UNIT 32 SCIENCE – THE ROAD TO DEVELOPMENT

Structure

32.1 INTRODUCTION

In the previous unit you have learnt about the interaction between science and society. You have also learnt that social objectives must be kept in mind while deciding what orientation science and technology should be given in a particular social context. In this unit, we will see how, in an unequal world, science and technology have been used as tools of domination, rather than as means of prosperity for all. From this situation has arisen the call for a "New International Economic Order", an expression of the urge of the peoples of developing world to share equitably natural resources and the knowledge, which are the common human heritage. The countries who have thrown off the colonial yoke are eager to use science and technology for the welfare of their vast masses. They want to create indigenous infrastructure of science and technology which will enable them to become self-reliant and take their own decisions, while participating in global economy.

Objectives

After studying this unit you should be able to:

- realise that the natural resources as well as the fruits of science and technology are not shared equitably between the developed and the developing countries,
- appreciate the urge of the developing countries for a New International Economic Order and
- appreciate the aspirations of the developing countries to become self-reliant, which can give them the freedom of choices and the freedom of action.

32.2 QUEST OF PROSPERITY FOR ALL

There is an all-round desire to create a society where every one can equally draw the benefits of development and is provided a minimum decent standard of living. As we have said earlier, science and technology by themselves do not ensure social justice or equity; these are goals of a society and a people, in the pursuit of which, science and technology can be of great help. In India, the Parliament passed a Scientific Policy Resolution in 1958, which is said to have been drafted by our first Prime Minister, Jawaharlal Nehru. This point was made in the document by saying that the very idea of a welfare state (which became popular in many countries) is based upon the ability of science and technology to help us produce enough of everything–food, medicine, clothing, housing materials and so on, so as to be able to fulfil the needs of all.

Internationally, however, there is hardly any movement or desire to make the benefits of science and technology available to all inhabitants of the world, cutting across national

and political boundaries. The world remains divided. There are now two well-defined categories of nations: industrialised or developed countries; and others, optimistically called "developing" countries (in place of the more blunt terms such as poor or semi-industrialised or non-industrialised countries. The developing countries are also known as Third World countries, although there is no "second world".)

The disparities between the developed and the developing countries are tremendous, and by all accounts they are only increasing, because of the advanced level of science and technology possessed by the developed countries. There are many ways of expressing these disparities. For example, three quarters of world's income, investment, services and almost all research are in the hands of these developed countries, which represent one quarter of world's people. Per capita grain consumption in the USA increased from 700 kg in 1965 to 900 kg in 1975- *an increase of 200 kg per head*- which is a*lmost the total per head consumption in India per year.* Similarly, energy consumption per head in the United States is so high that if the whole world consumed at that rate, the planet's non-renewable resources would be finished in a decade. The disparities were built mainly in the colonial period, as explained earlier, but the advantage once gained has been increased with the help of science and technology.

32.2.1 Technology as a Tool of Domination

Production of knowledge and its dissemination through books, journals, magazines etc. is very largely in the hands of the developed countries. It is estimated that these countries spend about 98% of all money that is spent on scientific and developmental research. In the remaining 2% , all the more than 100 developing countries including our own, have a share!

We, in India, have hundreds of research laboratories, and we are proud of this- but when we compare our effort with that of the developed countries, we realise our limitations. Our expenditure in R&D is not as productive, because much of it goes into maintaining personnel and laboratories. The equipment, which has to be largely bought from the developed countries, is not the latest. Besides, our science and technology lacks the linkage with the processes of production. The productive system in our society is still so backward generally, that it does not make many demands on our indigenous R&D. At the slightest necessity we import technology, machines or other equipment, at times even when such needs can be met indigenously.

Furthermore, we are affected by the phenomenon of brain drain. It is estimated that close to a million scientists, technologists and medical persons from the developing countries are living and working in the developed countries. The reasons are many. The developed countries have more challenges and better opportunities to offer. There is lack of demand on high quality sophisticated science and technology at home and, therefore, employment opportunities are scarce. This flow of trained human resources to the developed countries is of more value, even in monetary terms, than all the aid the developing countries receive from them.

It is not surprising then that all new inventions emanate from developed countries. They create technological wonders, and we have only to wonder! For everything we want to do in an up-to-date manner- make special type of steel, of fertiliser, or aircraft – we have to look for technology from the developed countries. If we produce goods with out-of-date technology, we will not be able to sell them in a competitive market.

Much of the science and technology being developed in the advanced countries is in areas which do not even exist in most of the developing countries. Even a country like ours, which is bit forward, cannot take full advantage of the major developments in many areas of science, either because of secrecy or because the techniques used are too sophisticated. The developed countries spend billions of dollars per year on synthetics, plastics, fibres, glasses etc. In many cases, these products tend to displace the raw materials produced by the developing countries, such as rubber, cotton, tin, vegetable oil etc.

Furthermore, the technologies evolved in developed countries are capital intensive and use much less labour. Thus, by importing such technologies, we end up spending more capital, our labour force is under-utilised and the goods produced have a higher price so they cannot sell in the international market. Thus, the superior quality of science and technology in the advanced countries has a none too healthy effect on our own science and technology. It also perpetuates our general backwardness, through the benefits do accrue to a small privileged section of our population.

A significant change has taken place in the world. The collapse of the Soviet Union has made the word unipolar, with USA as the solitary superpower. During the last few years, India has been making concerted efforts to liberalise its economy to integrate it with the world economy at large, and to permit ever-increasing interplay of market forces.

In the changed circumstances, it would be necessary to strike a balance between purely economic forces on the one hand and social forces on the other. It is imperative that all obstacles in the path of rapid industrialisation and building of strong infrastructure are removed, that competitiveness, quality and profitability become the mantra of our factories and production centres. At the same time, it is imperative that people and their problems are not ignored, that long-standing problems pertaining to poverty and social justice are solved quickly. The key phrase of the new economic era should be *production of industrial wealth accompanied by social justice.*

SAQ 1

Name two instances where efforts are being made to develop infrastructure in India.

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32.3 NEW INTERNATIONAL ECONOMIC ORDER

The developing countries mostly threw off the colonial yoke in the 1940s and 1950s, and ever since they have been struggling to stand on their feet for the kind of development which would benefit their people. You would have realised that a crying need of our times is development which would satisfy the national needs as well as the aspirations of the common people of the developing countries. Right now, there exists a cumulative backlog of poverty, ignorance, ill-health, unemployment and untold misery among vast sections of populations in these countries. These problems are mounting day by day. Lack of resource for all-round human development is known to be continuing cause of explosive growth of population and environmental pressures. Many of the countries have tried to reconstruct a society where satisfaction of the minimum needs of the entire population would be the first priority of development. But this development has mostly eluded us.

We have not been able to make policy choices in keeping with our national needs and aspirations. The strategic, industrial and commercial interests of the countries criss-cross in the highly interdependent world of today. Experience has shown that the developing countries are forced by circumstances to do what suits the developed countries most. For example, to defend ourselves, we have to buy modern weapons from the developed countries, and replace them as new weapons are introduced by them; we buy modern goods or import technologies from them to produce those goods.

This has given rise to discussions in the developing countries about adopting a totally different path of development, i.e., a path of development which would not be an

imitation of the stages through which the developed countries have passed. The term "alternative development strategies" is used for this purpose. We would not be copying any one, we would be finding our own way of satisfying the most urgent needs of our people.

We would like to evolve a new economic and political system, which would combine competition and enterprise with human welfare and planning. A strategy would have to be developed in which the character, content, direction and pace of development would be firmly under national control. The strategy would need to be followed by a plan to rearrange production, to mobilise resources and allocate them to all relevant sectors. Steps would have to be taken to generate and put to use appropriate science and technology for national development.

Internationally, such feelings were so strong that, in 1974, the United Nations passed a resolution called the "New International Economic Order-Declaration and Programme of Action". We give you just a few lines from it, which reflect the conditions which prevail.

Para 1 of this resolution say, "The greatest and the most significant achievement during the last decades has been the independence from colonial and alien domination of a large number of peoples and nations which has enabled them to become members of the community of free peoples. Technological progress has also been made in all spheres of economic activities in the last three decades, thus providing a solid potential for improving the well being of all peoples. However, the remaining vestiges of alien and colonial domination, foreign occupation, racial discrimination, apartheid, and neo-colonialism in all its forms continue to be among the greatest obstacles to the full emancipation and progress of the developing countries and all the people involved. The benefits of technological progress are not shared equitably by all members of the international community. The developing countries which constitute 70% of the world's population, account for only 30% of the world's income. It has proved impossible to achieve an even and balanced development of the international community under the existing international order. The gap between the developed and the developing countries continues to widen in a system which was established at a time when most of the developing countries did not even exist as independent states and which perpetuates inequality."

Para 4 spells out the principles on which the New International Economic Order can be based. To quote, " The new international economic order should be founded on full respect for the following principles... full permanent sovereignty of every state on its natural resources and all economic activities. In order to safeguard these resources, each state is entitled to exercise effective control over them and their exploitation with means suitable to its own situation including the right to nationalisation or transfer of ownership to its nationals, this right being an expression of the full permanent sovereignty of the state. No state may be subjected to economic, political or any other type of coercion to prevent the free and full exercise of this inalienable right", and further

"Just and equitable relationship between the prices of raw materials, primary products, manufactured and semi-manufactured goods exported by developing countries and the prices of raw materials, primary commodities, manufactures, capital goods, and equipment imported by them with the aim of bringing about sustained improvement in their unsatisfactory terms of trade and the expansion of the world economy."

This should given you an idea of the kind of situation which prevails in the world economic relations, which is to the great disadvantage of countries whose industry, science, technology and social development should receive a boost now.

32.4 EXPLODED MYTHS

Experience has shown that some ideas which were popular soon after the Second world war (1939-45) are not valid in practice. It was thought that the highly industrialised countries, or the developed countries, would serve as a "bank" from which capital, skills,

technology and management could be transferred through "aid" which could raise life to a better quality in the developing countries. It was the general belief among scientists that modern science and technology could flow freely to our developing countries for the benefit of our people. These ideas or premises have been found to be largely invalid.

As summarised in an important international symposium, Pugwash on Self-reliance, "the fact [is] that the [supposedly global] technological revolution has been conceived, planned and executed so as to enable the attainment of the economic and security goals of the highly industrialised countries; what is more, it has also been contributing greatly both to the unprecedented scarcities of basic resources and to serious maldistribution in their use, with a steadily larger share being consumed by the industrialised nations".

In this connection, it would do us well to remember the fact that the key of human progress is Knowledge. After we were able to win our freedom, the developed countries were no more in a position to put any restriction on the spread of knowledge in our countries. But they have played a part in maintaining a great difference in the level of knowledge available to them and that available to us. You have read in Unit 28 about patent laws which prevent us from making anything by a known process.

Even in science and technology, knowledge is restricted in its flow due to potential application, which could lead to developing countries making new kinds of products. There are trade secrets, as also government imposed restrictions on spreading knowledge about fresh scientific and technological discoveries. In superconductivity, about which you have read in Unit 30, for example, what is being freely published is just a fraction of what is being discovered in the laboratories of the developed countries. So is the case with biotechnology, lasers, nuclear science, electronics and many emerging areas. They don't want us to be able to convert some of the ideas into products, which may find markets in their countries, or shut off our markets to them.

Not only that, there are several instances to show that if a developing country like ours develops its own technology in a particular field, all efforts are made to scuttle it. It is not rare to find frustrated researchers in our country whose dedicated efforts were put to waste by importing the process or the product at the last moment.

32.5 SELF-RELIANCE

On the basis of this historic lesson on harsh realities about science, technology and national development, a new concept of "self-reliance" has become popular, particularly among the developing or the third world countries. It is realised that for the developing countries, freedom of action is crucial, which is impossible in a state of dependency, in which the individual or the nation will always be at the mercy of the benefactor. Therefore, a country has to build up its science, technology and economy in such an integrated way that it can *take and implement decisions independently*, in its own interest, irrespective of external pressures, while at the same time participating in the global order. Self-reliance can also be said to be a state of mind that promotes confidence in oneself, and one's ability to determine one's destiny. The idea can be given meaning by expressing it in different ways. For example, if there are choices in economic or social objectives, those should be given precedence, which can be fulfilled with a minimum of dependence on other countries. If there is a choice in setting up industries, those should be preferred which can be set up with our own effort. If there is a choice between technologies, those should be adopted which rely on what is available in the country and so on. Naturally, this has to be accompanied by scientific and technological development in our own institutions, backed up by suitable education, training and research. Thus, the areas of our choice should be constantly enlarged.

Self-reliance does not mean shutting ourselves off from the world of science and technology, or stopping import of whatever is essential or unavoidable, but to constantly strive and plan to enlarge the scope of "avoidable". The implication is that luxury goods, whether in manufacture or in import , ought to have the lowest priority. To run trains at

200 km/hr is not as urgent, since materials and technology would have to be imported; as running more trains or opening up more routes to far away parts of our country. In matters of national defence, the scope of what we can produce by our ever-advancing technology should be enlarged, but then whatever is left and needs to be updated can be bought.

Perhaps, you can see that self-reliance as a policy admirably fits with the objectives of tackling problems which concern large masses of people. 70% of our population lives in villages and hardly uses anything which requires imported goods or technology. Even if pulses or edible oil are imported today, we can easily increase our own production. Our large population does not need so many kinds of tooth pastes, shampoos, electric shavers etc.; but it does need food, medicine, clothing, shelter and the like. Economic and technological effort directed to uplift their condition would not require leaning on other countries and exposing ourselves to their blandishment or pressure or foreign exchange. On the other hand, betterment of the conditions of living of the common people is bound to contribute towards greater satisfaction and consolidation of the nation, increasing our inner strength. It can be said with justification that such self-reliance would be in accordance with what father of our Nation, Mahatma Gandhi preached, and personally practised. His word for it was **Swadeshi**.

Propagation of Swadeshi was an important ideological weapon in our freedom movement. Besides the upliftment of economic conditions and improvement of general welfare, it brought about an awakening which afforded Indian people the strength, unity and above all the deep love and respect for their culture and heritage. This kind of weapon was used by Gandhiji from district level down to the village level, and the whole country was roused.

You can perhaps also see that self-reliance of the kind we are discussing involves choices made and actions taken at different levels, the individual (self-confidence and fulfilment of personality), village, district and State-or forms, factories, schools, research institutions. So, it has to become a movement in which people participate – and for the country as a whole, it becomes a new strategy for development.

32.5.1 Science and Technology for National Development

Science and technology are a major national resource and a vital element in the task of achieving self-reliance. With the ideal of self-reliance, presented above, what role can science and technology be made to play for national development? As you know, the needs for food, shelter, clothing, health and education for all are still the most pressing needs of our society. A rapid fulfilment of these needs would need new advances in agriculture, food technology, health science and medicine, building materials, clothing, tapping new resources etc. Solution of problems relevant to our own society or economy poses a fundamental challenge before our scientific and technological activity. And in pursuing this challenge, new questions and new answers, new technologies and new areas of scientific work are bound to emerge. To tackle the problems experienced in such an endeavour would need the ingenuity and resources of men, materials and ideas.
In India, we have a great potential of material resources and intelligent people. We have also a democratic system where ideas can be tested and the best can prevail. The task is to optimise knowledge of all kinds, whether in social science, natural sciences or technology, by making it available to the largest number. It would do our society well to produce at all levels of education, creative and critical thinkers who can use the scientific method to question the social reality on the basis of relevant data and problems. There is a need to re-examine ideas which have been uncritically accepted by the people as well as the political and administrative set-up in our society. The task of getting out of the vicious circle of under-development should not be under-estimated. Science, technology and other kinds of knowledge have played a crucial role in establishing the present structure of societies, their trade, industry and distribution of benefits. Let us hope that they will also be made to play an increasing role in taking our country to the right path of future development.

SAQ 2

Fill in the blanks with appropriate words.

i) The new internal economic order should be founded on the ..... of full ..... of every state on its ..... and all.....

ii) Self-reliance is a state of ....., that promotes ..... in oneself.

iii) Freedom of .....is impossible in a state of .....

iv) For self-reliance our scientific and technological development has to be backed up by .....

32.6 SUMMARY

- In this unit you have learnt that in spite of the age old human quest for an egalitarian and just society, the world today presents a very different picture. There are the rich developed countries who control most of the world resources and the scientific and technical know-how. There are the poor developing countries, which in the absence of this know-how and capital, are unable to utilise their resources for their own good; or ensure that the fruits of science and technology reach their vast masses. This realisation has found expression in the developing countries' call for a New International Economic Order based on equitable sharing of resources and knowledge. They want to become self-reliant, so that they can have freedom of choices and action, and seek a path of development where science and technology can be used for upliftment of their vast masses.

32.7 TERMINAL QUESTIONS

1) Spell out briefly the essence of New International Economic Order. How does India stand to benefit from it?

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2) a) What are the requisites for self-reliance?

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b) Name two areas where we do not depend on imported technology or know-how.

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32.8 ANSWERS

Self Assessment Questions

1) Power generation, roads

2) i) principle, permanent sovereignty, natural resources, economic activities
   ii) mind, confidence
   iii) action, dependency
   iv) suitable education, training and research.

Terminal Questions

1) New International Economic Order was declared by UNO in 1974. It includes:

- Independence from colonial and alien domination.
- Technological progress and its distribution.
- Sovereignty of every state on its natural resources and all economic activities.
- Better terms and conditions for trade and expansion of world economy.
- Just price for the import/export of raw materials, primary products, capital goods etc.

As India is also a supplier of many raw materials to the developed countries and also imports goods from them, fixing just prices for these items will help to improve the economic conditions of our country.
(Elaborate your answer on these guidelines).

2) a) Development of confidence.
Freedom of action and independent implementation of decisions.
Advancement in science, technology and economy for one's own interest.
b) Nuclear science, missile technology.

EPILOGUE

In this Foundation Course on Science and technology, we have covered a vast ground. Beginning with some comments on science as a great human endeavour, whose growth has been entwined with that of civilisation itself, we gave you a glimpse of history of science with particular reference to India. We concluded that by remarks on the nature of scientific knowledge and on the method of science.

It was then time to cross over to some specific, attractive and significant areas from the point of view of a citizen of modern India. Even so, there was some arbitrariness in our choice of subject areas; we talked about the universe to locate the planet Earth in the larger context, and then we discussed the origin of life, and its evolution right up to humankind. We explored with you the ecosystem, the environment and natural resources of our habitat, the Earth.

Food, agriculture, health and disease are subjects of great relevance to us and so we acquainted you with some technicalities and social and economic problems connected with the subject. We briefly went into the very interesting subject of mind and the body, leading to a glimpse of psychology, and of the powerful tool that man needs and uses today, called communication. All the wanderings then led us to the topical question of science, technology, industry and economic development. This was followed by a peep at the future – the new, round the corner, technologies.

In this broad-based survey of science and technology meant for the young reader, who may not have studied science at all, except, perhaps, a little bit through newspapers or the radio, we tried to portray the objectivity, rationality and the openness of a scientific approach. But we have not failed to underline the fact that science is not an abstract body of knowledge, it is very much a knowledge of the reality as it exists, from the environment, to the mind and body, and on the human society. Being itself a part of reality, science can change the material and social reality from within.

When one discusses the interface of science with social reality, the author's way of looking at the reality, or their world-view comes into play. It is inevitable. Therefore, our point of view of looking at Indian society and its problems, or what colonialism did to the countries it ruled, or how the means of communication give a handle to regulate common people's thinking – in fact in everything, our point of view has been present. If we had no point of view, or if we suppressed it, to present a sterilised picture to you, we would have done great injustice to you – presenting figures, tables, charts, separate statements, a jumble of images, *without a message*. Some authors are able to do so, but they also get blamed for having confused every issue-perhaps to a purpose!

But, we have constantly urged you to think for yourself, to scrutinise material presented before you, and to develop your own connected set of ideas. You may like to pursue some of these subjects further, and that would be a positive gain for all of us.

We can close this course in many ways, but we have chosen to do so by quoting Jawaharlal Nehru – who was not only a thinker, a scientist, one of our country's most beloved leaders, a maker of modern India, but also a most charming communicator who used to capture people's minds with his beautiful imagery.

"Though I have long been a slave driven in the chariot of Indian politics, with little leisure for other thoughts, my mind has often wandered to the days when as a student I haunted the laboratories of that home of science, Cambridge. And though circumstances made me part company with science, my thoughts turned to it with longing. In later years, through devious process, I arrived again at science, when I realised that science was not only a pleasant diversion and abstraction, but was of the very texture of life, without which our modern world would vanish away. Politics led me to economics, and this led me inevitably to science and the scientific approach to all our problems and to life itself. It was science alone that could solve these problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people". (From an Address at the Indian Science congress, Calcutta, December 1937).

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