies, irrational fears, unfounded speculations. It is for statesmen, religious teachers, humanists and social reformers to give a sense of purpose to mankind. If scepticism is the price which mankind has to pay for the truth of things, nobody can say that the price is prohibitive.

Men ought no longer to live on myths. Instead of becoming determinists they must take their destiny into their own hands, and build a glorious future for the human race. Science and scientific outlook open up infinite possibilities for man. What he must bring with him as his contribution is wisdom.

Science has given man various forms of power to replace the power of animals and that of human muscles. This has made it possible for him to annihilate distances, overcome the forces of gravitation and explore outer space and undertake production on a big scale.

Never was the world so completely integrated as it is today. Chemistry gave mankind gun powder which resulted in the destruction of feudalism and the emergence of the modern State. It also gave man the power to create new materials. The resources of the world in many things are very limited, and there is always the fear that, if they continue to be used on the present scale, they would be exhausted before long. This fear is no longer so serious because chemistry has discovered substitutes for them or made synthetics to replace them.

Scientific breeding has already yielded highly satisfactory results in the case of animals and plants. Given more knowledge of heredity and embryology, it would be possible to produce even finer specimens of the animal and human species. It is a fascinating subject to speculate on what physics, chemistry and biology would be able to achieve in the next few centuries.

Man may be able to reach other planets, explore further the immense interstellar spaces, learn to control the climate, manufacture a vast number of synthetics, including food. There is no theoretical limit to what man can achieve through science and technology. Science and technology have annihilated distances, brought the various parts of the world much nearer each other, enormously increased international trade and integrated the economy of all nations.

Science has revolutionised life in the intellectual, social and material spheres, creating a large number of problems for the human race. These problems are not unmanageable. What is needed is revolution in the minds of men to ensure that the knowledge and power gained through science is used for a constructive purpose. The future of mankind cannot be left to be determined by old parochial passions, reckless competition among producers and the operation of uncontrolled urges. The future has to be scientifically planned.